THE NORTHERN PASS

PROPOSED STRUCTURE DESIGNS

PRELIMINARY - NOT FOR CONSTRUCTION

NO.	DATE	REVISIONS	BY	CHK	APP	APP
A	10/8/15	ISSUED FOR PERMIT USE	MSP	DAB		

BURNS McDONNELL

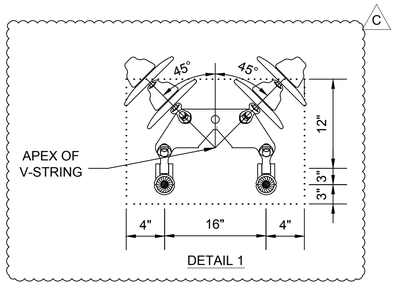
BMCD 58479

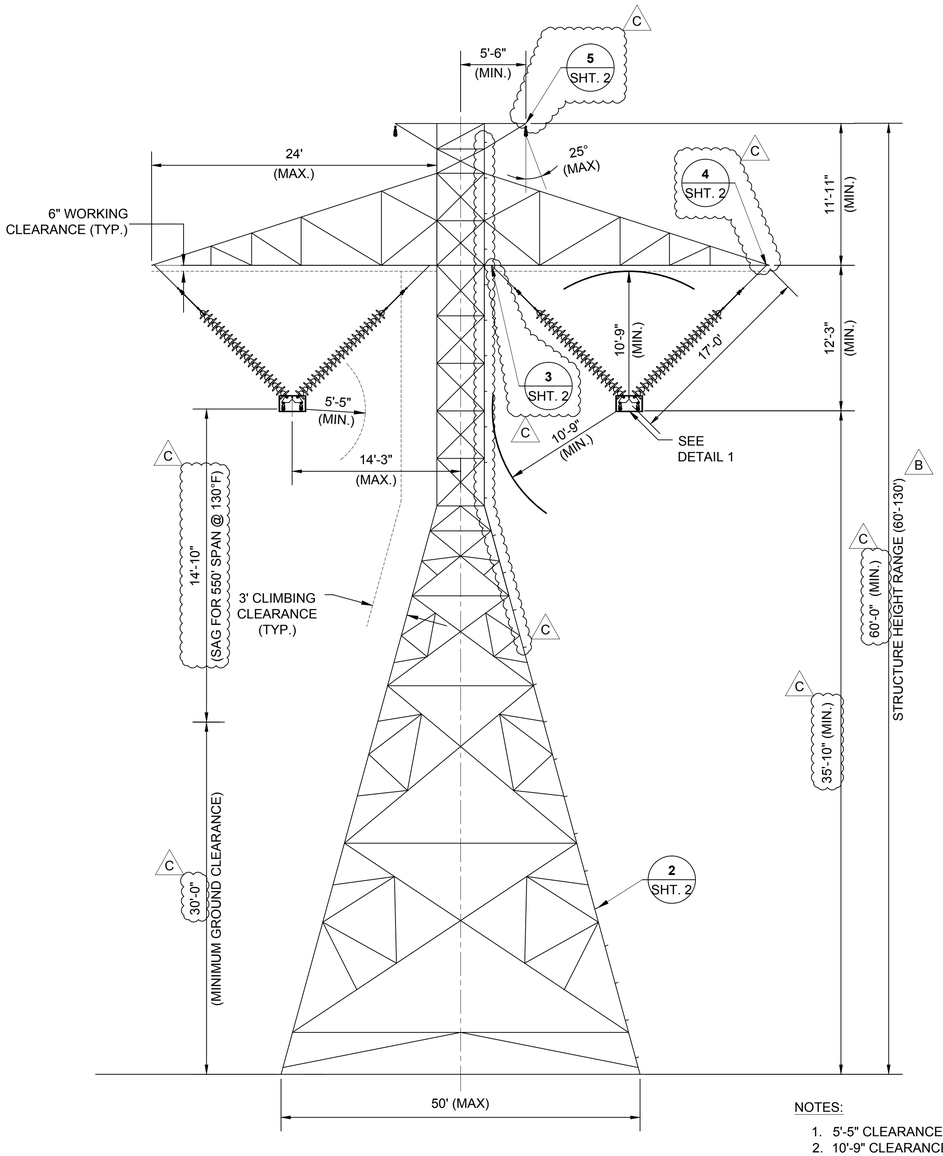
NU VER: 08/2012

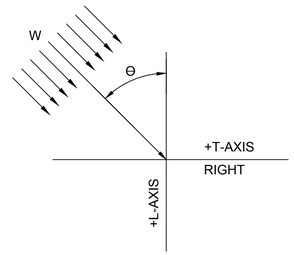
STRUCTURE NAME: 32-SCHLT-LTG-002
320-KV DC CONDUCTOR: 2 - 2933 KCMIL 91 STRAND AAAC PER PHASE (20000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 550
WEIGHT SPAN (FT): 850
LINE ANGLE: 0 - 2 DEGREES

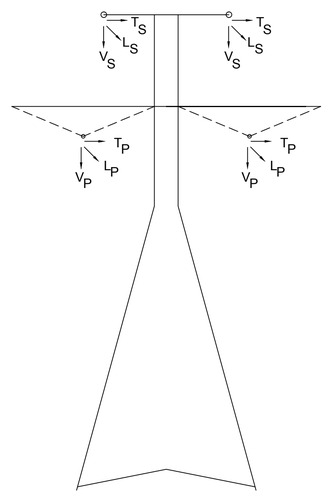
LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.45	1.03	0.00	13.54	5.30	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.43	0.75	0.00	5.61	5.98	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	2.03	0.74	0.00	12.70	3.28	0.00	4.00	90.00	1.00
4	HQ EXTREME ICE	15.00	1.50	39.53	3.62	1.06	0.00	17.43	4.15	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.96	0.48	0.00	9.02	2.65	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.96	0.47	0.00	9.02	2.49	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.96	0.37	5.50	9.02	1.51	24.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.58	0.27	0.27	23.61	2.17	2.27	3.45	90.00	1.50
9	MAINTENANCE	60.00	0.00	0.00	2.66	0.21	0.00	13.01	1.66	0.00	0.00	90.00	2.00
10	OBLIQUE WIND	60.00	0.00	100.00	0.43	0.46	0.00	5.61	3.67	0.00	29.00	45.00	1.00

C









LOADING TREE

GENERAL NOTES:

1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, AND L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE, AND LONGITUDINAL AXIS RESPECTIVELY.
3. TEMPERATURE, RADIAL DESIGN ICE THICKNESS, AND WIND SPEED ARE INDICATED IN THE LOAD TABLE. THESE VALUES WERE USED TO CALCULATE THE VERTICAL, TRANSVERSE, AND LONGITUDINAL LOADS APPLIED TO THE STRUCTURE.
4. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.6 SHALL BE APPLIED TO THE WIND LOAD. WIND SHALL BE BLOWN ON TWO FACES OF THE LATTICE TOWER.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THETA (Θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION.
7. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
8. EACH MEMBER, WHICH IS INCLINED AT AN ANGLE OF LESS THAN 45 DEGREES WITH THE HORIZONTAL SHALL BE OF SUFFICIENT SECTION TO WITHSTAND, INDEPENDENT OF ALL OTHER LOADS, A CONCENTRATED LOAD OF 350 POUNDS APPLIED NORMAL TO THE MEMBER ON ITS WEAKEST AXIS AT ANY POINT ALONG ITS LENGTH. CONCENTRATED LOAD SHALL BE MULTIPLIED BY AN OVERLOAD FACTOR OF 2.0.
9. LATTICE MEMBER ORIENTATION SHALL MINIMIZE SNOW ACCUMULATION ON THE STRUCTURE.
10. ELECTRICAL CLEARANCES MUST BE CHECKED TO THE SURFACE OF THE NEAREST MEMBER.
11. THE MAXIMUM SHIELDING ANGLE AT THE STRUCTURE SHALL BE 25 DEGREES.
12. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0 - 20°. CLEARANCES MUST BE CHECKED TO CLEARANCE ENVELOPE PROVIDED IN DETAIL 1.
13. SNUB ANGLES SHALL BE LIMITED TO A 2 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
14. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR HELICOPTER AND CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
15. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
16. C CROSSARMS, AND GROUND WIRE PEAKS SHALL BE DESIGNED WITH FALL ARREST ATTACHMENT POINTS. FALL ARREST ATTACHMENT POINTS SHALL SUPPORT A LOAD OF 3,000 POUNDS AND BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE. AT EACH FALL ARREST ATTACHMENT POINT, A GUSSET PLATE OR VANG WITH A 1-INCH DIAMETER HOLE SHALL BE PROVIDED.
17. CROSSARMS AND HORIZONTAL MEMBERS ADJACENT TO PHASES SHALL BE DESIGNED TO SUPPORT A LADDER LOAD OF 1,200 POUNDS. LADDER LOAD SHALL BE APPLIED AS TWO POINT LOADS OF 600 POUNDS SPACED AT 15 INCHES. LOAD SHALL BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE.
18. CLIMBING AND WORKING CLEARANCES MUST BE PROVIDED AS INDICATED IN THE ELEVATION VIEW.
19. STRUCTURE SHALL BE DESIGNED TO WITHSTAND UNEVEN LEG EXTENSION DIFFERENTIAL ASSUMING VERTICAL TO HORIZONTAL GROUND SLOPE RATIO OF (1:2).

NOTES:

1. 5'-5" CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WORKING CLEARANCE.
2. 10'-9" CLEARANCE MUST BE CONSIDERED FROM TOWER BODY AND ARMS.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS	.	5/21/15	KAK	.	.
B	UPDATED STRUCTURE HEIGHT RANGE	.	5/8/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	KAK	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

C

DRAWN KAK
ENGINEER AKO
CHECKED TAB
APPROVED
DATE 5/1/15

320kV DC LIGHT TANGENT 0°–2°
32–SCHLT–LTG–002
LOAD & DESIGN DRAWING

SCALE NTS
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IMAGE:
DRAWING NO. LST–01–001

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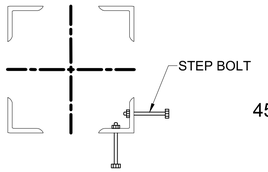
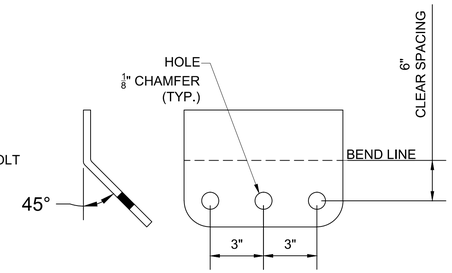
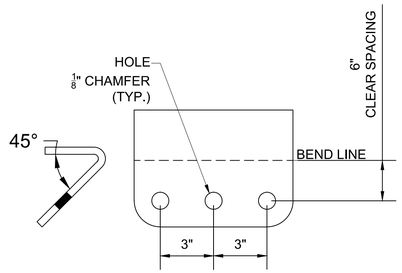


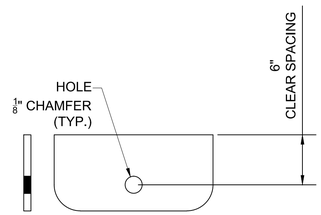
DETAIL 2
STEP BOLTS (TYP.) 2



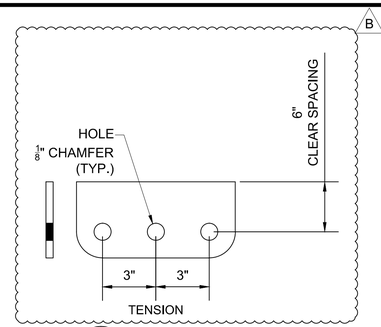
DETAIL 3
CONDUCTOR ATTACHMENT 2



DETAIL 4
CONDUCTOR ATTACHMENT 2

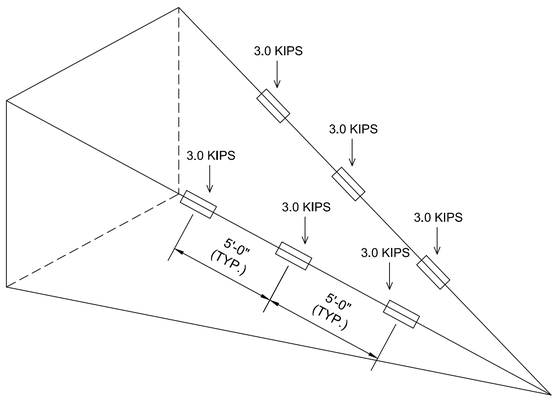


SUSPENSION

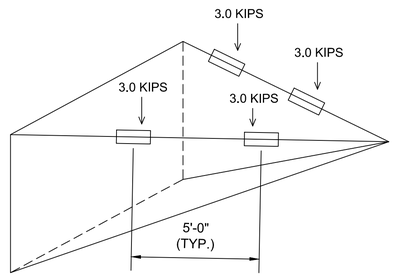


TENSION

DETAIL 5
OHGW ATTACHMENT 2



DETAIL 6
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL CONDUCTOR CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.) 2



DETAIL 7
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL OHSW CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.) 2

NOTES:

1. HOLE DIAMETERS AND VANG DIMENSIONS TO BE DETERMINED DURING DETAIL DESIGN THROUGH COORDINATION WITH TOWER VENDOR AND HARDWARE MANUFACTURER.
2. (B) STEP BOLTS SHALL BE INSTALLED ON ALTERNATE FLANGES OF ONE LEG. SPACING SHALL NOT EXCEED 16 INCHES. STEP BOLTS SHALL BE PROVIDED FROM TOWER BASE TO TOP OF TOWER.
3. STRUCTURE SHALL BE DESIGNED WITH SUSPENSION AND TENSION ATTACHMENT PLATES AS SHOWN IN DETAIL 5.
4. FALL ARREST LOADS SHALL BE APPLIED SINGULARLY AT EACH LOCATION.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

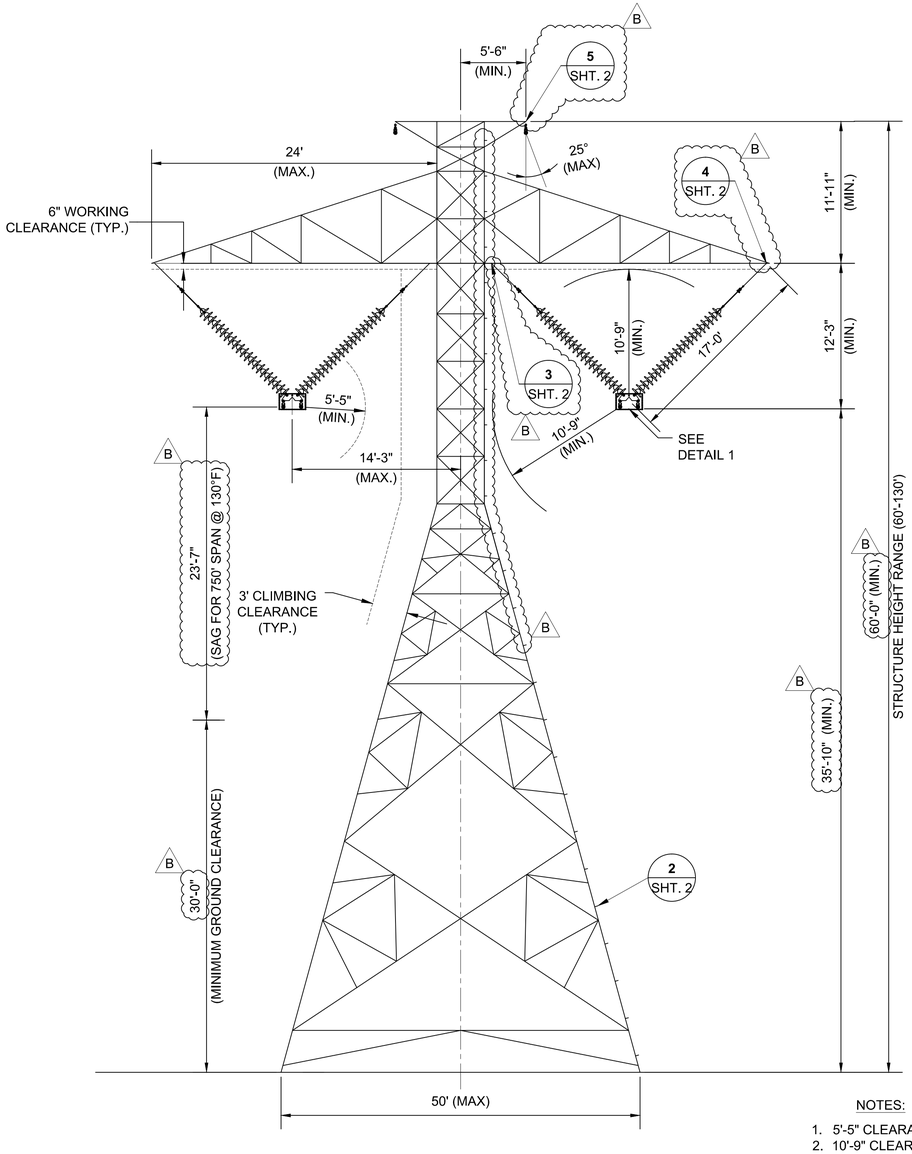
REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
B	MISC. REVISIONS	.	5/21/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	KAK	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

320kV DC LIGHT TANGENT 0°–2°
32–SCHLT–LTG–002
LOAD & DESIGN DRAWING

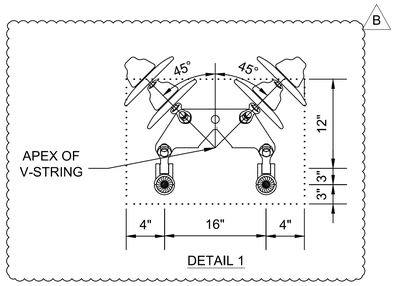
	B
DRAWN	KAK
ENGINEER	AKO
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	LST–01–002.DWG
IMAGE:	
DRAWING NO.	LST–01–002

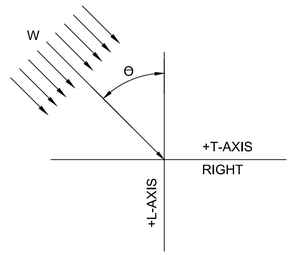
NU VER: 08/2012

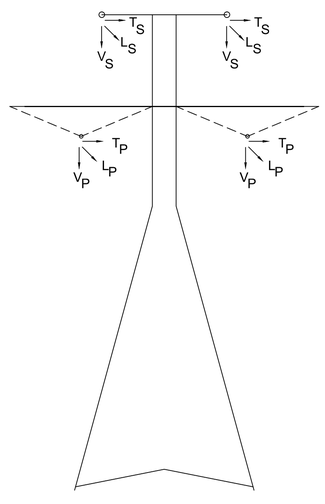


NOTES:

1. 5'-5" CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WORKING CLEARANCE.
2. 10'-9" CLEARANCE MUST BE CONSIDERED FROM TOWER BODY AND ARMS.







LOADING TREE

STRUCTURE NAME: 32-SCHLT-MTG-002
320-KV DC CONDUCTOR: 2 - 2933 KCMIL 91 STRAND AAAC PER PHASE (20000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 750
WEIGHT SPAN (FT): 1200
LINE ANGLE: 0 - 2 DEGREES

LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	2.01	1.28	0.00	18.06	6.29	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.59	0.97	0.00	7.55	7.67	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	2.84	0.91	0.00	17.22	3.81	0.00	4.00	90.00	1.00
4	HQ EXTREME ICE	15.00	1.50	39.53	5.09	1.30	0.00	23.90	4.81	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	1.34	0.58	0.00	12.04	3.04	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	1.34	0.57	0.00	12.04	2.88	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	1.34	0.47	5.50	12.04	2.01	30.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.82	0.30	0.27	26.51	2.40	2.27	3.45	90.00	1.50
9	MAINTENANCE	60.00	0.00	0.00	2.98	0.21	0.00	16.89	1.66	0.00	0.00	90.00	2.00
10	OBLIQUE WIND	60.00	0.00	100.00	0.59	0.56	0.00	7.55	4.51	0.00	29.00	45.00	1.00

B

GENERAL NOTES:

1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, AND L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE, AND LONGITUDINAL AXIS RESPECTIVELY.
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5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THETA (Θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION.
7. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
8. EACH MEMBER, WHICH IS INCLINED AT AN ANGLE OF LESS THAN 45 DEGREES WITH THE HORIZONTAL SHALL BE OF SUFFICIENT SECTION TO WITHSTAND, INDEPENDENT OF ALL OTHER LOADS, A CONCENTRATED LOAD OF 350 POUNDS APPLIED NORMAL TO THE MEMBER ON ITS WEAKEST AXIS AT ANY POINT ALONG ITS LENGTH. CONCENTRATED LOAD SHALL BE MULTIPLIED BY AN OVERLOAD FACTOR OF 2.0.
9. LATTICE MEMBER ORIENTATION SHALL MINIMIZE SNOW ACCUMULATION ON THE STRUCTURE.
10. ELECTRICAL CLEARANCES MUST BE CHECKED TO THE SURFACE OF THE NEAREST MEMBER.
11. THE MAXIMUM SHIELDING ANGLE AT THE STRUCTURE SHALL BE 25 DEGREES.
12. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0 - 20°. CLEARANCES MUST BE CHECKED TO CLEARANCE ENVELOPE PROVIDED IN DETAIL 1.
13. SNUB ANGLES SHALL BE LIMITED TO A 2 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
14. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR HELICOPTER AND CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
15. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.

B

16. CROSSARMS, AND GROUND WIRE PEAKS SHALL BE DESIGNED WITH FALL ARREST ATTACHMENT POINTS. FALL ARREST ATTACHMENT POINTS SHALL SUPPORT A LOAD OF 3,000 POUNDS AND BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE. AT EACH FALL ARREST ATTACHMENT POINT, A GUSSET PLATE OR VANG WITH A 1-INCH DIAMETER HOLE SHALL BE PROVIDED.
17. CROSSARMS AND HORIZONTAL MEMBERS ADJACENT TO PHASES SHALL BE DESIGNED TO SUPPORT A LADDER LOAD OF 1,200 POUNDS. LADDER LOAD SHALL BE APPLIED AS TWO POINT LOADS OF 600 POUNDS SPACED AT 15 INCHES. LOAD SHALL BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE.
18. CLIMBING AND WORKING CLEARANCES MUST BE PROVIDED AS INDICATED IN THE ELEVATION VIEW.
19. STRUCTURE SHALL BE DESIGNED TO WITHSTAND UNEVEN LEG EXTENSION DIFFERENTIAL ASSUMING VERTICAL TO HORIZONTAL GROUND SLOPE RATIO OF (1:2).

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
B	MISC. REVISIONS	.	5/21/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	KAK	.	.

DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

320kV DC MEDIUM TANGENT 0°-2°
32-SCHLT-MTG-002
LOAD & DESIGN DRAWING

	B
DRAWN	KAK
ENGINEER	AKO
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
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IMAGE:	
DRAWING NO.	LST-02-001

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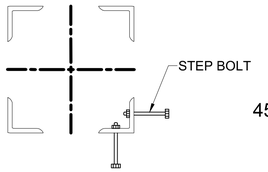
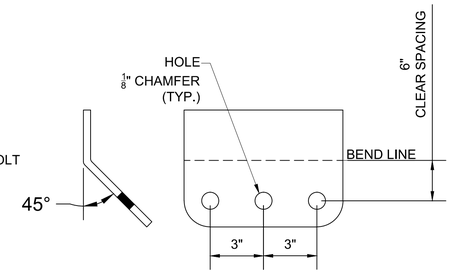


DETAIL 2
STEP BOLTS (TYP.) 2



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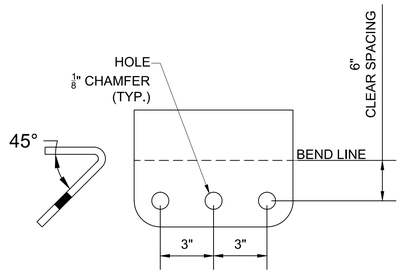
CONDUCTOR ATTACHMENT 2



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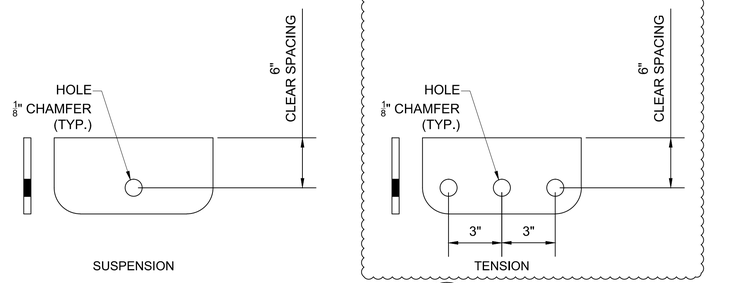
CONDUCTOR ATTACHMENT 2



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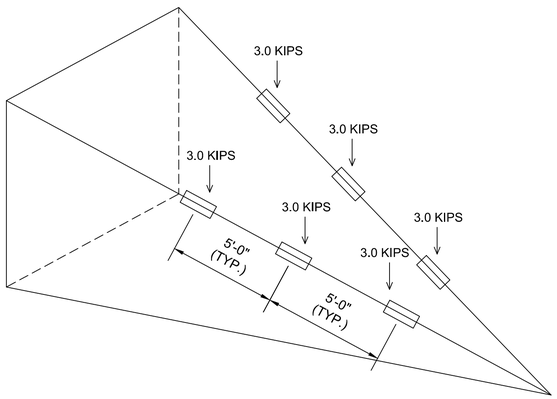
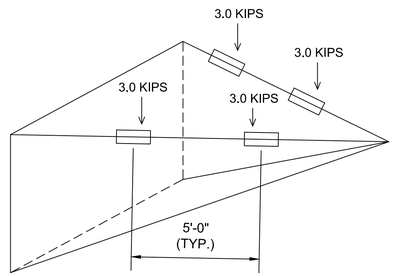
OHGW ATTACHMENT 2



DETAIL 6
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL CONDUCTOR CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.) 2



DETAIL 7
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL OHSW CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.) 2

NOTES:

1. HOLE DIAMETERS AND VANG DIMENSIONS TO BE DETERMINED DURING DETAIL DESIGN THROUGH COORDINATION WITH TOWER VENDOR AND HARDWARE MANUFACTURER.
2. STEP BOLTS SHALL BE INSTALLED ON ALTERNATE FLANGES OF ONE LEG. SPACING SHALL NOT EXCEED 16 INCHES. STEP BOLTS SHALL BE PROVIDED FROM TOWER BASE TO TOP OF TOWER.
3. STRUCTURE SHALL BE DESIGNED WITH SUSPENSION AND TENSION ATTACHMENT PLATES AS SHOWN IN DETAIL 5.
4. FALL ARREST LOADS SHALL BE APPLIED SINGULARLY AT EACH LOCATION.

B

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

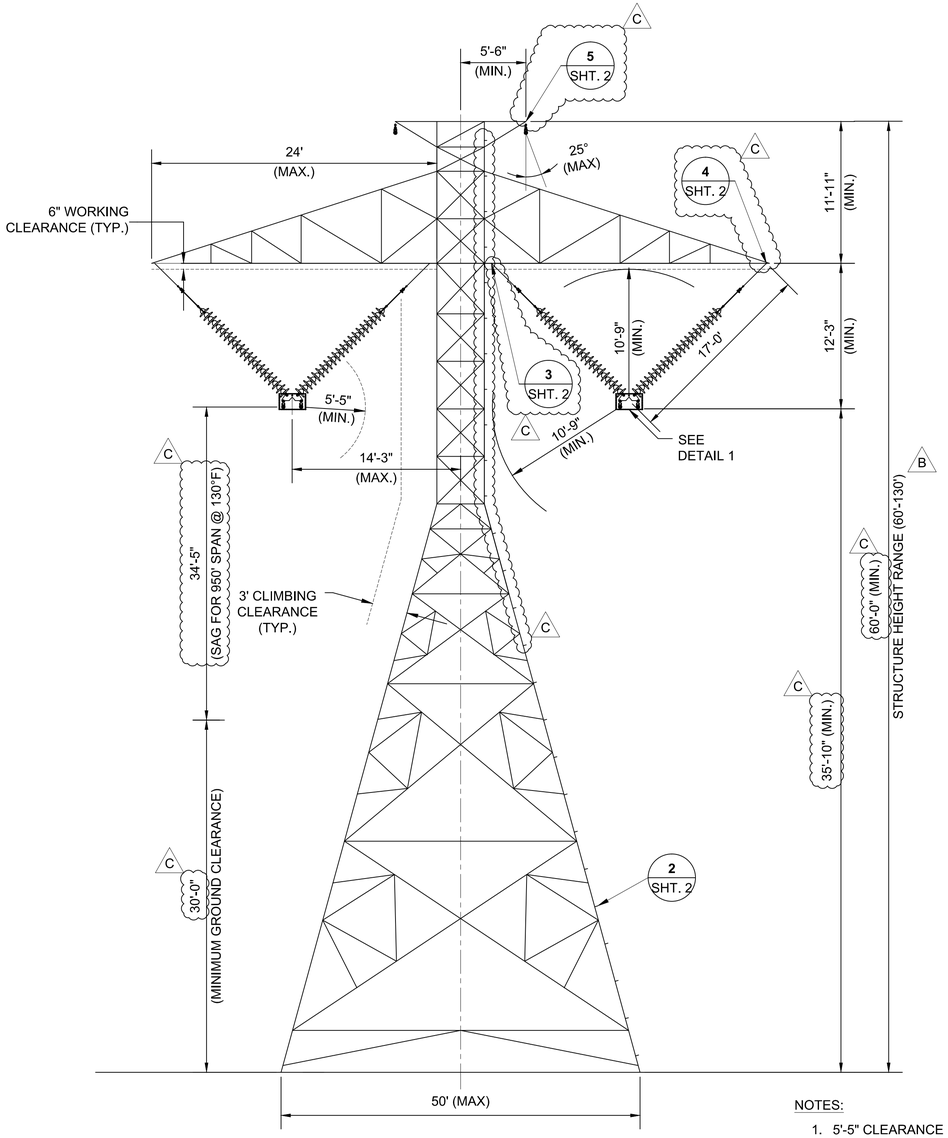
REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
B	MISC. REVISIONS	.	5/21/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	KAK	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

320kV DC MEDIUM TANGENT 0°–2°
32–SCHLT–MTG–002
LOAD & DESIGN DRAWING

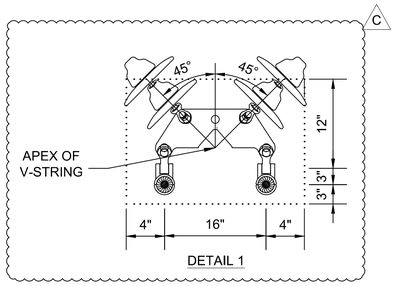
	B
DRAWN	KAK
ENGINEER	AKO
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	LST–02–002.DWG
IMAGE:	
DRAWING NO.	LST–02–002

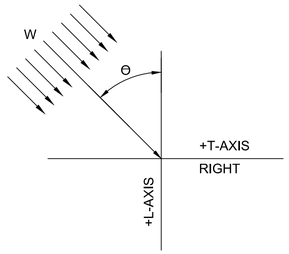
NU VER: 08/2012



NOTES:

1. 5'-5" CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WORKING CLEARANCE.
2. 10'-9" CLEARANCE MUST BE CONSIDERED FROM TOWER BODY AND ARMS.





LOADING TREE

STRUCTURE NAME: 32-SCHLT-HTG-002
320-KV DC CONDUCTOR: 2 - 2933 KCMIL 91 STRAND AAAC PER PHASE (20000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 950
WEIGHT SPAN (FT): 1850
LINE ANGLE: 0 - 2 DEGREES

LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	3.06	1.53	0.00	26.46	7.28	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.88	1.19	0.00	11.15	9.36	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	4.35	1.07	0.00	25.63	4.34	0.00	4.00	90.00	1.00
4	HQ EXTREME ICE	15.00	1.50	39.53	7.81	1.53	0.00	35.93	5.48	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	2.04	0.68	0.00	17.64	3.44	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	2.04	0.67	0.00	17.64	3.28	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	2.04	0.57	5.50	17.64	2.58	40.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	4.25	0.33	0.27	31.91	2.63	2.27	3.45	90.00	1.50
9	MAINTENANCE	60.00	0.00	0.00	3.56	0.21	0.00	24.09	1.66	0.00	0.00	90.00	2.00
10	OBLIQUE WIND	60.00	0.00	100.00	0.88	0.67	0.00	11.15	5.35	0.00	29.00	45.00	1.00

C

GENERAL NOTES:

1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, AND L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE, AND LONGITUDINAL AXIS RESPECTIVELY.
3. TEMPERATURE, RADIAL DESIGN ICE THICKNESS, AND WIND SPEED ARE INDICATED IN THE LOAD TABLE. THESE VALUES WERE USED TO CALCULATE THE VERTICAL, TRANSVERSE, AND LONGITUDINAL LOADS APPLIED TO THE STRUCTURE.
4. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.6 SHALL BE APPLIED TO THE WIND LOAD. WIND SHALL BE BLOWN ON TWO FACES OF THE LATTICE TOWER.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THETA (Θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION.
7. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
8. EACH MEMBER, WHICH IS INCLINED AT AN ANGLE OF LESS THAN 45 DEGREES WITH THE HORIZONTAL SHALL BE OF SUFFICIENT SECTION TO WITHSTAND, INDEPENDENT OF ALL OTHER LOADS, A CONCENTRATED LOAD OF 350 POUNDS APPLIED NORMAL TO THE MEMBER ON ITS WEAKEST AXIS AT ANY POINT ALONG ITS LENGTH. CONCENTRATED LOAD SHALL BE MULTIPLIED BY AN OVERLOAD FACTOR OF 2.0.
9. LATTICE MEMBER ORIENTATION SHALL MINIMIZE SNOW ACCUMULATION ON THE STRUCTURE.
10. ELECTRICAL CLEARANCES MUST BE CHECKED TO THE SURFACE OF THE NEAREST MEMBER.
11. THE MAXIMUM SHIELDING ANGLE AT THE STRUCTURE SHALL BE 25 DEGREES.
12. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0 - 20°. CLEARANCES MUST BE CHECKED TO CLEARANCE ENVELOPE PROVIDED IN DETAIL 1.
13. SNUB ANGLES SHALL BE LIMITED TO A 2 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
14. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR HELICOPTER AND CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
15. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
16. CROSSARMS, AND GROUND WIRE PEAKS SHALL BE DESIGNED WITH FALL ARREST ATTACHMENT POINTS. FALL ARREST ATTACHMENT POINTS SHALL SUPPORT A LOAD OF 3,000 POUNDS AND BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE. AT EACH FALL ARREST ATTACHMENT POINT, A GUSSET PLATE OR VANG WITH A 1-INCH DIAMETER HOLE SHALL BE PROVIDED.
17. CROSSARMS AND HORIZONTAL MEMBERS ADJACENT TO PHASES SHALL BE DESIGNED TO SUPPORT A LADDER LOAD OF 1,200 POUNDS. LADDER LOAD SHALL BE APPLIED AS TWO POINT LOADS OF 600 POUNDS SPACED AT 15 INCHES. LOAD SHALL BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE.
18. CLIMBING AND WORKING CLEARANCES MUST BE PROVIDED AS INDICATED IN THE ELEVATION VIEW.
19. STRUCTURE SHALL BE DESIGNED TO WITHSTAND UNEVEN LEG EXTENSION DIFFERENTIAL ASSUMING VERTICAL TO HORIZONTAL GROUND SLOPE RATIO OF (1:2).

C

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS	.	5/21/15	KAK	.	.
B	UPDATED STRUCTURE HEIGHT RANGE	.	5/8/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	KAK	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

320kV DC HEAVY TANGENT 0°-2°
32-SCHLT-HTG-002
LOAD & DESIGN DRAWING

	C
DRAWN	KAK
ENGINEER	AKO
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	LST-03-001.DWG
IMAGE:	
DRAWING NO.	LST-03-001

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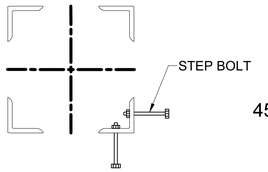
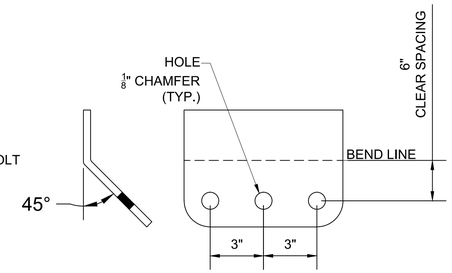
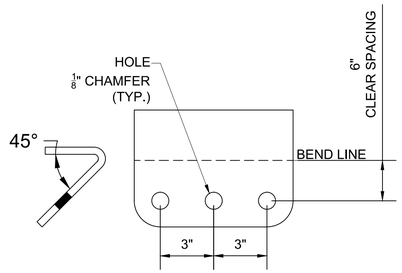
NU VER: 08/2012



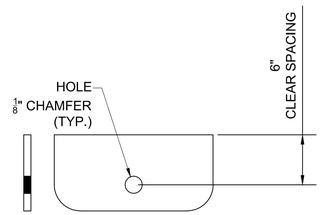
DETAIL 2
STEP BOLTS (TYP.) 2



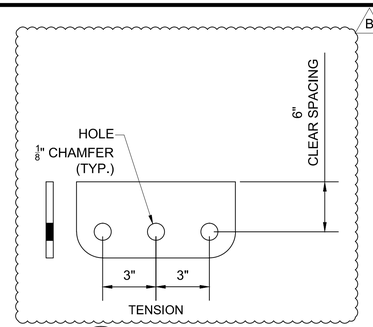
DETAIL 3
CONDUCTOR ATTACHMENT 2



DETAIL 4
CONDUCTOR ATTACHMENT 2

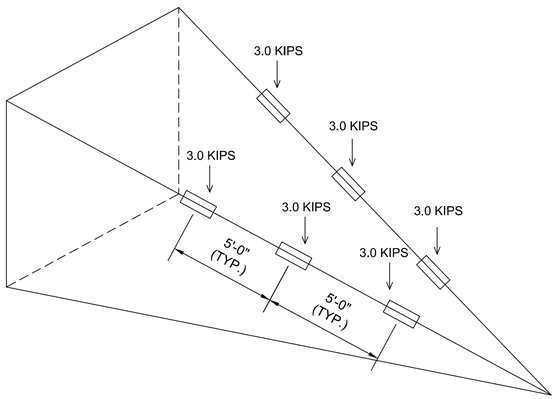


SUSPENSION

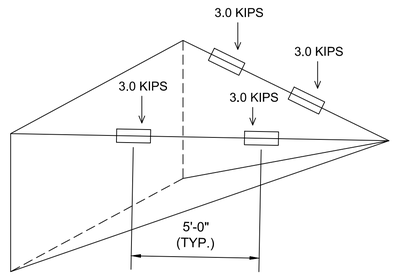


TENSION

DETAIL 5
OHGW ATTACHMENT 2



DETAIL 6
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL CONDUCTOR CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.) 2



DETAIL 7
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL OHSW CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.) 2

NOTES:

1. HOLE DIAMETERS AND VANG DIMENSIONS TO BE DETERMINED DURING DETAIL DESIGN THROUGH COORDINATION WITH TOWER VENDOR AND HARDWARE MANUFACTURER.
2. STEP BOLTS SHALL BE INSTALLED ON ALTERNATE FLANGES OF ONE LEG. SPACING SHALL NOT EXCEED 16 INCHES. STEP BOLTS SHALL BE PROVIDED FROM TOWER BASE TO TOP OF TOWER.
3. STRUCTURE SHALL BE DESIGNED WITH SUSPENSION AND TENSION ATTACHMENT PLATES AS SHOWN IN DETAIL 5.
4. FALL ARREST LOADS SHALL BE APPLIED SINGULARLY AT EACH LOCATION.

B

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
B	MISC. REVISIONS	.	5/21/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	KAK	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

320kV DC HEAVY TANGENT 0°–2°
32–SCHLT–HTG–002
LOAD & DESIGN DRAWING

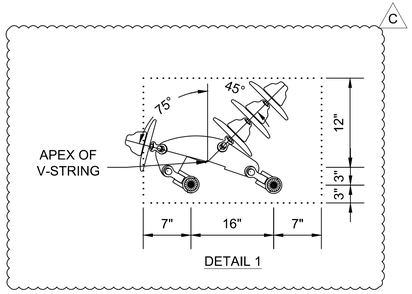
	B
DRAWN	KAK
ENGINEER	AKO
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	LST–03–002.DWG
IMAGE:	
DRAWING NO.	LST–03–002

6/16/2015 3:49 PM – mspeich – N:\NUSCO\58479 – NPT\Overhead\Cadd\01–Record Worksheets\LST–03–002.dwg – SKETCH

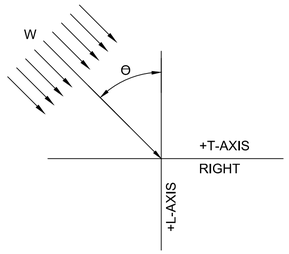
STRUCTURE NAME: 32-SCHLT-LAG-010
320-KV DC CONDUCTOR: 2 - 2933 KCMIL 91 STRAND AAAC PER PHASE (20000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 900
WEIGHT SPAN (FT): 1250
LINE ANGLE: 2 - 10 DEGREES

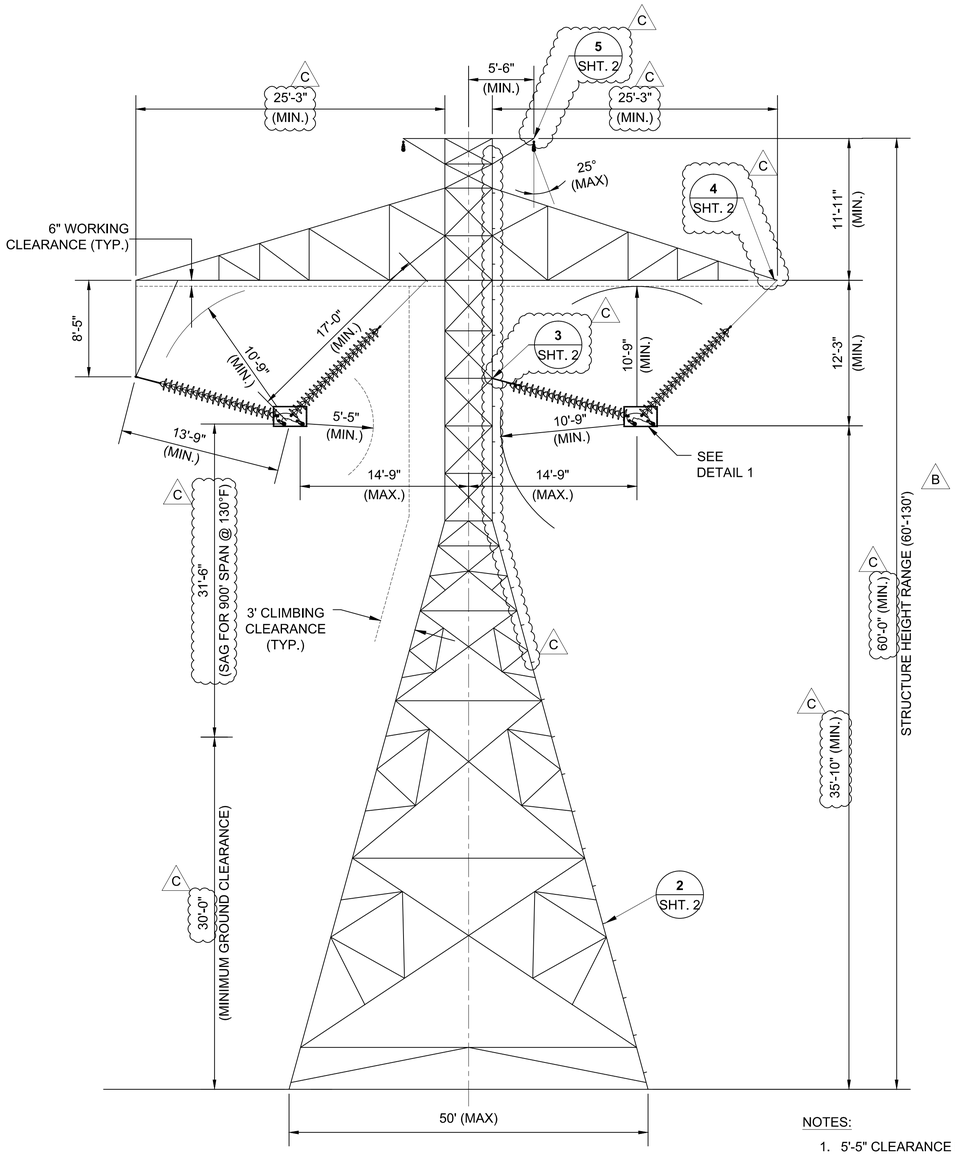
LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	2.09	2.81	0.00	18.70	17.29	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.61	1.76	0.00	7.82	14.32	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	2.96	2.15	0.00	17.87	11.47	0.00	4.00	90.00	1.00
4	HQ EXTREME ICE	15.00	1.50	39.53	5.30	3.15	0.00	24.83	14.60	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	1.40	1.47	0.00	12.47	9.56	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	1.40	1.41	0.00	12.47	8.76	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	1.40	0.93	5.50	12.47	3.88	24.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.85	1.05	0.27	26.93	8.74	2.27	3.45	90.00	1.50
9	MAINTENANCE	60.00	0.00	0.00	3.02	1.03	0.00	17.45	8.27	0.00	0.00	90.00	2.00
10	OBLIQUE WIND	60.00	0.00	100.00	0.61	1.28	0.00	7.82	10.53	0.00	29.00	45.00	1.00

C



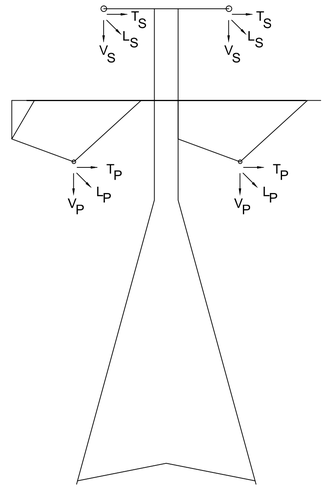
DETAIL 1





NOTES:

1. 5'-5" CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WORKING CLEARANCE.
2. 10'-9" CLEARANCE MUST BE CONSIDERED FROM TOWER BODY AND ARMS.



LOADING TREE

GENERAL NOTES:

1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, AND L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE, AND LONGITUDINAL AXIS RESPECTIVELY.
3. TEMPERATURE, RADIAL DESIGN ICE THICKNESS, AND WIND SPEED ARE INDICATED IN THE LOAD TABLE. THESE VALUES WERE USED TO CALCULATE THE VERTICAL, TRANSVERSE, AND LONGITUDINAL LOADS APPLIED TO THE STRUCTURE.
4. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.6 SHALL BE APPLIED TO THE WIND LOAD. WIND SHALL BE BLOWN ON TWO FACES OF THE LATTICE TOWER.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THETA (Θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION.
7. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
8. EACH MEMBER, WHICH IS INCLINED AT AN ANGLE OF LESS THAN 45 DEGREES WITH THE HORIZONTAL SHALL BE OF SUFFICIENT SECTION TO WITHSTAND, INDEPENDENT OF ALL OTHER LOADS, A CONCENTRATED LOAD OF 350 POUNDS APPLIED NORMAL TO THE MEMBER ON ITS WEAKEST AXIS AT ANY POINT ALONG ITS LENGTH. CONCENTRATED LOAD SHALL BE MULTIPLIED BY AN OVERLOAD FACTOR OF 2.0.
9. LATTICE MEMBER ORIENTATION SHALL MINIMIZE SNOW ACCUMULATION ON THE STRUCTURE.
10. ELECTRICAL CLEARANCES MUST BE CHECKED TO THE SURFACE OF THE NEAREST MEMBER.
11. THE MAXIMUM SHIELDING ANGLE AT THE STRUCTURE SHALL BE 25 DEGREES.
12. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0 - 20°. CLEARANCES MUST BE CHECKED TO CLEARANCE ENVELOPE PROVIDED IN DETAIL 1.
13. SNUB ANGLES SHALL BE LIMITED TO A 10 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
14. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR HELICOPTER AND CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
15. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
16. CROSSARMS, AND GROUND WIRE PEAKS SHALL BE DESIGNED WITH FALL ARREST ATTACHMENT POINTS. FALL ARREST ATTACHMENT POINTS SHALL SUPPORT A LOAD OF 3,000 POUNDS AND BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE. AT EACH FALL ARREST ATTACHMENT POINT, A GUSSET PLATE OR VANG WITH A 1-INCH DIAMETER HOLE SHALL BE PROVIDED.
17. CROSSARMS AND HORIZONTAL MEMBERS ADJACENT TO PHASES SHALL BE DESIGNED TO SUPPORT A LADDER LOAD OF 1,200 POUNDS. LADDER LOAD SHALL BE APPLIED AS TWO POINT LOADS OF 600 POUNDS SPACED AT 15 INCHES. LOAD SHALL BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE.
18. CLIMBING AND WORKING CLEARANCES MUST BE PROVIDED AS INDICATED IN THE ELEVATION VIEW.
19. STRUCTURE SHALL BE DESIGNED TO WITHSTAND UNEVEN LEG EXTENSION DIFFERENTIAL ASSUMING VERTICAL TO HORIZONTAL GROUND SLOPE RATIO OF (1:2).

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

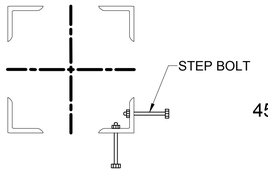
REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS	.	5/21/15	KAK	.	.
B	UPDATED STRUCTURE HEIGHT RANGE	.	5/8/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	KAK	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

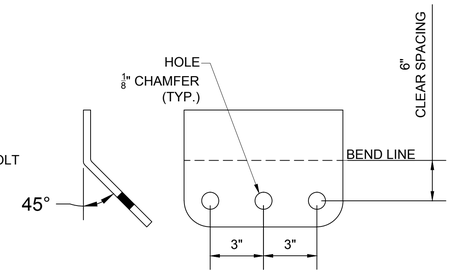
320kV DC LIGHT RUNNING ANGLE 2°-10°
32-SCHLT-LAG-010
LOAD & DESIGN DRAWING

C
DRAWN: KAK
ENGINEER: AKO
CHECKED: TAB
APPROVED:
DATE: 5/1/15
SCALE: NTS
FILE: LST-04-001.DWG
IMAGE:
DRAWING NO.: LST-04-001

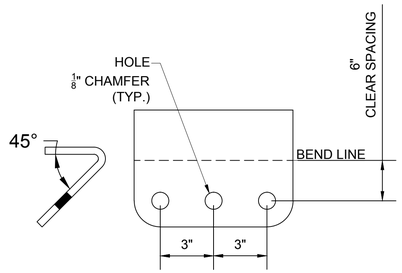
NU VER: 08/2012



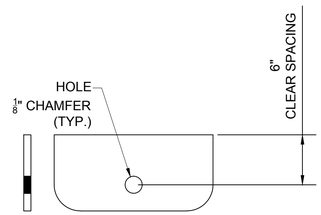
DETAIL 2/2
STEP BOLTS (TYP.)



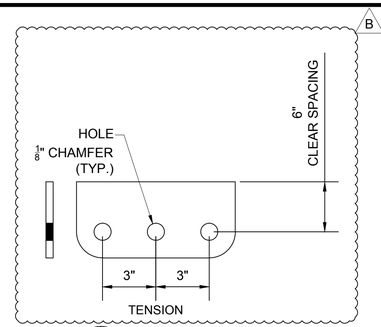
DETAIL 3/2
CONDUCTOR ATTACHMENT



DETAIL 4/2
CONDUCTOR ATTACHMENT

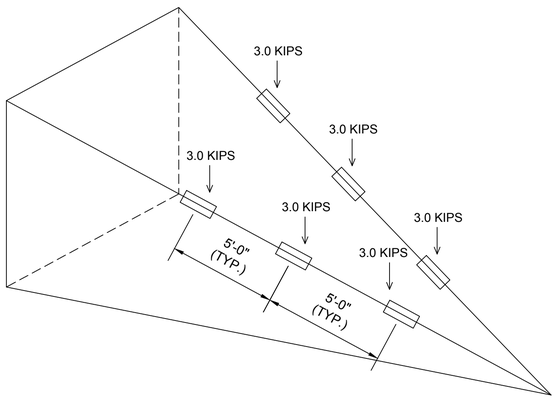


SUSPENSION

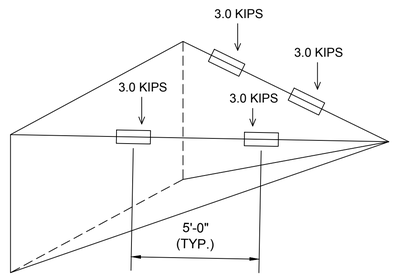


TENSION

DETAIL 5/2
OHGW ATTACHMENT



DETAIL 6/2
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL CONDUCTOR CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.)



DETAIL 7/2
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL OHSW CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.)

NOTES:

1. HOLE DIAMETERS AND VANG DIMENSIONS TO BE DETERMINED DURING DETAIL DESIGN THROUGH COORDINATION WITH TOWER VENDOR AND HARDWARE MANUFACTURER.
2. STEP BOLTS SHALL BE INSTALLED ON ALTERNATE FLANGES OF ONE LEG. SPACING SHALL NOT EXCEED 16 INCHES. STEP BOLTS SHALL BE PROVIDED FROM TOWER BASE TO TOP OF TOWER.
3. STRUCTURE SHALL BE DESIGNED WITH SUSPENSION AND TENSION ATTACHMENT PLATES AS SHOWN IN DETAIL 5.
4. FALL ARREST LOADS SHALL BE APPLIED SINGULARLY AT EACH LOCATION.

B

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
B	MISC. REVISIONS	.	5/21/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	KAK	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

320kV DC LIGHT RUNNNING ANGLE 2°-10°
32-SCHLT-LAG-010
LOAD & DESIGN DRAWING

	B
DRAWN	KAK
ENGINEER	AKO
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	LST-04-002.DWG
IMAGE:	
DRAWING NO.	LST-04-002

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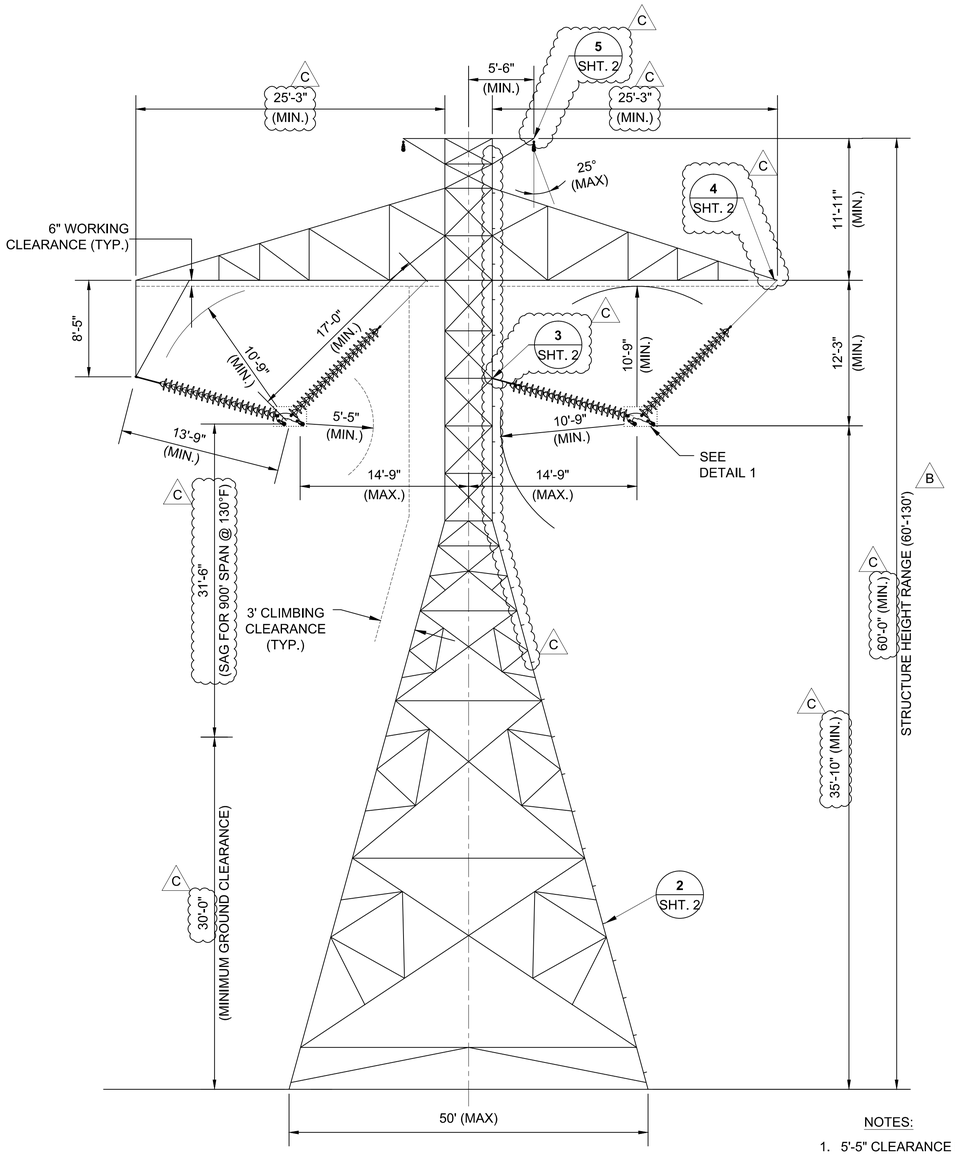
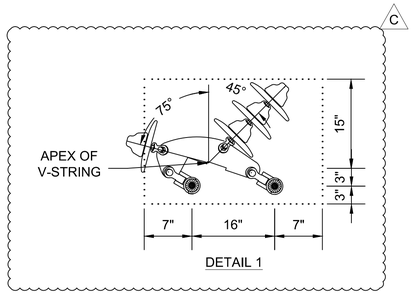
NU VER: 08/2012

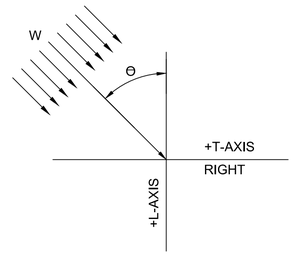


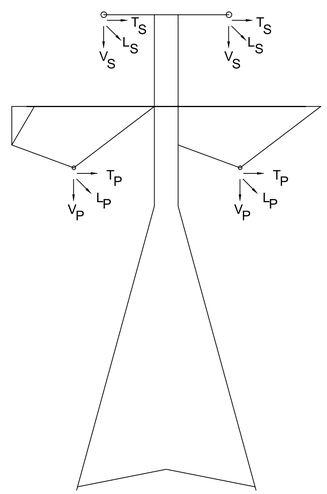
NOTES:

1. 5'-5" CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WORKING CLEARANCE.
2. 10'-9" CLEARANCE MUST BE CONSIDERED FROM TOWER BODY AND ARMS.



DETAIL 1





LOADING TREE

STRUCTURE NAME: 32-SCHLT-HAG-025
320-KV DC CONDUCTOR: 2 - 2933 KCMIL 91 STRAND AAAC PER PHASE (20000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 900
WEIGHT SPAN (FT): 1250
LINE ANGLE: 10 - 25 DEGREES

LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	2.09	5.30	0.00	18.70	36.32	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.61	2.93	0.00	7.82	24.32	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	2.96	4.22	0.00	17.87	24.95	0.00	4.00	90.00	1.00
4	HQ EXTREME ICE	15.00	1.50	39.53	5.30	6.27	0.00	24.83	31.83	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	1.40	2.98	0.00	12.47	21.09	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	1.40	2.83	0.00	12.47	19.10	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	1.40	1.64	5.48	12.47	10.44	39.85	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.85	2.40	0.27	26.93	20.18	2.27	3.45	90.00	1.50
9	MAINTENANCE	60.00	0.00	0.00	3.02	2.56	0.00	17.45	20.54	0.00	0.00	90.00	2.00
10	OBLIQUE WIND	60.00	0.00	100.00	0.61	2.44	0.00	7.82	20.53	0.00	29.00	45.00	1.00

GENERAL NOTES:

1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, AND L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE, AND LONGITUDINAL AXIS RESPECTIVELY.
3. TEMPERATURE, RADIAL DESIGN ICE THICKNESS, AND WIND SPEED ARE INDICATED IN THE LOAD TABLE. THESE VALUES WERE USED TO CALCULATE THE VERTICAL, TRANSVERSE, AND LONGITUDINAL LOADS APPLIED TO THE STRUCTURE.
4. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.6 SHALL BE APPLIED TO THE WIND LOAD. WIND SHALL BE BLOWN ON TWO FACES OF THE LATTICE TOWER.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THETA (Θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION.
7. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
8. EACH MEMBER, WHICH IS INCLINED AT AN ANGLE OF LESS THAN 45 DEGREES WITH THE HORIZONTAL SHALL BE OF SUFFICIENT SECTION TO WITHSTAND, INDEPENDENT OF ALL OTHER LOADS, A CONCENTRATED LOAD OF 350 POUNDS APPLIED NORMAL TO THE MEMBER ON ITS WEAKEST AXIS AT ANY POINT ALONG ITS LENGTH. CONCENTRATED LOAD SHALL BE MULTIPLIED BY AN OVERLOAD FACTOR OF 2.0.
9. LATTICE MEMBER ORIENTATION SHALL MINIMIZE SNOW ACCUMULATION ON THE STRUCTURE.
10. ELECTRICAL CLEARANCES MUST BE CHECKED TO THE SURFACE OF THE NEAREST MEMBER.
11. THE MAXIMUM SHIELDING ANGLE AT THE STRUCTURE SHALL BE 25 DEGREES.
12. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0 - 20°. CLEARANCES MUST BE CHECKED TO CLEARANCE ENVELOPE PROVIDED IN DETAIL 1.
13. SNUB ANGLES SHALL BE LIMITED TO A 15 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
14. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR HELICOPTER AND CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
15. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
16. CROSSARMS, AND GROUND WIRE PEAKS SHALL BE DESIGNED WITH FALL ARREST ATTACHMENT POINTS. FALL ARREST ATTACHMENT POINTS SHALL SUPPORT A LOAD OF 3,000 POUNDS AND BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE. AT EACH FALL ARREST ATTACHMENT POINT, A GUSSET PLATE OR VANG WITH A 1-INCH DIAMETER HOLE SHALL BE PROVIDED.
17. CROSSARMS AND HORIZONTAL MEMBERS ADJACENT TO PHASES SHALL BE DESIGNED TO SUPPORT A LADDER LOAD OF 1,200 POUNDS. LADDER LOAD SHALL BE APPLIED AS TWO POINT LOADS OF 600 POUNDS SPACED AT 15 INCHES. LOAD SHALL BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE.
18. CLIMBING AND WORKING CLEARANCES MUST BE PROVIDED AS INDICATED IN THE ELEVATION VIEW.
19. STRUCTURE SHALL BE DESIGNED TO WITHSTAND UNEVEN LEG EXTENSION DIFFERENTIAL ASSUMING VERTICAL TO HORIZONTAL GROUND SLOPE RATIO OF (1:2).

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS	.	5/21/15	KAK	.	.
B	UPDATED STRUCTURE HEIGHT RANGE	.	5/8/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	KAK	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

C

DRAWN KAK
ENGINEER AKO
CHECKED TAB
APPROVED
DATE 5/1/15

320kV DC HEAVY RUNNING ANGLE 10°-25°
32-SCHLT-HAG-025
LOAD & DESIGN DRAWING

SCALE NTS
FILE: LST-05-001.DWG
IMAGE:
DRAWING NO. LST-05-001

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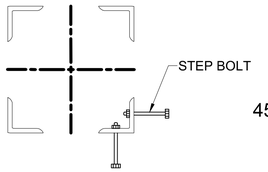
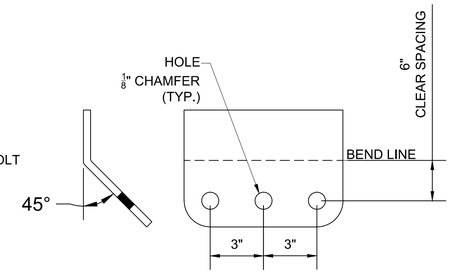
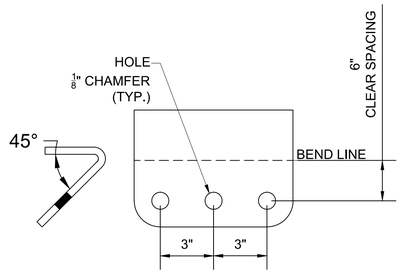


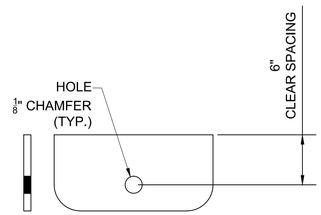
DETAIL 2
STEP BOLTS (TYP.) 2



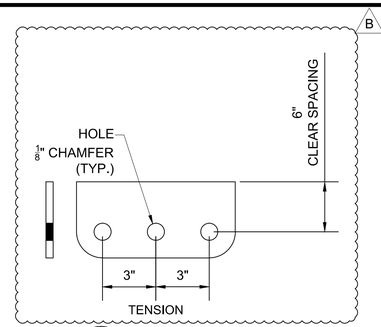
DETAIL 3
CONDUCTOR ATTACHMENT 2



DETAIL 4
CONDUCTOR ATTACHMENT 2

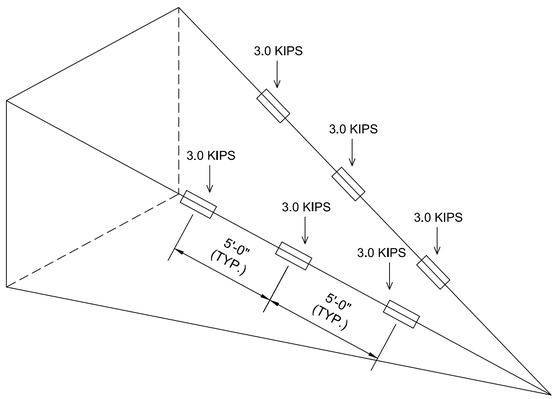


SUSPENSION

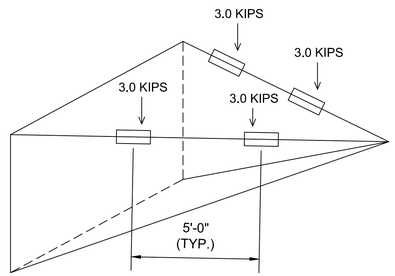


TENSION

DETAIL 5
OHGW ATTACHMENT 2



DETAIL 6
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL CONDUCTOR CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.) 2



DETAIL 7
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL OHSW CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.) 2

NOTES:

1. HOLE DIAMETERS AND VANG DIMENSIONS TO BE DETERMINED DURING DETAIL DESIGN THROUGH COORDINATION WITH TOWER VENDOR AND HARDWARE MANUFACTURER.
2. STEP BOLTS SHALL BE INSTALLED ON ALTERNATE FLANGES OF ONE LEG. SPACING SHALL NOT EXCEED 16 INCHES. STEP BOLTS SHALL BE PROVIDED FROM TOWER BASE TO TOP OF TOWER.
3. STRUCTURE SHALL BE DESIGNED WITH SUSPENSION AND TENSION ATTACHMENT PLATES AS SHOWN IN DETAIL 5.
4. FALL ARREST LOADS SHALL BE APPLIED SINGULARLY AT EACH LOCATION.

B

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

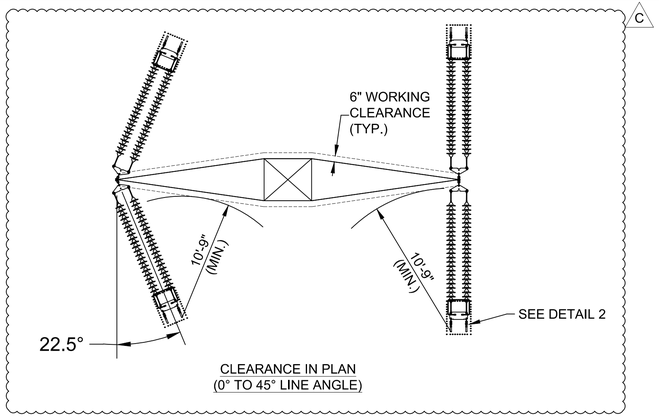
REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
B	MISC. REVISIONS	.	5/21/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	KAK	.	.

DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

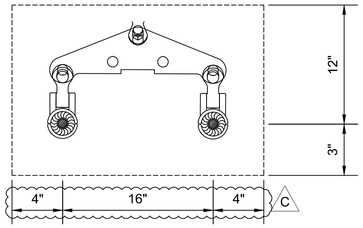
THE NORTHERN PASS

320kV DC HEAVY RUNNNING ANGLE 10°-25°
32-SCHLT-HAG-025
LOAD & DESIGN DRAWING

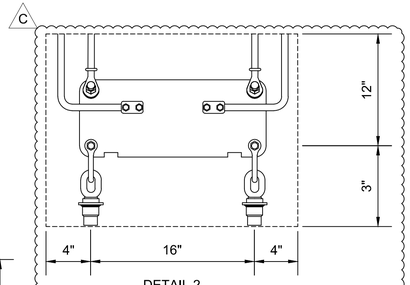
	B
DRAWN	KAK
ENGINEER	AKO
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	LST-05-002.DWG
IMAGE:	
DRAWING NO.	LST-05-002



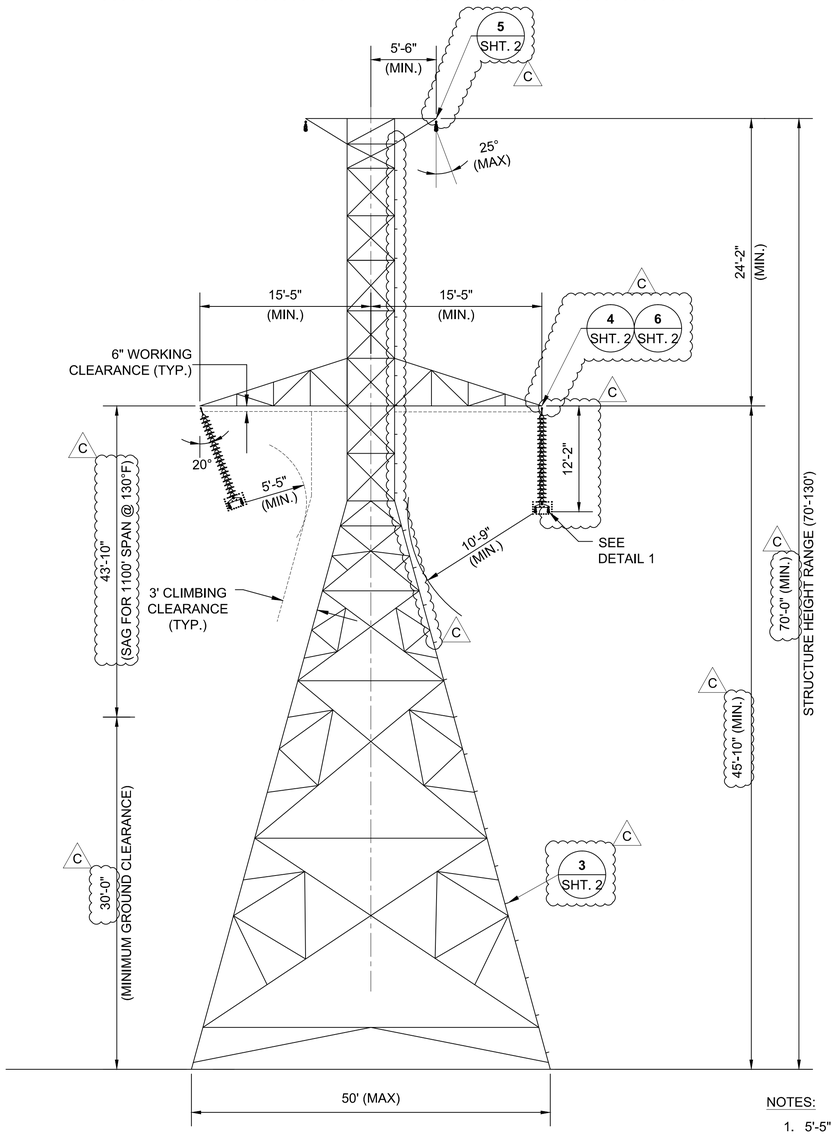
CLEARANCE IN PLAN
(0° TO 45° LINE ANGLE)

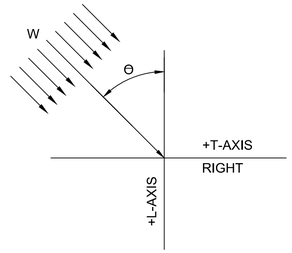


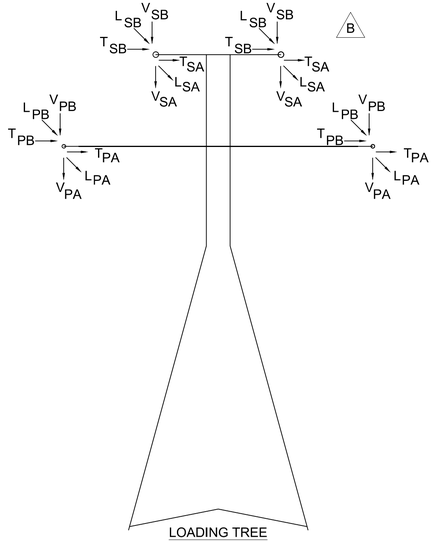
DETAIL 1



DETAIL 2







NOTES:

1. 5'-5" CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WORKING CLEARANCE.
2. 10'-9" CLEARANCE MUST BE CONSIDERED FROM TOWER BODY AND ARMS.

STRUCTURE NAME: 32-SCHLT-LDG-045
320-KV DC CONDUCTOR: 2 - 2933 KCMIL 91 STRAND AAAC PER PHASE (20000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 550 WIND SPAN BACK (FT): 550
WEIGHT SPAN AHEAD (FT): 825 WEIGHT SPAN BACK (FT): 825
LINE ANGLE: 0 - 45 DEGREES

LOADING CASE					DESIGN LOADS														
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.41	4.37	9.62	1.41	4.37	-9.62	13.36	30.89	73.59	13.36	30.89	-73.59	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.42	2.32	4.51	0.42	2.32	-4.51	5.52	19.43	38.67	5.52	19.43	-38.67	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	1.97	3.53	8.01	1.97	3.53	-8.01	12.47	21.41	52.13	12.47	21.41	-52.13	4.00	90.00	1.00
4	HQ EXTREME ICE	15.00	1.50	39.53	3.51	5.25	12.04	3.51	5.25	-12.04	16.96	27.33	66.65	16.96	27.33	-66.65	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.94	2.51	5.83	0.94	2.51	-5.83	8.91	18.16	44.60	8.91	18.16	-44.60	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.94	2.38	5.50	0.94	2.38	-5.50	8.91	16.40	40.00	8.91	16.40	-40.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.94	2.38	5.50	0.94	0.28	0.00	8.91	16.40	40.00	8.91	1.09	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	4.12	1.52	0.27	1.98	2.08	-5.23	30.33	12.71	2.27	9.63	17.56	-44.25	3.45	90.00	1.50
9	MAINTENANCE	60.00	0.00	0.00	2.64	2.26	5.92	2.64	2.26	-5.92	12.84	18.16	47.44	12.84	18.16	-47.44	0.00	90.00	2.00
10	OBLIQUE WIND	60.00	0.00	100.00	0.42	2.03	4.51	0.42	2.03	-4.51	5.52	17.12	38.67	5.52	17.12	-38.67	29.00	45.00	1.00
11	UPLIFT	-20.00	0.00	0.00	0.42	1.70	4.43	0.42	1.70	-4.43	5.52	16.59	43.34	5.52	16.59	-43.34	0.00	90.00	1.00

GENERAL NOTES:

1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, AND L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE, AND LONGITUDINAL AXIS RESPECTIVELY.
3. TEMPERATURE, RADIAL DESIGN ICE THICKNESS, AND WIND SPEED ARE INDICATED IN THE LOAD TABLE. THESE VALUES WERE USED TO CALCULATE THE VERTICAL, TRANSVERSE, AND LONGITUDINAL LOADS APPLIED TO THE STRUCTURE.
4. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.6 SHALL BE APPLIED TO THE WIND LOAD. WIND SHALL BE BLOWN ON TWO FACES OF THE LATTICE TOWER.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THETA (Θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION.
7. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
   D. AHEAD OR BACK CONDUCTORS AND GROUND WIRES ONLY.
8. EACH MEMBER, WHICH IS INCLINED AT AN ANGLE OF LESS THAN 45 DEGREES WITH THE HORIZONTAL SHALL BE OF SUFFICIENT SECTION TO WITHSTAND, INDEPENDENT OF ALL OTHER LOADS, A CONCENTRATED LOAD OF 350 POUNDS APPLIED NORMAL TO THE MEMBER ON ITS WEAKEST AXIS AT ANY POINT ALONG ITS LENGTH. CONCENTRATED LOAD SHALL BE MULTIPLIED BY AN OVERLOAD FACTOR OF 2.0.
9. LATTICE MEMBER ORIENTATION SHALL MINIMIZE SNOW ACCUMULATION ON THE STRUCTURE.
10. ELECTRICAL CLEARANCES MUST BE CHECKED TO THE SURFACE OF THE NEAREST MEMBER.
11. THE MAXIMUM SHIELDING ANGLE AT THE STRUCTURE SHALL BE 25 DEGREES.
12. ALL CLEARANCE CHECKS TO CONDUCTOR MUST BE CHECKED TO CLEARANCE ENVELOPE PROVIDED IN DETAIL 1.
13. SNUB ANGLES SHALL BE LIMITED TO A 15 DEGREE DEFLECTION LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
14. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR HELICOPTER AND CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
15. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
16. CROSSARMS, AND GROUND WIRE PEAKS SHALL BE DESIGNED WITH FALL ARREST ATTACHMENT POINTS. FALL ARREST ATTACHMENT POINTS SHALL SUPPORT A LOAD OF 3,000 POUNDS AND BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE. AT EACH FALL ARREST ATTACHMENT POINT, A GUSSET PLATE OR VANG WITH A 1-INCH DIAMETER HOLE SHALL BE PROVIDED.
17. CROSSARMS AND HORIZONTAL MEMBERS ADJACENT TO PHASES SHALL BE DESIGNED TO SUPPORT A LADDER LOAD OF 1,200 POUNDS. LADDER LOAD SHALL BE APPLIED AS TWO POINT LOADS OF 600 POUNDS SPACED AT 15 INCHES. LOAD SHALL BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE.
18. CLIMBING AND WORKING CLEARANCES MUST BE PROVIDED AS INDICATED IN THE ELEVATION VIEW.
19. STRUCTURE SHALL BE DESIGNED TO WITHSTAND UNEVEN LEG EXTENSION DIFFERENTIAL ASSUMING VERTICAL TO HORIZONTAL GROUND SLOPE RATIO OF (1:2).
20. STRUCTURES SHALL ALSO BE DESIGNED WITH UPLIFT LOADING. UPLIFT SHALL BE CONSIDERED UNDER LOAD CASE 1, LOAD CASE 2, & LOAD CASE 11. FOR LOAD CASE 1 REPLACE V_{SA} & V_{SB} WITH -0.2 KIPS AND V_{PA} & V_{PB} WITH -1 KIPS. FOR LOAD CASE 2 REPLACE V_{SA} & V_{SB} WITH -0.1 KIPS AND V_{PA} & V_{PB} WITH -1.6 KIPS. FOR LOAD CASE 13 REPLACE V_{SA} & V_{SB} WITH -0.2 KIPS AND V_{PA} & V_{PB} WITH -2.3 KIPS.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS	.	5/21/15	KAK	.	.
B	MISC. REVISIONS	.	5/8/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	KAK	.	.

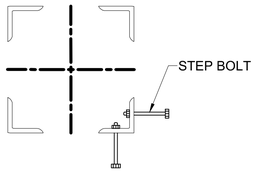
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

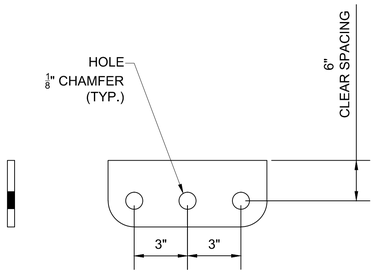
320kV DC LIGHT DEADEND 0°–45°
32–SCHLT–LDG–045
LOAD & DESIGN DRAWING

	C
DRAWN	KAK
ENGINEER	AKO
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	LST–06–001.DWG
IMAGE:	
DRAWING NO.	LST–06–001

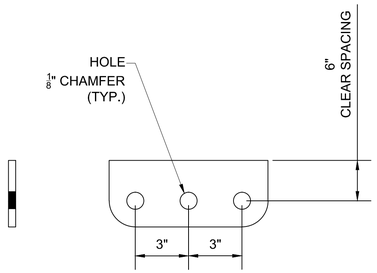
NU VER: 08/2012



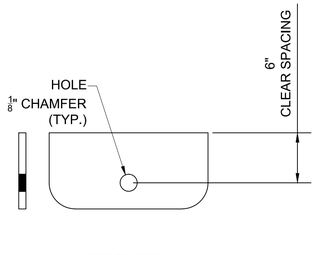
DETAIL 3
STEP BOLTS (TYP.) 2



DETAIL 4
CONDUCTOR ATTACHMENT 2



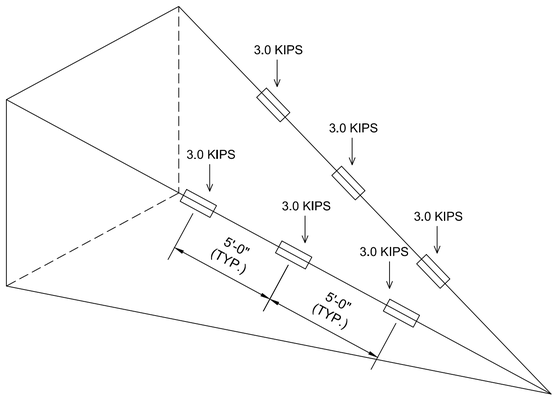
DETAIL 5
OHGW ATTACHMENT 2



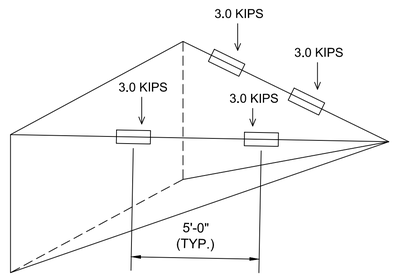
SUSPENSION

DETAIL 6
JUMPER ATTACHMENT 2

B



DETAIL 7
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL CONDUCTOR CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.) 2



DETAIL 8
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL OHSW CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.) 2

NOTES:

B
1. HOLE DIAMETERS AND VANG DIMENSIONS TO BE DETERMINED DURING DETAIL DESIGN THROUGH COORDINATION WITH TOWER VENDOR AND HARDWARE MANUFACTURER.
2. STEP BOLTS SHALL BE INSTALLED ON ALTERNATE FLANGES OF ONE LEG. SPACING SHALL NOT EXCEED 16 INCHES. STEP BOLTS SHALL BE PROVIDED FROM TOWER BASE TO TOP OF TOWER.
3. BOX ARMS SHALL HAVE PLATE ATTACHMENT HOLE AT EACH CORNER AND AT MIDPOINT.
4. FALL ARREST LOADS SHALL BE APPLIED SINGULARLY AT EACH LOCATION.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
B	MISC. REVISIONS	.	5/21/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	KAK	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

320kV DC LIGHT DEADEND 0°-45°
32-SCHLT-LDG-045
LOAD & DESIGN DRAWING

	B
DRAWN	KAK
ENGINEER	AKO
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	LST-06-002.DWG
IMAGE:	
DRAWING NO.	LST-06-002

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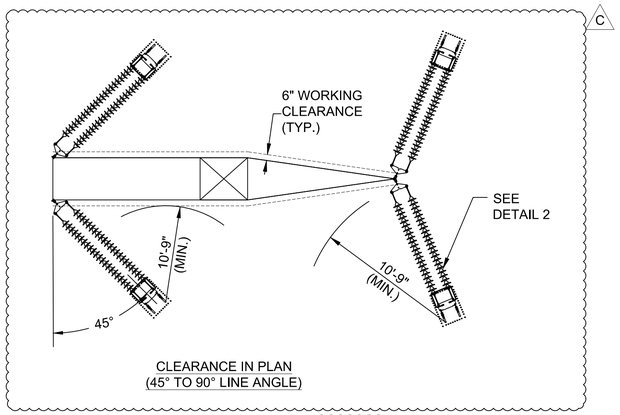
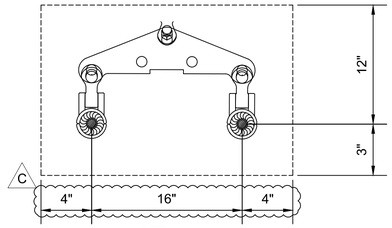
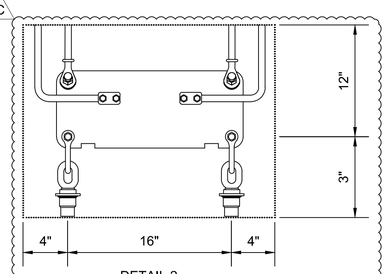


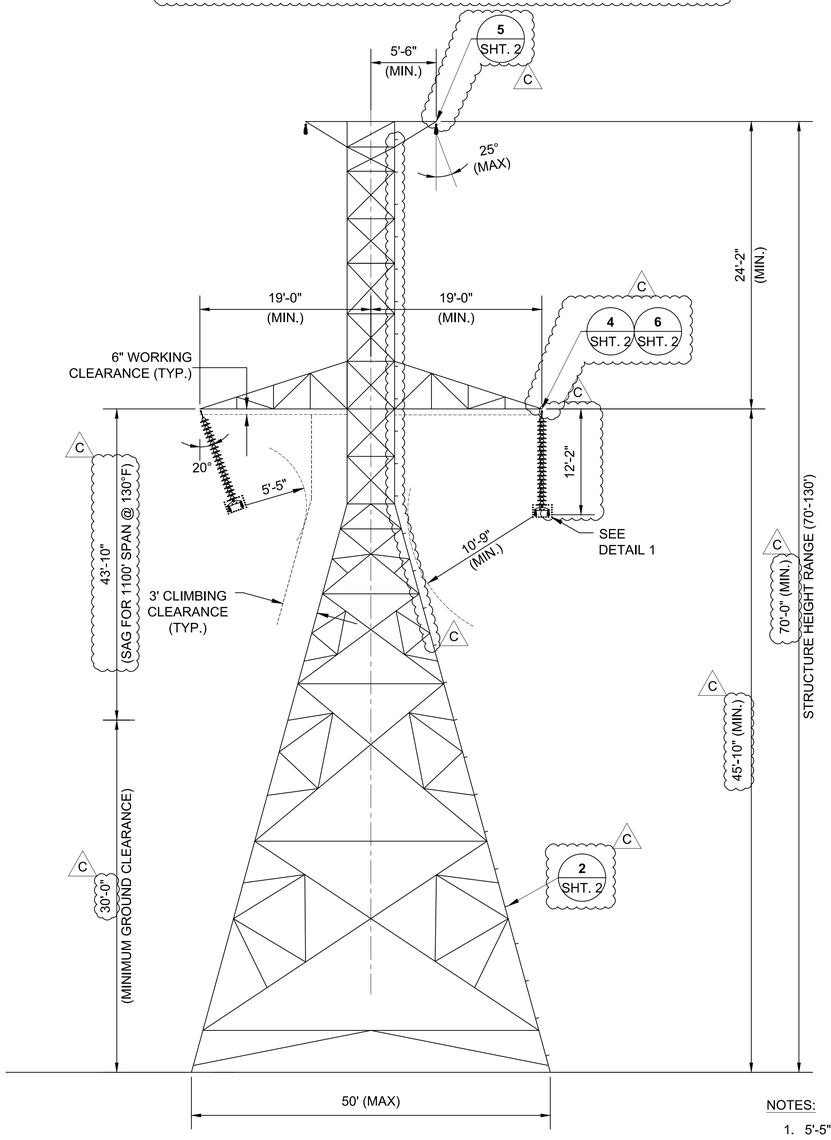
CLEARANCE IN PLAN
(45° TO 90° LINE ANGLE)



DETAIL 1

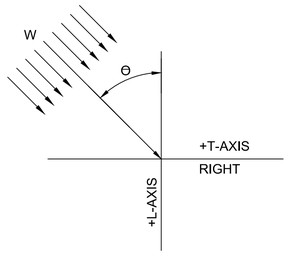


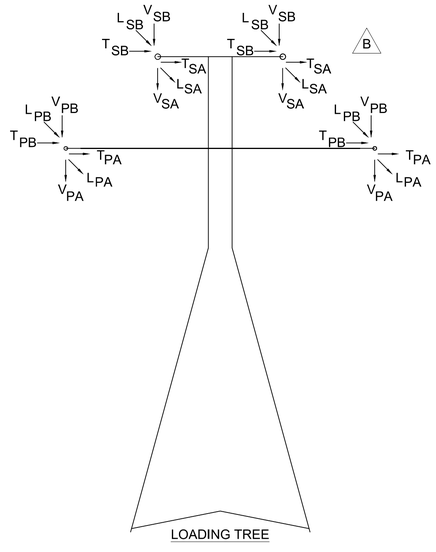
DETAIL 2



NOTES:

1. 5'-5" CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WORKING CLEARANCE.
2. 10'-9" CLEARANCE MUST BE CONSIDERED FROM TOWER BODY AND ARMS.





LOADING TREE

STRUCTURE NAME: 32-SCHLT-HDG-090
320-KV DC CONDUCTOR: 2 - 2933 KCMIL 91 STRAND AAAC PER PHASE (20000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 550 WIND SPAN BACK (FT): 550
WEIGHT SPAN AHEAD (FT): 825 WEIGHT SPAN BACK (FT): 825
LINE ANGLE: 45 - 90 DEGREES

LOADING CASE					DESIGN LOADS														
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.41	7.50	8.89	1.41	7.50	-8.89	13.36	54.76	67.99	13.36	54.76	-67.99	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.42	3.79	4.17	0.42	3.79	-4.17	5.52	31.98	35.73	5.52	31.98	-35.73	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	1.97	6.12	7.40	1.97	6.12	-7.40	12.47	38.32	48.17	12.47	38.32	-48.17	4.00	90.00	1.00
4	HQ EXTREME ICE	15.00	1.50	39.53	3.51	9.16	11.13	3.51	9.16	-11.13	16.96	48.95	61.57	16.96	48.95	-61.57	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.94	4.40	5.39	0.94	4.40	-5.39	8.91	32.63	41.21	8.91	32.63	-41.21	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.94	4.17	5.08	0.94	4.17	-5.08	8.91	29.38	36.96	8.91	29.38	-36.96	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.94	4.17	5.08	0.94	0.28	0.00	8.91	29.38	36.96	8.91	1.09	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	4.12	1.38	0.25	1.98	3.78	-4.83	30.33	11.55	2.10	9.63	31.91	-40.88	3.45	90.00	1.50
9	MAINTENANCE	60.00	0.00	0.00	2.64	4.18	5.47	2.64	4.18	-5.47	12.84	33.55	43.83	12.84	33.55	-43.83	0.00	90.00	2.00
10	OBLIQUE WIND	60.00	0.00	100.00	0.42	3.49	4.17	0.42	3.49	-4.17	5.52	29.66	35.73	5.52	29.66	-35.73	29.00	45.00	1.00
11	UPLIFT	-20.00	0.00	0.00	0.42	3.13	4.09	0.42	3.13	-4.09	5.52	30.65	40.04	5.52	30.65	-40.04	0.00	90.00	1.00

GENERAL NOTES:

1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, AND L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE, AND LONGITUDINAL AXIS RESPECTIVELY.
3. TEMPERATURE, RADIAL DESIGN ICE THICKNESS, AND WIND SPEED ARE INDICATED IN THE LOAD TABLE. THESE VALUES WERE USED TO CALCULATE THE VERTICAL, TRANSVERSE, AND LONGITUDINAL LOADS APPLIED TO THE STRUCTURE.
4. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.6 SHALL BE APPLIED TO THE WIND LOAD. WIND SHALL BE BLOWN ON TWO FACES OF THE LATTICE TOWER.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THETA (Θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION.
7. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
   D. AHEAD OR BACK CONDUCTORS AND GROUND WIRES ONLY.
8. EACH MEMBER, WHICH IS INCLINED AT AN ANGLE OF LESS THAN 45 DEGREES WITH THE HORIZONTAL SHALL BE OF SUFFICIENT SECTION TO WITHSTAND, INDEPENDENT OF ALL OTHER LOADS, A CONCENTRATED LOAD OF 350 POUNDS APPLIED NORMAL TO THE MEMBER ON ITS WEAKEST AXIS AT ANY POINT ALONG ITS LENGTH. CONCENTRATED LOAD SHALL BE MULTIPLIED BY AN OVERLOAD FACTOR OF 2.0.
9. LATTICE MEMBER ORIENTATION SHALL MINIMIZE SNOW ACCUMULATION ON THE STRUCTURE.
10. ELECTRICAL CLEARANCES MUST BE CHECKED TO THE SURFACE OF THE NEAREST MEMBER.
11. THE MAXIMUM SHIELDING ANGLE AT THE STRUCTURE SHALL BE 25 DEGREES.
12. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0 - 20°. CLEARANCES MUST BE CHECKED TO CLEARANCE ENVELOPE PROVIDED IN DETAIL 1.
13. SNUB ANGLES SHALL BE LIMITED TO A 15 DEGREE DEFLECTION LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
14. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR HELICOPTER AND CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
15. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
16. CROSSARMS, AND GROUND WIRE PEAKS SHALL BE DESIGNED WITH FALL ARREST ATTACHMENT POINTS. FALL ARREST ATTACHMENT POINTS SHALL SUPPORT A LOAD OF 3,000 POUNDS AND BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE. AT EACH FALL ARREST ATTACHMENT POINT, A GUSSET PLATE OR VANG WITH A 1-INCH DIAMETER HOLE SHALL BE PROVIDED.
17. CROSSARMS AND HORIZONTAL MEMBERS ADJACENT TO PHASES SHALL BE DESIGNED TO SUPPORT A LADDER LOAD OF 1,200 POUNDS. LADDER LOAD SHALL BE APPLIED AS TWO POINT LOADS OF 600 POUNDS SPACED AT 15 INCHES. LOAD SHALL BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE.
18. CLIMBING AND WORKING CLEARANCES MUST BE PROVIDED AS INDICATED IN THE ELEVATION VIEW.
19. STRUCTURE SHALL BE DESIGNED TO WITHSTAND UNEVEN LEG EXTENSION DIFFERENTIAL ASSUMING VERTICAL TO HORIZONTAL GROUND SLOPE RATIO OF (1:2).
20. STRUCTURES SHALL ALSO BE DESIGNED WITH UPLIFT LOADING. UPLIFT SHALL BE CONSIDERED UNDER LOAD CASE 1, LOAD CASE 2, & LOAD CASE 11. FOR LOAD CASE 1 REPLACE V_{SA} & V_{SB} WITH -0.3 KIPS AND V_{PA} & V_{PB} WITH -1.9 KIPS. FOR LOAD CASE 2 REPLACE V_{SA} & V_{SB} WITH -0.2 KIPS AND V_{PA} & V_{PB} WITH -2.1 KIPS. FOR LOAD CASE 13 REPLACE V_{SA} & V_{SB} WITH -0.2 KIPS AND V_{PA} & V_{PB} WITH -3 KIPS.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS	.	5/21/15	KAK	.	.
B	MISC. REVISIONS	.	5/8/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	KAK	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

320kV DC HEAVY DEADEND 45°-90°
32-SCHLT-HDG-090
LOAD & DESIGN DRAWING

	C
DRAWN	KAK
ENGINEER	AKO
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
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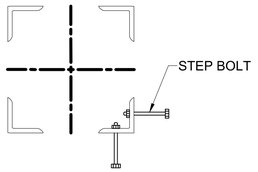
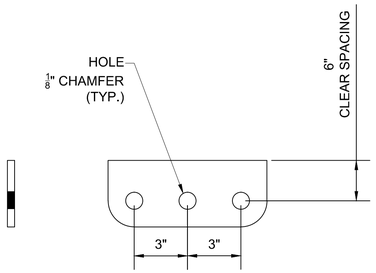
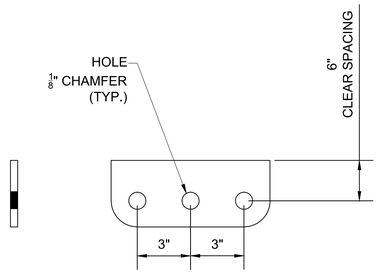
DRAWING NO.	LST-07-001



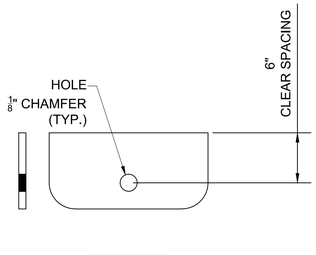
DETAIL 3 / 2
STEP BOLTS (TYP.)



DETAIL 4 / 2
CONDUCTOR ATTACHMENT



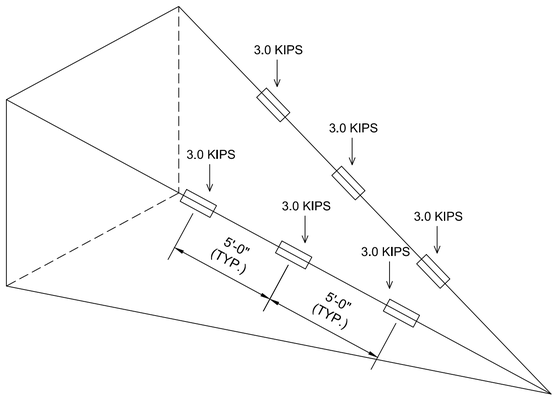
DETAIL 5 / 2
OHGW ATTACHMENT



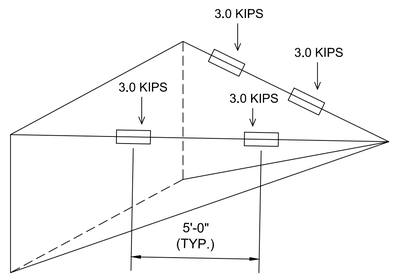
SUSPENSION

DETAIL 6 / 2
JUMPER ATTACHMENT

B



DETAIL 7 / 2
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL CONDUCTOR CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.)



DETAIL 8 / 2
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL OHSW CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.)

NOTES:

B
1. HOLE DIAMETERS AND VANG DIMENSIONS TO BE DETERMINED DURING DETAIL DESIGN THROUGH COORDINATION WITH TOWER VENDOR AND HARDWARE MANUFACTURER.
2. STEP BOLTS SHALL BE INSTALLED ON ALTERNATE FLANGES OF ONE LEG. SPACING SHALL NOT EXCEED 16 INCHES. STEP BOLTS SHALL BE PROVIDED FROM TOWER BASE TO TOP OF TOWER.
3. BOX ARMS SHALL HAVE PLATE ATTACHMENT HOLE AT EACH CORNER AND AT MIDPOINT.
4. FALL ARREST LOADS SHALL BE APPLIED SINGULARLY AT EACH LOCATION.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

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A	RELEASED FOR RFP BID	.	5/1/15	KAK	.	.

DWG REV | EPN/DESCRIPTION | CONT/PE# | DATE | DRN | CHKD | APPR

THE NORTHERN PASS

320kV DC HEAVY DEADEND 45°-90°
32-SCHLT-HDG-090
LOAD & DESIGN DRAWING

	B
DRAWN	KAK
ENGINEER	AKO
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DATE	5/1/15
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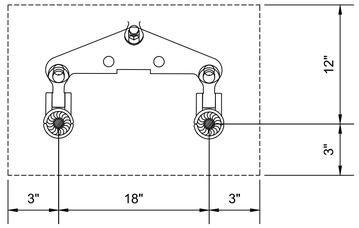
FILE:	LST-07-002.DWG
IMAGE:	
DRAWING NO.	LST-07-002

NU VER: 08/2012



DETAIL 1

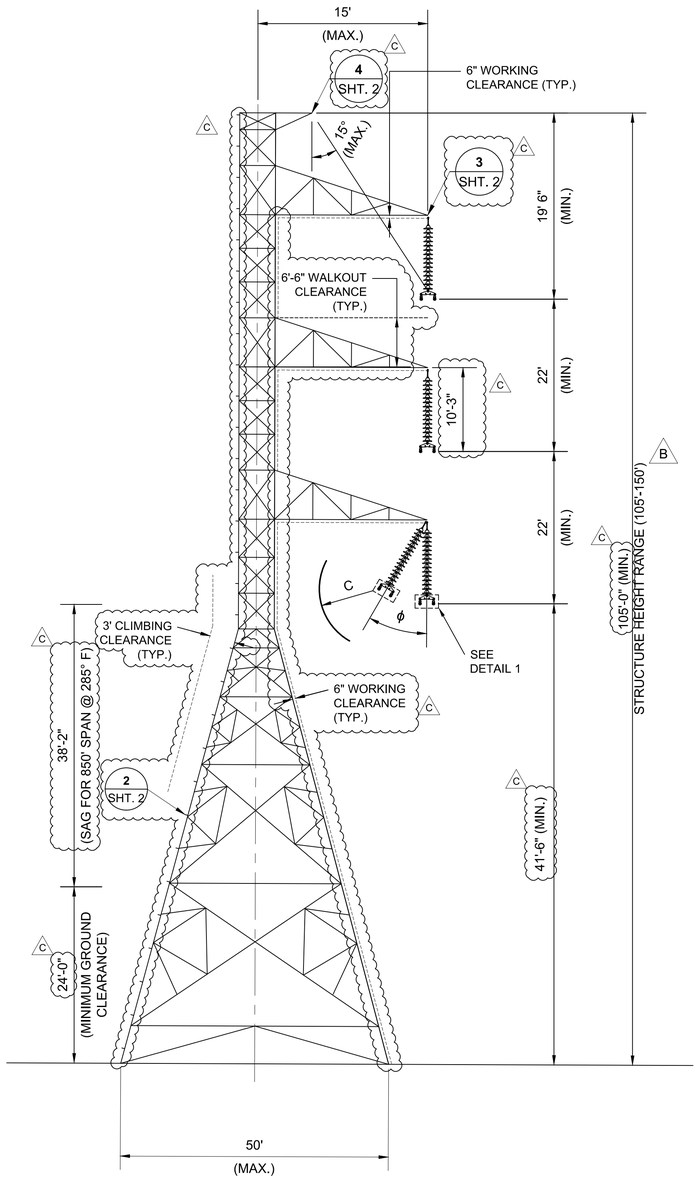
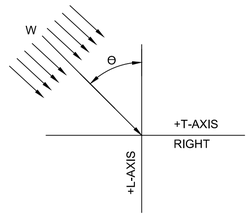
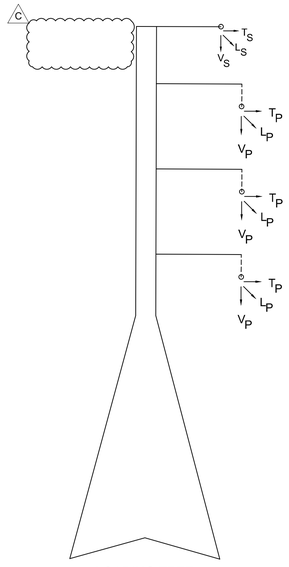


TABLE 1. INSULATOR SWING AND CLEARANCE

CONDITION	ϕ	C	REMARKS
NU SWING C_W	0°	8'-6"	CLEARANCE MUST BE CONSIDERED FROM TOWER BODY AND ARMS
NU SWING C_L	25°	8'-1"	
NU SWING C_S	43°	6'-2"	
NU SWING C_R	54°	2'-6"	
NU SWING C_W	0°	8'-6" C	CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WALKOUT CLEARANCE





LOADING TREE

STRUCTURE NAME: 30-SCVLT-LTG-002
345-KV AC CONDUCTOR: 2 - 1590 KCMIL 45/7 "LAPWING" ACSR PER PHASE (11400# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 850
WEIGHT SPAN (FT): 850
LINE ANGLE: 0 - 2 DEGREES

LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.45	1.40	0.00	8.94	4.99	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.43	1.08	0.00	3.49	6.26	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	2.03	0.99	0.00	9.14	3.09	0.00	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	2.76	1.20	0.00	11.12	3.56	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.96	0.63	0.00	5.96	2.29	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.96	0.62	0.00	5.96	2.21	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.96	0.52	5.50	5.96	1.66	13.68	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.58	0.31	0.27	13.87	1.56	1.21	3.45	90.00	1.50
9	MAINTENANCE	60.00	0.00	0.00	2.66	0.21	0.00	8.79	0.93	0.00	0.00	90.00	2.00
10	OBLIQUE WIND	60.00	0.00	100.00	0.43	0.62	0.00	3.49	3.53	0.00	29.00	45.00	1.00

C

GENERAL NOTES:

1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, AND L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE, AND LONGITUDINAL AXIS RESPECTIVELY.
3. TEMPERATURE, RADIAL DESIGN ICE THICKNESS, AND WIND SPEED ARE INDICATED IN THE LOAD TABLE. THESE VALUES WERE USED TO CALCULATE THE VERTICAL, TRANSVERSE, AND LONGITUDINAL LOADS APPLIED TO THE STRUCTURE.
4. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.6 SHALL BE APPLIED TO THE WIND LOAD. WIND SHALL BE BLOWN ON TWO FACES OF THE LATTICE TOWER.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THETA (Θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION.
7. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
8. EACH MEMBER, WHICH IS INCLINED AT AN ANGLE OF LESS THAN 45 DEGREES WITH THE HORIZONTAL SHALL BE OF SUFFICIENT SECTION TO WITHSTAND, INDEPENDENT OF ALL OTHER LOADS, A CONCENTRATED LOAD OF 350 POUNDS APPLIED NORMAL TO THE MEMBER ON ITS WEAKEST AXIS AT ANY POINT ALONG ITS LENGTH. CONCENTRATED LOAD SHALL BE MULTIPLIED BY AN OVERLOAD FACTOR OF 2.0.
9. LATTICE MEMBER ORIENTATION SHALL MINIMIZE SNOW ACCUMULATION ON THE STRUCTURE.
10. ELECTRICAL CLEARANCES MUST BE CHECKED TO THE SURFACE OF NEAREST MEMBER.
11. THE MAXIMUM SHIELDING ANGLE AT THE STRUCTURE SHALL BE 15 DEGREES.
12. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0 - 20°. CLEARANCES MUST BE CHECKED TO CLEARANCE ENVELOPE PROVIDED IN DETAIL 1.
13. SNUB ANGLES SHALL BE LIMITED TO A 2 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
14. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR HELICOPTER AND CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
15. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.

C
16. CROSSARMS, AND GROUND WIRE PEAKS SHALL BE DESIGNED WITH FALL ARREST ATTACHMENT POINTS. FALL ARREST ATTACHMENT POINTS SHALL SUPPORT A LOAD OF 3,000 POUNDS AND BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE. AT EACH FALL ARREST ATTACHMENT POINT, A GUSSET PLATE OR VANG WITH A 1-INCH DIAMETER HOLE SHALL BE PROVIDED.
17. CROSSARMS AND HORIZONTAL MEMBERS ADJACENT TO PHASES SHALL BE DESIGNED TO SUPPORT A LADDER LOAD OF 1,200 POUNDS. LADDER LOAD SHALL BE APPLIED AS TWO POINT LOADS OF 600 POUNDS SPACED AT 15 INCHES. LOAD SHALL BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE.
18. PHI (ϕ) IS THE SWING ANGLE OF THE ASSEMBLY AND "C" IS THE REQUIRED ELECTRICAL CLEARANCE. THE STRUCTURE DESIGN SHALL PROVIDE CLEARANCE AS INDICATED IN TABLE 1.

C
19. CLIMBING AND WORKING CLEARANCES MUST BE PROVIDED AS INDICATED IN THE ELEVATION VIEW. (FOR WALKOUT CLEARANCES, ASSUME A WORKER HEIGHT OF 6'-6".
20. STRUCTURE SHALL BE DESIGNED TO WITHSTAND UNEVEN LEG EXTENSION DIFFERENTIAL ASSUMING VERTICAL TO HORIZONTAL GROUND SLOPE RATIO OF (1:2).

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS	.	5/21/15	MSP	.	.
B	UPDATED STRUCTURE HEIGHT RANGE	.	5/8/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	KAK	.	.

DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

345kV AC LIGHT TANGENT 0°–2°
30–SCVLT–LTG–002
LOAD & DESIGN DRAWING

	C
DRAWN	KAK
ENGINEER	AKO
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	LST–08–001.DWG
IMAGE:	
DRAWING NO.	LST–08–001

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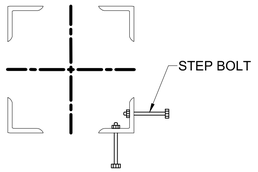
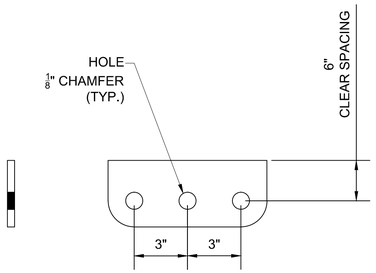
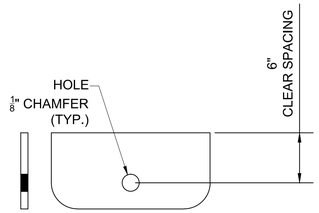


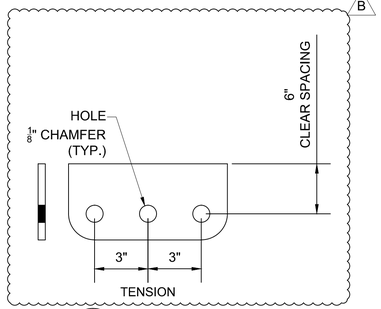
DETAIL 2
STEP BOLTS (TYP.) 2



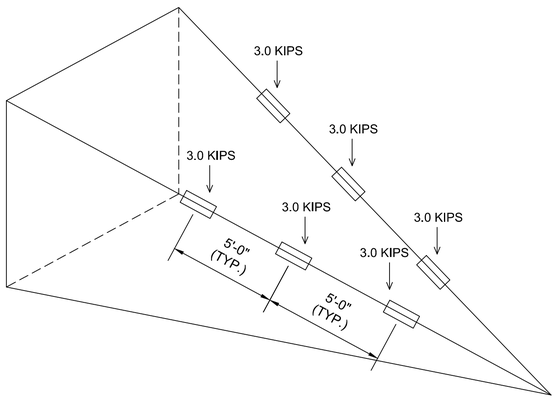
DETAIL 3
CONDUCTOR ATTACHMENT 2



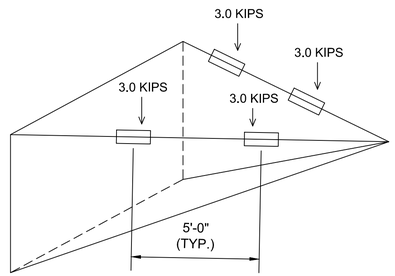
SUSPENSION



DETAIL 4
OHGW ATTACHMENT 2



DETAIL 5
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL CONDUCTOR CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.) 2



DETAIL 6
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL OHSW CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.) 2

NOTES:

1. HOLE DIAMETERS AND VANG DIMENSIONS TO BE DETERMINED DURING DETAIL DESIGN THROUGH COORDINATION WITH TOWER VENDOR AND HARDWARE MANUFACTURER.
2. STEP BOLTS SHALL BE INSTALLED ON ALTERNATE FLANGES OF ONE LEG. SPACING SHALL NOT EXCEED 16 INCHES. STEP BOLTS SHALL BE PROVIDED FROM TOWER BASE TO TOP OF TOWER.
3. STRUCTURE SHALL BE DESIGNED WITH SUSPENSION AND TENSION ATTACHMENT PLATES AS SHOWN IN DETAIL 4.
4. FALL ARREST LOADS SHALL BE APPLIED SINGULARLY AT EACH LOCATION.

B

PRELIMINARY - NOT FOR CONSTRUCTION

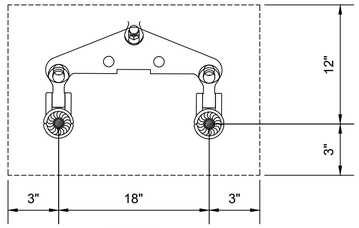
CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
B	MISC. REVISIONS	.	5/21/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	KAK	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

345kV AC LIGHT TANGENT 0°–2°
30–SCVLT–LTG–002
LOAD & DESIGN DRAWING

	B
DRAWN	KAK
ENGINEER	AKO
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	LST–08–002.DWG
IMAGE:	
DRAWING NO.	LST–08–002



DETAIL 1

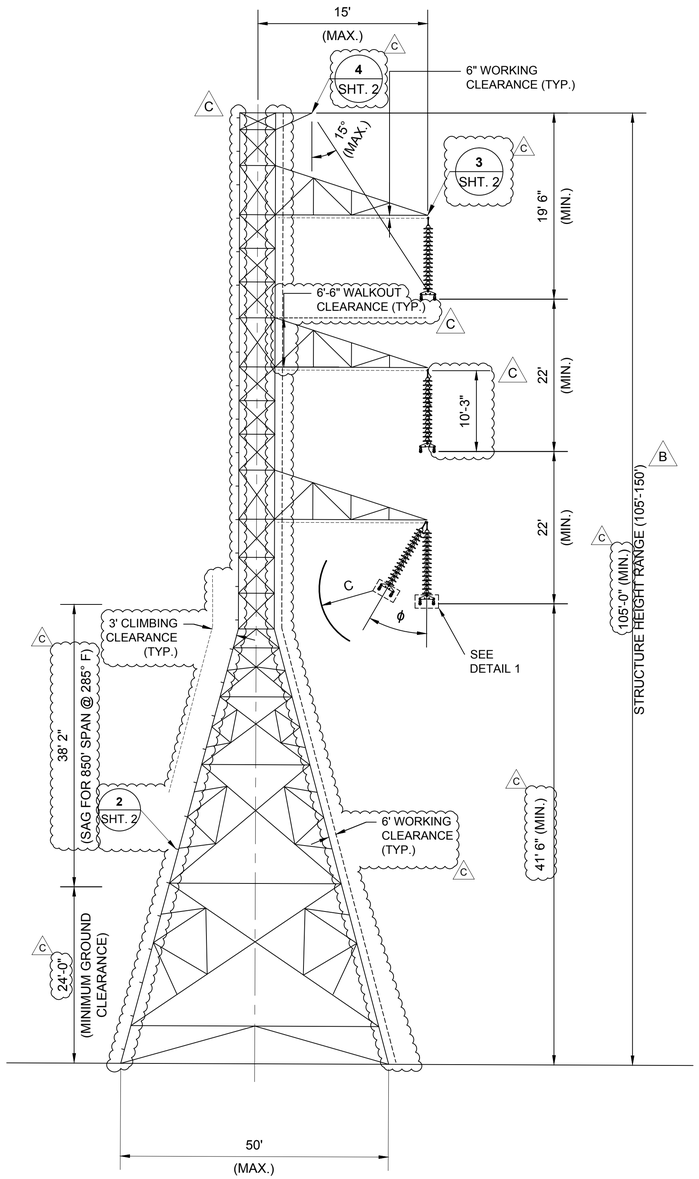
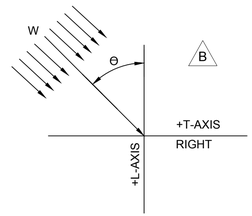
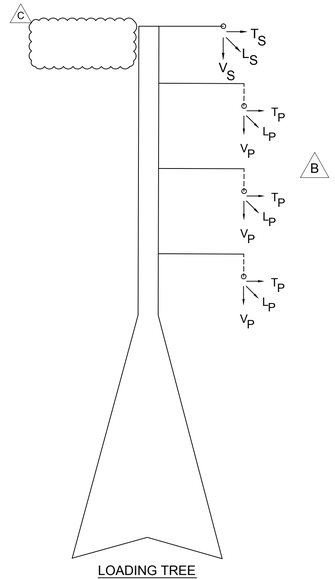


TABLE 1. INSULATOR SWING AND CLEARANCE

CONDITION	ϕ	C	REMARKS
NU SWING C_W	0°	8'-6"	CLEARANCE MUST BE CONSIDERED FROM TOWER BODY AND ARMS
NU SWING C_L	25°	8'-1"	
NU SWING C_S	43°	6'-2"	
NU SWING C_R	54°	2'-6"	
NU SWING C_W	0°	8'-6"	CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WALKOUT CLEARANCE





LOADING TREE

STRUCTURE NAME: 30-SCVLT-HTG-002
345-KV AC CONDUCTOR: 2 - 1590 KCMIL 45/7 "LAPWING" ACSR PER PHASE (11400# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 850
WEIGHT SPAN (FT): 1550
LINE ANGLE: 0 - 2 DEGREES

LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	2.58	1.40	0.00	15.32	4.99	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.75	1.08	0.00	6.00	6.26	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	3.65	0.99	0.00	16.00	3.09	0.00	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	4.98	1.20	0.00	19.62	3.56	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	1.72	0.63	0.00	10.21	2.29	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	1.72	0.62	0.00	10.21	2.21	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	1.72	0.52	5.50	10.21	1.82	22.80	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	4.05	0.31	0.27	17.63	1.56	1.21	3.45	90.00	1.50
9	MAINTENANCE	60.00	0.00	0.00	3.29	0.21	0.00	13.80	0.93	0.00	0.00	90.00	2.00
10	OBLIQUE WIND	60.00	0.00	100.00	0.75	0.62	0.00	6.00	3.53	0.00	29.00	45.00	1.00

C

GENERAL NOTES:

1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, AND L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE, AND LONGITUDINAL AXIS RESPECTIVELY.
3. TEMPERATURE, RADIAL DESIGN ICE THICKNESS, AND WIND SPEED ARE INDICATED IN THE LOAD TABLE. THESE VALUES WERE USED TO CALCULATE THE VERTICAL, TRANSVERSE, AND LONGITUDINAL LOADS APPLIED TO THE STRUCTURE.
4. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.6 SHALL BE APPLIED TO THE WIND LOAD. WIND SHALL BE BLOWN ON TWO FACES OF THE LATTICE TOWER.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THETA (Θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION.
7. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
8. EACH MEMBER, WHICH IS INCLINED AT AN ANGLE OF LESS THAN 45 DEGREES WITH THE HORIZONTAL SHALL BE OF SUFFICIENT SECTION TO WITHSTAND, INDEPENDENT OF ALL OTHER LOADS, A CONCENTRATED LOAD OF 350 POUNDS APPLIED NORMAL TO THE MEMBER ON ITS WEAKEST AXIS AT ANY POINT ALONG ITS LENGTH. CONCENTRATED LOAD SHALL BE MULTIPLIED BY AN OVERLOAD FACTOR OF 2.0.
9. LATTICE MEMBER ORIENTATION SHALL MINIMIZE SNOW ACCUMULATION ON THE STRUCTURE.
10. ELECTRICAL CLEARANCES MUST BE CHECKED TO THE SURFACE OF NEAREST MEMBER.
11. THE MAXIMUM SHIELDING ANGLE AT THE STRUCTURE SHALL BE 15 DEGREES.
12. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0 - 20°. CLEARANCES MUST BE CHECKED TO CLEARANCE ENVELOPE PROVIDED IN DETAIL 1.
13. SNUB ANGLES SHALL BE LIMITED TO A 2 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
14. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR HELICOPTER AND CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
15. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.

C

16. CROSSARMS, AND GROUND WIRE PEAKS SHALL BE DESIGNED WITH FALL ARREST ATTACHMENT POINTS. FALL ARREST ATTACHMENT POINTS SHALL SUPPORT A LOAD OF 3,000 POUNDS AND BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE. AT EACH FALL ARREST ATTACHMENT POINT, A GUSSET PLATE OR VANG WITH A 1-INCH DIAMETER HOLE SHALL BE PROVIDED.
17. CROSSARMS AND HORIZONTAL MEMBERS ADJACENT TO PHASES SHALL BE DESIGNED TO SUPPORT A LADDER LOAD OF 1,200 POUNDS. LADDER LOAD SHALL BE APPLIED AS TWO POINT LOADS OF 600 POUNDS SPACED AT 15 INCHES. LOAD SHALL BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE.
18. PHI (ϕ) IS THE SWING ANGLE OF THE ASSEMBLY AND "C" IS THE REQUIRED ELECTRICAL CLEARANCE. THE STRUCTURE DESIGN SHALL PROVIDE CLEARANCE AS INDICATED IN TABLE 1.

C

19. CLIMBING AND WORKING CLEARANCES MUST BE PROVIDED AS INDICATED IN THE ELEVATION VIEW. FOR WALKOUT CLEARANCES, ASSUME A WORKER HEIGHT OF 6'-6".
20. STRUCTURE SHALL BE DESIGNED TO WITHSTAND UNEVEN LEG EXTENSION DIFFERENTIAL ASSUMING VERTICAL TO HORIZONTAL GROUND SLOPE RATIO OF (1:2).

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

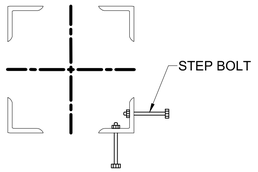
REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS	.	5/21/15	MSP	.	.
B	UPDATED STRUCTURE HEIGHT RANGE	.	5/8/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	KAK	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

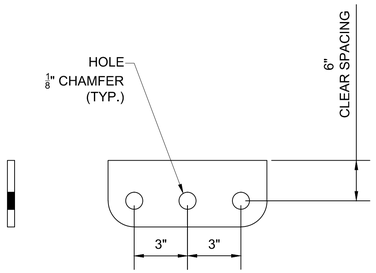
345kV AC HEAVY TANGENT 0°-2°
30-SCVLT-HTG-002
LOAD & DESIGN DRAWING

	C
DRAWN	KAK
ENGINEER	AKO
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	LST-09-001.DWG
IMAGE:	
DRAWING NO.	LST-09-001

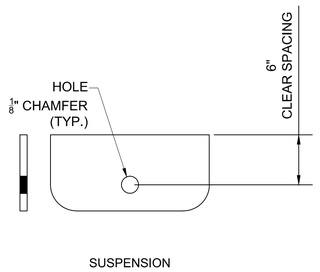
NU VER: 08/2012

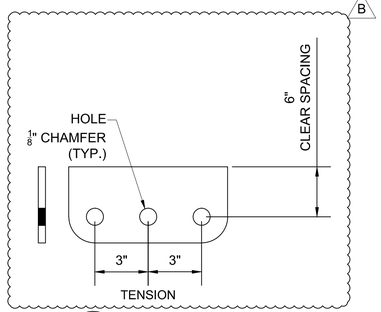


DETAIL 2
STEP BOLTS (TYP.) 2

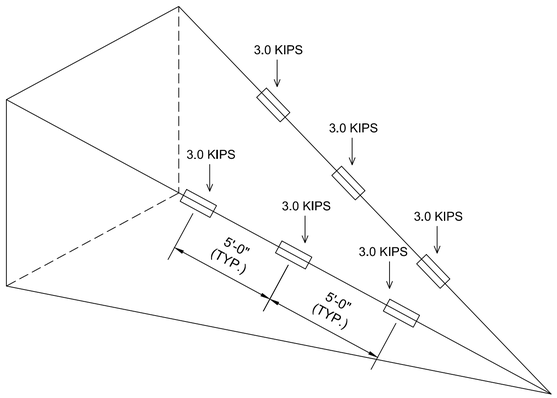


DETAIL 3
CONDUCTOR ATTACHMENT 2

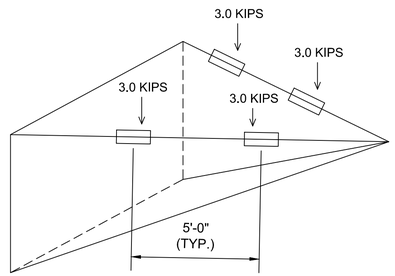




DETAIL 4
OHGW ATTACHMENT 2



DETAIL 5
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL CONDUCTOR CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.) 2



DETAIL 6
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL OHSW CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.) 2

NOTES:

1. HOLE DIAMETERS AND VANG DIMENSIONS TO BE DETERMINED DURING DETAIL DESIGN THROUGH COORDINATION WITH TOWER VENDOR AND HARDWARE MANUFACTURER.
2. STEP BOLTS SHALL BE INSTALLED ON ALTERNATE FLANGES OF ONE LEG. SPACING SHALL NOT EXCEED 16 INCHES. STEP BOLTS SHALL BE PROVIDED FROM TOWER BASE TO TOP OF TOWER.
3. STRUCTURE SHALL BE DESIGNED WITH SUSPENSION AND TENSION ATTACHMENT PLATES AS SHOWN IN DETAIL 4.
4. FALL ARREST LOADS SHALL BE APPLIED SINGULARLY AT EACH LOCATION.

B

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
B	MISC. REVISIONS	.	5/21/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	KAK	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

345kV AC HEAVY TANGENT 0°–2°
30–SCVLT–HTG–002
LOAD & DESIGN DRAWING

	B
DRAWN	KAK
ENGINEER	AKO
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	LST–09–002.DWG
IMAGE:	
DRAWING NO.	LST–09–002

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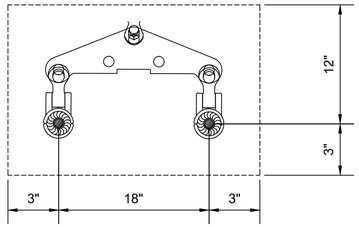


DETAIL 1

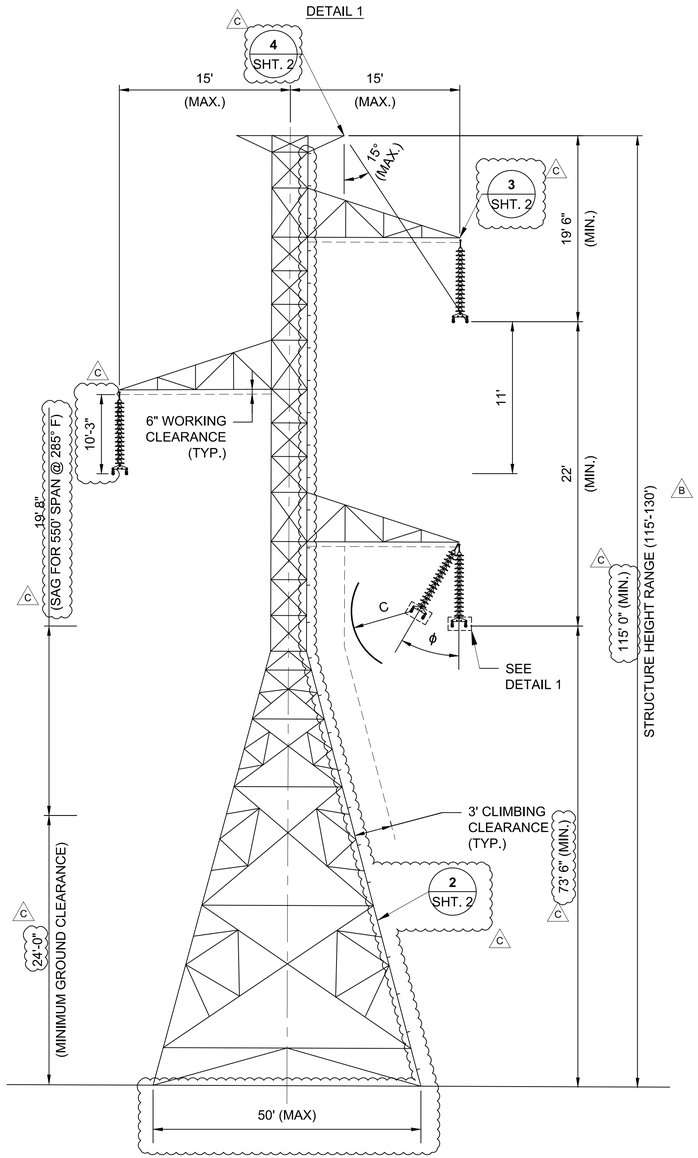
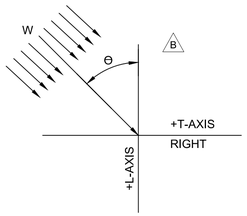
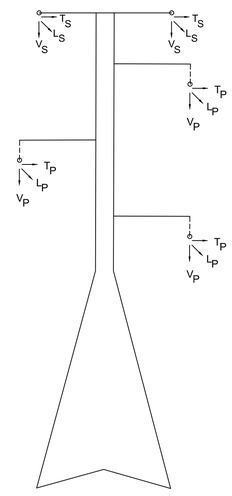


TABLE 1. INSULATOR SWING AND CLEARANCE

CONDITION	ϕ	C	REMARKS
NU SWING C_W	0°	8'-6"	CLEARANCE MUST BE CONSIDERED FROM TOWER BODY AND ARMS
NU SWING C_L	25°	8'-1"	
NU SWING C_S	43°	6'-2"	
NU SWING C_R	54°	2'-6"	
NU SWING C_W	0°	8'-6" C	CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WALKOUT CLEARANCE





LOADING TREE

STRUCTURE NAME: 30-SCDLT-LTG-002
345-KV AC CONDUCTOR: 2 - 1590 KCMIL 45/7 "LAPWING" ACSR PER PHASE (11400# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 550
WEIGHT SPAN (FT): 850
LINE ANGLE: 0 - 2 DEGREES

LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.45	1.03	0.00	8.94	3.73	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.43	0.75	0.00	3.49	4.34	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	2.03	0.74	0.00	9.14	2.39	0.00	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	2.76	0.90	0.00	11.12	2.76	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.96	0.48	0.00	5.96	1.79	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.96	0.47	0.00	5.96	1.71	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.96	0.37	5.50	5.96	1.16	13.68	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.58	0.27	0.27	13.87	1.30	1.21	3.45	90.00	1.50
9	MAINTENANCE	60.00	0.00	0.00	2.66	0.21	0.00	8.79	0.93	0.00	0.00	90.00	2.00
10	OBLIQUE WIND	60.00	0.00	100.00	0.43	0.46	0.00	3.49	2.57	0.00	29.00	45.00	1.00

C

GENERAL NOTES:

1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, AND L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE, AND LONGITUDINAL AXIS RESPECTIVELY.
3. TEMPERATURE, RADIAL DESIGN ICE THICKNESS, AND WIND SPEED ARE INDICATED IN THE LOAD TABLE. THESE VALUES WERE USED TO CALCULATE THE VERTICAL, TRANSVERSE, AND LONGITUDINAL LOADS APPLIED TO THE STRUCTURE.
4. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.6 SHALL BE APPLIED TO THE WIND LOAD. WIND SHALL BE BLOWN ON TWO FACES OF THE LATTICE TOWER.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THETA (Θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION.
7. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
8. EACH MEMBER, WHICH IS INCLINED AT AN ANGLE OF LESS THAN 45 DEGREES WITH THE HORIZONTAL SHALL BE OF SUFFICIENT SECTION TO WITHSTAND, INDEPENDENT OF ALL OTHER LOADS, A CONCENTRATED LOAD OF 350 POUNDS APPLIED NORMAL TO THE MEMBER ON ITS WEAKEST AXIS AT ANY POINT ALONG ITS LENGTH. CONCENTRATED LOAD SHALL BE MULTIPLIED BY AN OVERLOAD FACTOR OF 2.0.
9. LATTICE MEMBER ORIENTATION SHALL MINIMIZE SNOW ACCUMULATION ON THE STRUCTURE.
10. ELECTRICAL CLEARANCES MUST BE CHECKED TO THE SURFACE OF NEAREST MEMBER.
11. THE MAXIMUM SHIELDING ANGLE AT THE STRUCTURE SHALL BE 15 DEGREES.
12. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0 - 20°. CLEARANCES MUST BE CHECKED TO CLEARANCE ENVELOPE PROVIDED IN DETAIL 1.
13. SNUB ANGLES SHALL BE LIMITED TO A 2 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
14. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR HELICOPTER AND CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
15. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
16. C CROSSARMS, AND GROUND WIRE PEAKS SHALL BE DESIGNED WITH FALL ARREST ATTACHMENT POINTS. FALL ARREST ATTACHMENT POINTS SHALL SUPPORT A LOAD OF 3,000 POUNDS AND BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE. AT EACH FALL ARREST ATTACHMENT POINT, A GUSSET PLATE OR VANG WITH A 1-INCH DIAMETER HOLE SHALL BE PROVIDED.
17. CROSSARMS AND HORIZONTAL MEMBERS ADJACENT TO PHASES SHALL BE DESIGNED TO SUPPORT A LADDER LOAD OF 1,200 POUNDS. LADDER LOAD SHALL BE APPLIED AS TWO POINT LOADS OF 600 POUNDS SPACED AT 15 INCHES. LOAD SHALL BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE.
18. PHI (ϕ) IS THE SWING ANGLE OF THE ASSEMBLY AND "C" IS THE REQUIRED ELECTRICAL CLEARANCE. THE STRUCTURE DESIGN SHALL PROVIDE CLEARANCE AS INDICATED IN TABLE 1.
19. C CLIMBING AND WORKING CLEARANCES MUST BE PROVIDED AS INDICATED IN THE ELEVATION VIEW. FOR WALKING CLEARANCES, ASSUME A WORKER HEIGHT OF 6'-6".
20. STRUCTURE SHALL BE DESIGNED TO WITHSTAND UNEVEN LEG EXTENSION DIFFERENTIAL ASSUMING VERTICAL TO HORIZONTAL GROUND SLOPE RATIO OF (1:2).

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

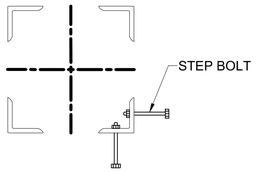
REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS	.	5/21/15	MSP	.	.
B	UPDATED STRUCTURE HEIGHT RANGE	.	5/8/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	MSP	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

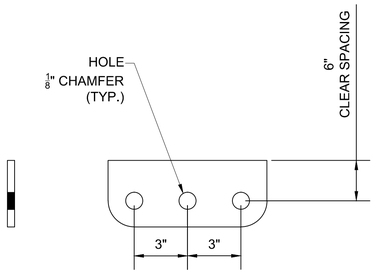
345kV AC DELTA TANGENT 0°–2°
30–SCDLT–LTG–002
LOAD & DESIGN DRAWING

	C
DRAWN	MSP
ENGINEER	AKO
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	LST–10–001.DWG
IMAGE:	
DRAWING NO.	LST–10–001

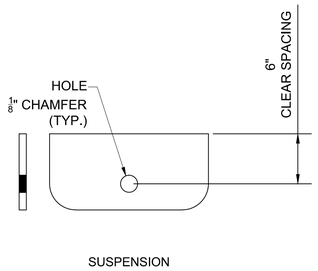
NU VER: 08/2012



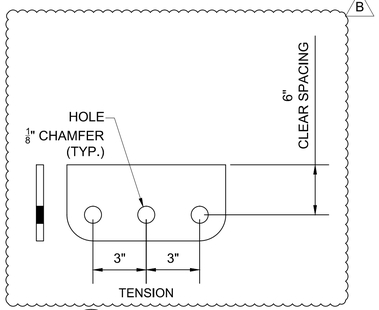
DETAIL 2
STEP BOLTS (TYP.) 2



DETAIL 3
CONDUCTOR ATTACHMENT 2

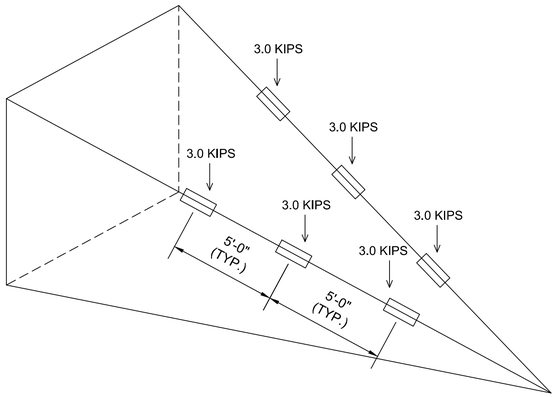


SUSPENSION

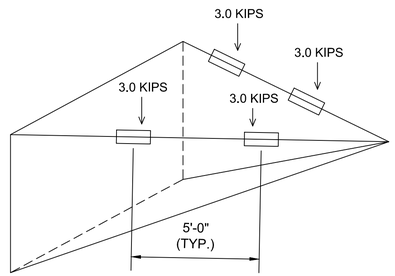


TENSION

DETAIL 4
OHGW ATTACHMENT 2



DETAIL 5
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL CONDUCTOR CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.) 2



DETAIL 6
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL OHSW CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.) 2

NOTES:

1. HOLE DIAMETERS AND VANG DIMENSIONS TO BE DETERMINED DURING DETAIL DESIGN THROUGH COORDINATION WITH TOWER VENDOR AND HARDWARE MANUFACTURER.
2. STEP BOLTS SHALL BE INSTALLED ON ALTERNATE FLANGES OF ONE LEG. SPACING SHALL NOT EXCEED 16 INCHES. STEP BOLTS SHALL BE PROVIDED FROM TOWER BASE TO TOP OF TOWER.
3. STRUCTURE SHALL BE DESIGNED WITH SUSPENSION AND TENSION ATTACHMENT PLATES AS SHOWN IN DETAIL 4.
4. FALL ARREST LOADS SHALL BE APPLIED SINGULARLY AT EACH LOCATION.

B

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
B	MISC. REVISIONS	.	5/21/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	MSP	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

345kV AC DELTA TANGENT 0°–2°
30–SCDLT–LTG–002
LOAD & DESIGN DRAWING

	B
DRAWN	MSP
ENGINEER	AKO
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	LST–10–002.DWG
IMAGE:	
DRAWING NO.	LST–10–002

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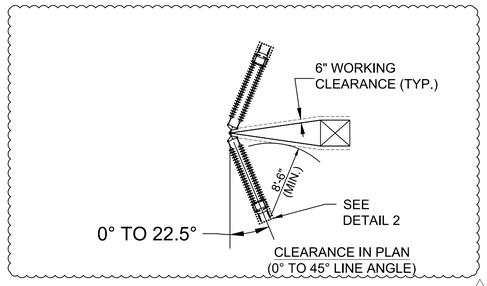
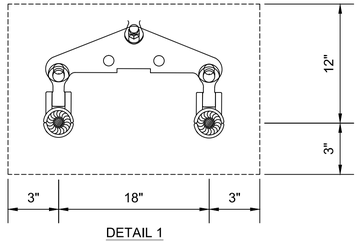
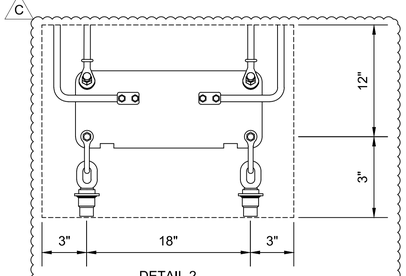




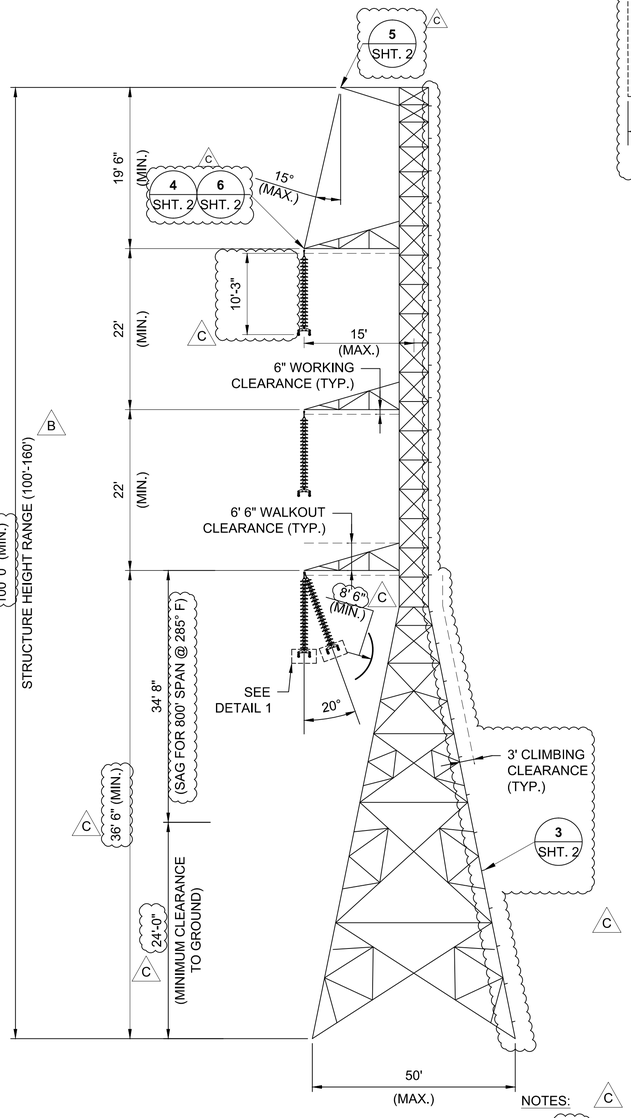
DETAIL 1

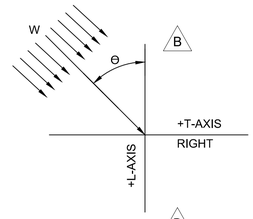


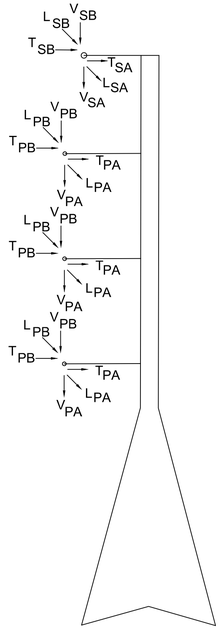
DETAIL 2

STRUCTURE NAME: 30-SCVLT-LDG-045
345-KV AC CONDUCTOR: 2 - 1590 KCMIL 45/7 "LAPWING" ACSR PER PHASE (11400# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 400 WIND SPAN BACK (FT): 400
WEIGHT SPAN AHEAD (FT): 475 WEIGHT SPAN BACK (FT): 475
LINE ANGLE: 0 - 45 DEGREES

LOADING CASE					DESIGN LOADS														
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	0.84	4.19	9.62	0.84	4.19	-9.62	6.50	17.45	41.24	6.50	17.45	-41.24	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.26	2.16	4.51	0.26	2.16	-4.51	2.48	11.41	23.11	2.48	11.41	-23.11	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	1.15	3.40	8.01	1.15	3.40	-8.01	6.11	13.00	31.53	6.11	13.00	-31.53	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	1.56	4.20	9.92	1.56	4.20	-9.92	7.22	15.22	36.98	7.22	15.22	-36.98	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.56	2.43	5.83	0.56	2.43	-5.83	4.33	10.23	24.99	4.33	10.23	-24.99	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.56	2.31	5.50	0.56	2.31	-5.50	4.33	9.39	22.80	4.33	9.39	-22.80	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.56	2.31	5.50	0.56	0.20	0.00	4.33	9.39	22.80	4.33	0.67	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.65	1.47	0.27	1.74	2.06	-5.23	14.89	6.78	1.21	5.06	9.33	-23.49	3.45	90.00	1.50
9	MAINTENANCE	60.00	0.00	0.00	2.33	2.26	5.92	2.33	2.26	-5.92	6.75	10.21	26.68	6.75	10.21	-26.68	0.00	90.00	2.00
10	OBLIQUE WIND	60.00	0.00	100.00	0.26	1.94	4.51	0.26	1.94	-4.51	2.48	10.13	23.11	2.48	10.13	-23.11	29.00	45.00	1.00
11	UPLIFT	-20.00	0.00	0.00	0.26	1.70	4.43	0.26	1.70	-4.43	2.48	7.92	20.69	2.48	7.92	-20.69	0.00	90.00	1.00







GENERAL NOTES:

1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, AND L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE, AND LONGITUDINAL AXIS RESPECTIVELY.
3. TEMPERATURE, RADIAL DESIGN ICE THICKNESS, AND WIND SPEED ARE INDICATED IN THE LOAD TABLE. THESE VALUES WERE USED TO CALCULATE THE VERTICAL, TRANSVERSE, AND LONGITUDINAL LOADS APPLIED TO THE STRUCTURE.
4. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.6 SHALL BE APPLIED TO THE WIND LOAD. WIND SHALL BE BLOWN ON TWO FACES OF THE LATTICE TOWER.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THETA (Θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION.
7. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
   D. AHEAD OR BACK CONDUCTORS AND GROUND WIRES ONLY.
8. EACH MEMBER, WHICH IS INCLINED AT AN ANGLE OF LESS THAN 45 DEGREES WITH THE HORIZONTAL SHALL BE OF SUFFICIENT SECTION TO WITHSTAND, INDEPENDENT OF ALL OTHER LOADS, A CONCENTRATED LOAD OF 350 POUNDS APPLIED NORMAL TO THE MEMBER ON ITS WEAKEST AXIS AT ANY POINT ALONG ITS LENGTH. CONCENTRATED LOAD SHALL BE MULTIPLIED BY AN OVERLOAD FACTOR OF 2.0.
9. LATTICE MEMBER ORIENTATION SHALL MINIMIZE SNOW ACCUMULATION ON THE STRUCTURE.
10. ELECTRICAL CLEARANCES MUST BE CHECKED TO THE SURFACE OF THE NEAREST MEMBER.
11. THE MAXIMUM SHIELDING ANGLE AT THE STRUCTURE SHALL BE 25 DEGREES.
12. ALL CLEARANCE CHECKS TO CONDUCTOR MUST BE CHECKED TO CLEARANCE ENVELOPE PROVIDED IN DETAIL 1.
13. SNUB ANGLES SHALL BE LIMITED TO A 15 DEGREE DEFLECTION ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
14. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR HELICOPTER AND CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
15. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
16. CROSSARMS, AND GROUND WIRE PEAKS SHALL BE DESIGNED WITH FALL ARREST ATTACHMENT POINTS. FALL ARREST ATTACHMENT POINTS SHALL SUPPORT A LOAD OF 3,000 POUNDS AND BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE. AT EACH FALL ARREST ATTACHMENT POINT, A GUSSET PLATE OR VANG WITH A 1-INCH DIAMETER HOLE SHALL BE PROVIDED.
17. CROSSARMS AND HORIZONTAL MEMBERS ADJACENT TO PHASES SHALL BE DESIGNED TO SUPPORT A LADDER LOAD OF 1,200 POUNDS. LADDER LOAD SHALL BE APPLIED AS TWO POINT LOADS OF 600 POUNDS SPACED AT 15 INCHES. LOAD SHALL BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE.
18. CLIMBING AND WORKING CLEARANCES MUST BE PROVIDED AS INDICATED IN THE ELEVATION VIEW.
19. STRUCTURE SHALL BE DESIGNED TO WITHSTAND UNEVEN LEG EXTENSION DIFFERENTIAL ASSUMING VERTICAL TO HORIZONTAL GROUND SLOPE RATIO OF (1:2).
20. STRUCTURES SHALL ALSO BE DESIGNED WITH UPLIFT LOADING. UPLIFT SHALL BE CONSIDERED UNDER LOAD CASE 1, LOAD CASE 2, & LOAD CASE 11. FOR LOAD CASE 1 REPLACE V_{SA} & V_{SB} WITH 0 KIPS AND V_{PA} & V_{PB} WITH 0 KIPS. FOR LOAD CASE 2 REPLACE V_{SA} & V_{SB} WITH 0 KIPS AND V_{PA} & V_{PB} WITH 0 KIPS. FOR LOAD CASE 13 REPLACE V_{SA} & V_{SB} WITH -0.1 KIPS AND V_{PA} & V_{PB} WITH -.8 KIPS.

NOTES:

1. 8'-6" CLEARANCE MUST BE CONSIDERED FROM CLIMBING, WORKING, AND WALKOUT CLEARANCES.
2. 8'-1" CLEARANCE MUST BE CONSIDERED FROM TOWER BODY AND ARMS.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

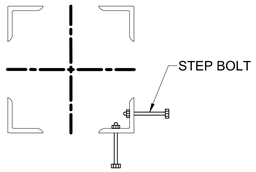
REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS	.	5/21/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	MSP	.	.

DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

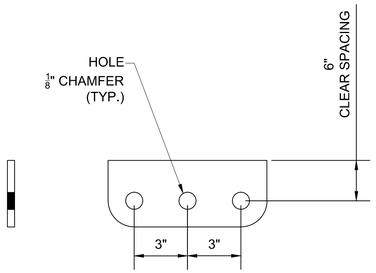
THE NORTHERN PASS

345kV AC LIGHT DEADEND 0°–45°
30–SCVLT–LDG–045
LOAD & DESIGN DRAWING

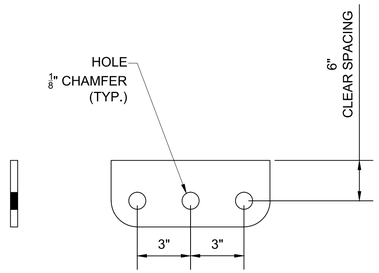
	C
DRAWN	MSP
ENGINEER	AKO
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	LST–11–001.DWG
IMAGE:	
DRAWING NO.	LST–11–001



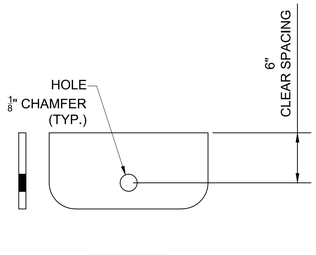
DETAIL 3 / 2
STEP BOLTS (TYP.)



DETAIL 4 / 2
CONDUCTOR ATTACHMENT



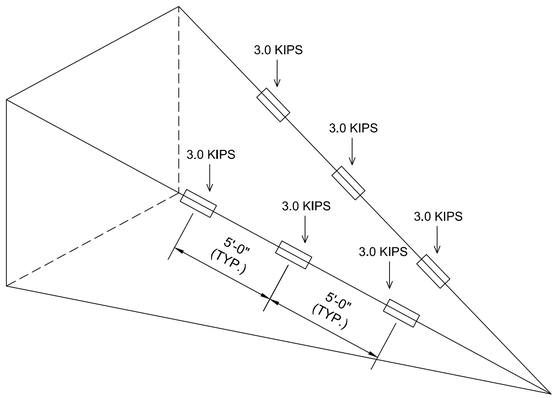
DETAIL 5 / 2
OHGW ATTACHMENT



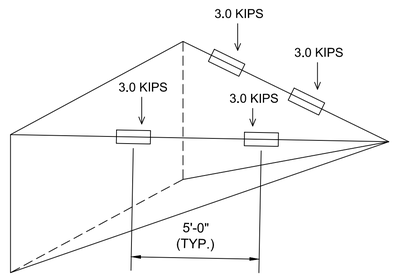
SUSPENSION

DETAIL 6 / 2
JUMPER ATTACHMENT

B



DETAIL 7 / 2
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL CONDUCTOR CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.)



DETAIL 8 / 2
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL OHSW CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.)

NOTES:

B
1. HOLE DIAMETERS AND VANG DIMENSIONS TO BE DETERMINED DURING DETAIL DESIGN THROUGH COORDINATION WITH TOWER VENDOR AND HARDWARE MANUFACTURER.
2. STEP BOLTS SHALL BE INSTALLED ON ALTERNATE FLANGES OF ONE LEG. SPACING SHALL NOT EXCEED 16 INCHES. STEP BOLTS SHALL BE PROVIDED FROM TOWER BASE TO TOP OF TOWER.
3. BOX ARMS SHALL HAVE PLATE ATTACHMENT HOLE AT EACH CORNER AND AT MIDPOINT.
4. FALL ARREST LOADS SHALL BE APPLIED SINGULARLY AT EACH LOCATION.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
B	MISC. REVISIONS	.	5/21/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	MSP	.	.

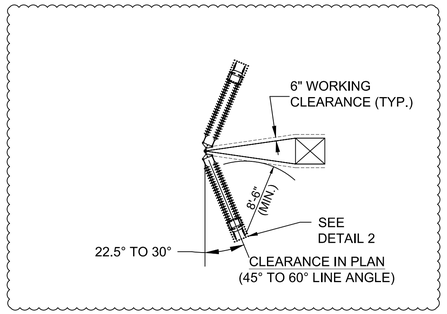
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

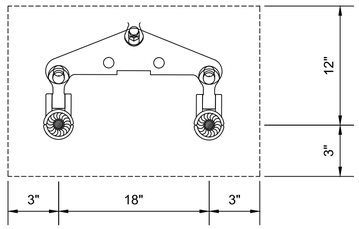
THE NORTHERN PASS

345kV AC LIGHT DEADEND 0°-45°
30-SCVLT-LDG-045
LOAD & DESIGN DRAWING

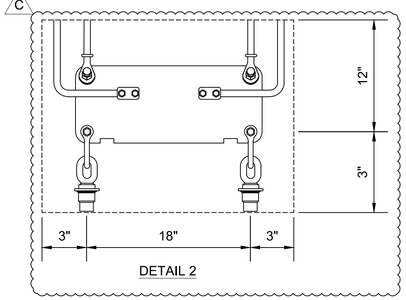
	B
DRAWN	MSP
ENGINEER	AKO
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	LST-11-002.DWG
IMAGE:	
DRAWING NO.	LST-11-002

NU VER: 08/2012





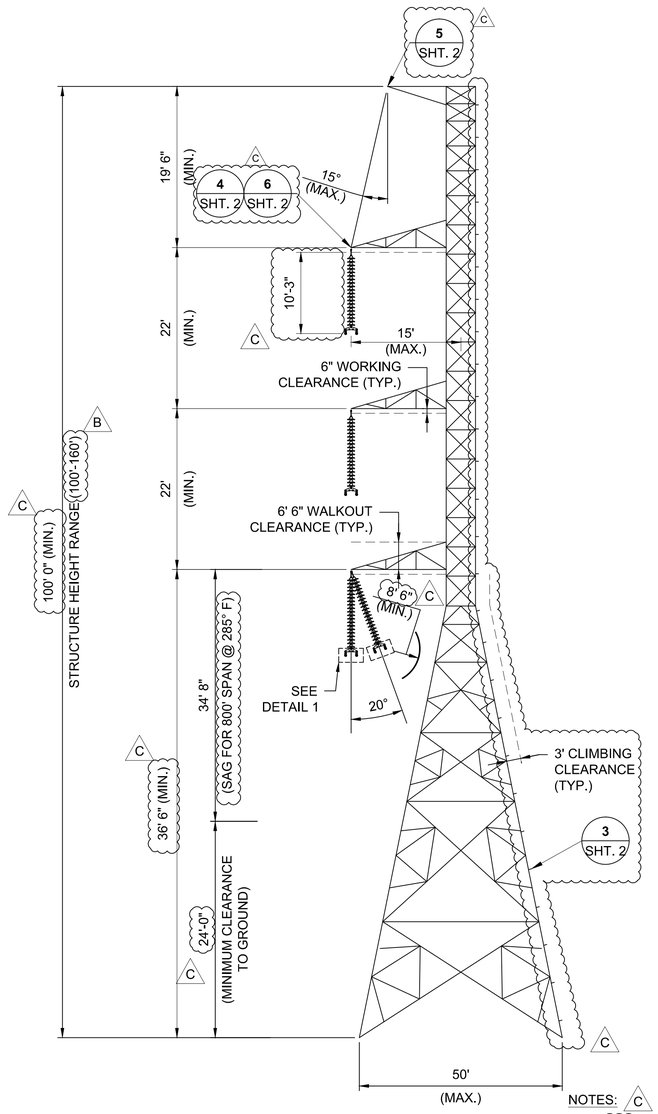
DETAIL 1

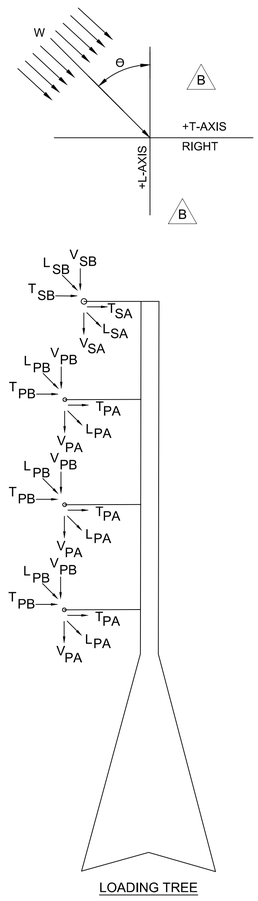


DETAIL 2

STRUCTURE NAME: 30-SCVLT-MDG-060
345-KV AC CONDUCTOR: 2 - 1590 KCMIL 45/7 "LAPWING" ACSR PER PHASE (11400# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 400 WIND SPAN BACK (FT): 400
WEIGHT SPAN AHEAD (FT): 475 WEIGHT SPAN BACK (FT): 475
LINE ANGLE: 45 - 60 DEGREES

LOADING CASE					DESIGN LOADS														
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	0.84	5.32	8.89	0.84	5.32	-8.89	6.50	22.29	38.10	6.50	22.29	-38.10	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.26	2.69	4.17	0.26	2.69	-4.17	2.48	14.12	21.35	2.48	14.12	-21.35	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	1.15	4.34	7.40	1.15	4.34	-7.40	6.11	16.70	29.13	6.11	16.70	-29.13	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	1.56	5.36	9.17	1.56	5.36	-9.17	7.22	19.56	34.16	7.22	19.56	-34.16	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.56	3.12	5.39	0.56	3.12	-5.39	4.33	13.16	23.09	4.33	13.16	-23.09	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.56	2.95	5.08	0.56	2.95	-5.08	4.33	12.07	21.06	4.33	12.07	-21.06	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.56	2.95	5.08	0.56	0.20	0.00	4.33	12.07	21.06	4.33	0.67	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.65	1.45	0.25	1.74	2.67	-4.83	14.89	6.67	1.12	5.06	12.09	-21.70	3.45	90.00	1.50
9	MAINTENANCE	60.00	0.00	0.00	2.33	2.96	5.47	2.33	2.96	-5.47	6.75	13.34	24.65	6.75	13.34	-24.65	0.00	90.00	2.00
10	OBLIQUE WIND	60.00	0.00	100.00	0.26	2.47	4.17	0.26	2.47	-4.17	2.48	12.84	21.35	2.48	12.84	-21.35	29.00	45.00	1.00
11	UPLIFT	-20.00	0.00	0.00	0.26	2.22	4.09	0.26	2.22	-4.09	2.48	10.34	19.11	2.48	10.34	-19.11	0.00	90.00	1.00





LOADING TREE

GENERAL NOTES:

1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, AND L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE, AND LONGITUDINAL AXIS RESPECTIVELY.
3. TEMPERATURE, RADIAL DESIGN ICE THICKNESS, AND WIND SPEED ARE INDICATED IN THE LOAD TABLE. THESE VALUES WERE USED TO CALCULATE THE VERTICAL, TRANSVERSE, AND LONGITUDINAL LOADS APPLIED TO THE STRUCTURE.
4. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.6 SHALL BE APPLIED TO THE WIND LOAD. WIND SHALL BE BLOWN ON TWO FACES OF THE LATTICE TOWER.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THETA (Θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION.
7. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
   D. AHEAD OR BACK CONDUCTORS AND GROUND WIRES ONLY.
8. EACH MEMBER, WHICH IS INCLINED AT AN ANGLE OF LESS THAN 45 DEGREES WITH THE HORIZONTAL SHALL BE OF SUFFICIENT SECTION TO WITHSTAND, INDEPENDENT OF ALL OTHER LOADS, A CONCENTRATED LOAD OF 350 POUNDS APPLIED NORMAL TO THE MEMBER ON ITS WEAKEST AXIS AT ANY POINT ALONG ITS LENGTH. CONCENTRATED LOAD SHALL BE MULTIPLIED BY AN OVERLOAD FACTOR OF 2.0.
9. LATTICE MEMBER ORIENTATION SHALL MINIMIZE SNOW ACCUMULATION ON THE STRUCTURE.
10. ELECTRICAL CLEARANCES MUST BE CHECKED TO THE SURFACE OF THE NEAREST MEMBER.
11. THE MAXIMUM SHIELDING ANGLE AT THE STRUCTURE SHALL BE 15 DEGREES.
12. ALL CLEARANCE CHECKS TO CONDUCTOR MUST BE CHECKED TO CLEARANCE ENVELOPE PROVIDED IN DETAIL 1.
13. SNUB ANGLES SHALL BE LIMITED TO A 15 DEGREE DEFLECTION ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
14. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR HELICOPTER AND CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
15. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
16. CROSSARMS, AND GROUND WIRE PEAKS SHALL BE DESIGNED WITH FALL ARREST ATTACHMENT POINTS. FALL ARREST ATTACHMENT POINTS SHALL SUPPORT A LOAD OF 3,000 POUNDS AND BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE. AT EACH FALL ARREST ATTACHMENT POINT, A GUSSET PLATE OR VANG WITH A 1-INCH DIAMETER HOLE SHALL BE PROVIDED.
17. CROSSARMS AND HORIZONTAL MEMBERS ADJACENT TO PHASES SHALL BE DESIGNED TO SUPPORT A LADDER LOAD OF 1,200 POUNDS. LADDER LOAD SHALL BE APPLIED AS TWO POINT LOADS OF 600 POUNDS SPACED AT 15 INCHES. LOAD SHALL BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE.
18. CLIMBING AND WORKING CLEARANCES MUST BE PROVIDED AS INDICATED IN THE ELEVATION VIEW.
19. STRUCTURE SHALL BE DESIGNED TO WITHSTAND UNEVEN LEG EXTENSION DIFFERENTIAL ASSUMING VERTICAL TO HORIZONTAL GROUND SLOPE RATIO OF (1:2).

NOTES:
1. 8'-6" CLEARANCE MUST BE CONSIDERED FROM CLIMBING, WORKING, AND WALKOUT CLEARANCES.
2. 8'-1" CLEARANCE MUST BE CONSIDERED FROM TOWER BODY AND ARMS.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS	.	5/21/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	MSP	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

345kV AC MEDIUM DEADEND 45°-60°
30-SCVLT-MDG-060
LOAD & DESIGN DRAWING

	C
DRAWN	MSP
ENGINEER	AKO
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	LST-12-001.DWG
IMAGE:	
DRAWING NO.	LST-12-001

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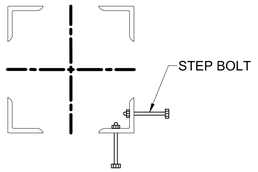
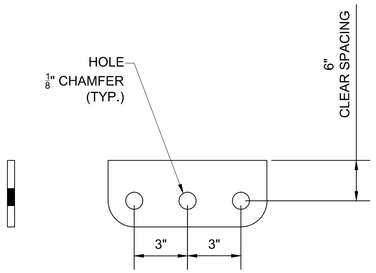
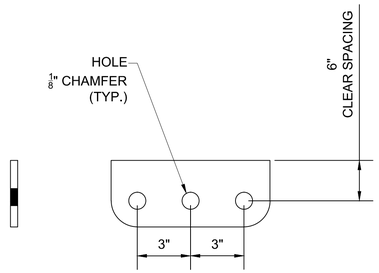


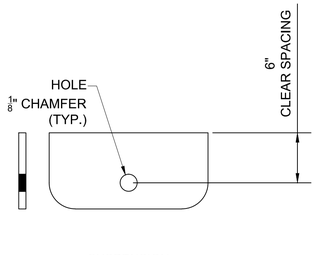
DETAIL 3 / 2
STEP BOLTS (TYP.)



DETAIL 4 / 2
CONDUCTOR ATTACHMENT



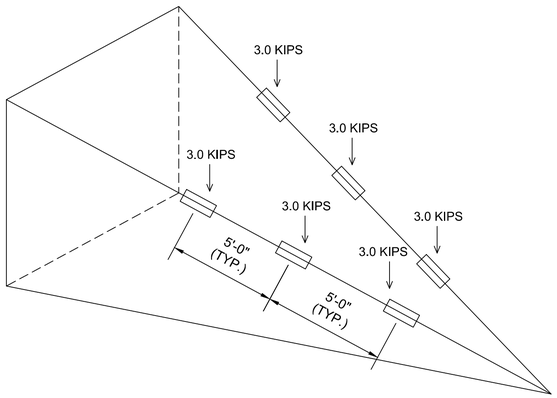
DETAIL 5 / 2
OHGW ATTACHMENT



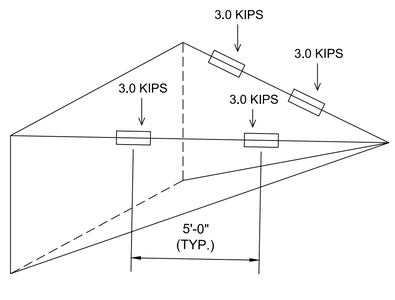
SUSPENSION

DETAIL 6 / 2
JUMPER ATTACHMENT

B



DETAIL 7 / 2
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL CONDUCTOR CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.)



DETAIL 8 / 2
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL OHSW CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.)

NOTES:

B
1. HOLE DIAMETERS AND VANG DIMENSIONS TO BE DETERMINED DURING DETAIL DESIGN THROUGH COORDINATION WITH TOWER VENDOR AND HARDWARE MANUFACTURER.
2. STEP BOLTS SHALL BE INSTALLED ON ALTERNATE FLANGES OF ONE LEG. SPACING SHALL NOT EXCEED 16 INCHES. STEP BOLTS SHALL BE PROVIDED FROM TOWER BASE TO TOP OF TOWER.
3. BOX ARMS SHALL HAVE PLATE ATTACHMENT HOLE AT EACH CORNER AND AT MIDPOINT.
4. FALL ARREST LOADS SHALL BE APPLIED SINGULARLY AT EACH LOCATION.

PRELIMINARY - NOT FOR CONSTRUCTION

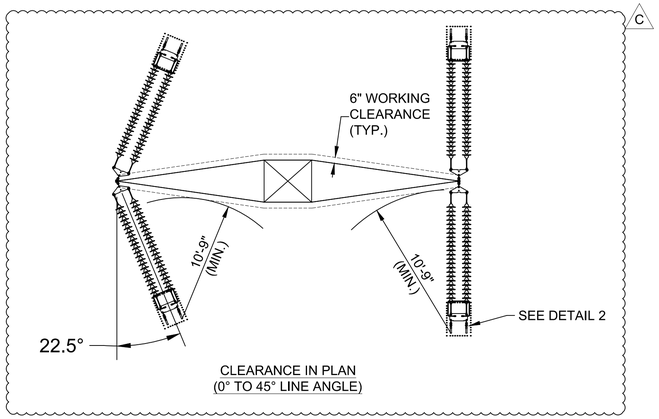
CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
B	MISC. REVISIONS	.	5/21/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	MSP	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

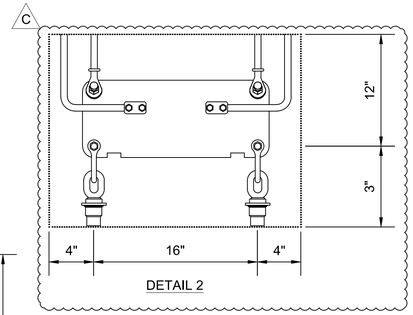
THE NORTHERN PASS

345kV AC MEDIUM DEADEND 60°
30-SCVLT-MDG-060
LOAD & DESIGN DRAWING

	B
DRAWN	MSP
ENGINEER	AKO
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	LST-12-002.DWG
IMAGE:	
DRAWING NO.	LST-12-002



CLEARANCE IN PLAN
(0° TO 45° LINE ANGLE)

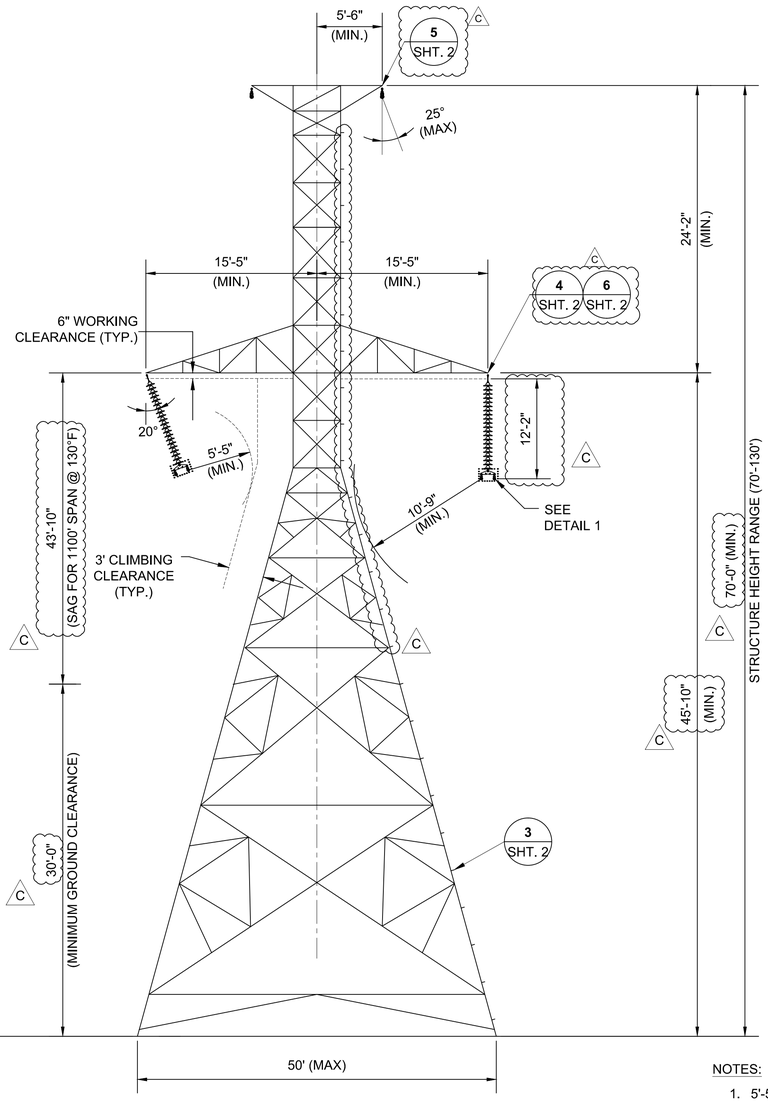


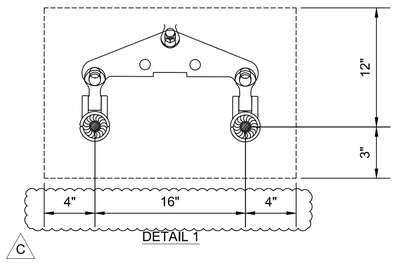
DETAIL 2

STRUCTURE NAME: 30-SCHLT-LSG-045
320-KV DC CONDUCTOR: 2 - 2933 KCMIL 91 STRAND AAAC PER PHASE (20000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 550 WIND SPAN BACK (FT): 550
WEIGHT SPAN AHEAD (FT): 825 WEIGHT SPAN BACK (FT): 825
LINE ANGLE: 0 - 45 DEGREES

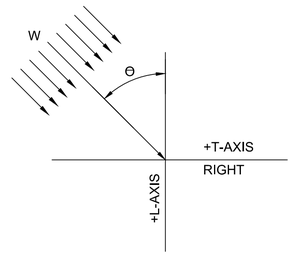
LOADING CASE					DESIGN LOADS														
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.41	4.37	9.62	1.41	4.37	-9.62	13.36	30.89	73.59	13.36	30.89	-73.59	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.42	2.32	4.51	0.42	2.32	-4.51	5.52	19.43	38.67	5.52	19.43	-38.67	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	1.97	3.53	8.01	1.97	3.53	-8.01	12.47	21.41	52.13	12.47	21.41	-52.13	4.00	90.00	1.00
4	HQ EXTREME ICE	15.00	1.50	39.53	3.51	5.25	12.04	3.51	5.25	-12.04	16.96	27.33	66.65	16.96	27.33	-66.65	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.94	2.51	5.83	0.94	2.51	-5.83	8.91	18.16	44.60	8.91	18.16	-44.60	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.94	2.38	5.50	0.94	2.38	-5.50	8.91	16.40	40.00	8.91	16.40	-40.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.94	2.38	5.50	0.94	0.28	0.00	8.91	16.40	40.00	8.91	1.09	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	4.12	0.43	0.27	1.98	2.08	-5.23	30.33	3.49	2.27	9.63	17.56	-44.25	3.45	90.00	1.50
9	MAINTENANCE	60.00	0.00	0.00	2.64	2.26	5.92	2.64	2.26	-5.92	12.84	18.16	47.44	12.84	18.16	-47.44	0.00	90.00	2.00
10	OBLIQUE WIND	60.00	0.00	100.00	0.42	2.03	4.51	0.42	2.03	-4.51	5.52	17.12	38.67	5.52	17.12	-38.67	29.00	45.00	1.00
11	UPLIFT	-20.00	0.00	0.00	0.42	1.70	4.43	0.42	1.70	-4.43	5.52	16.59	43.34	5.52	16.59	-43.34	0.00	90.00	1.00

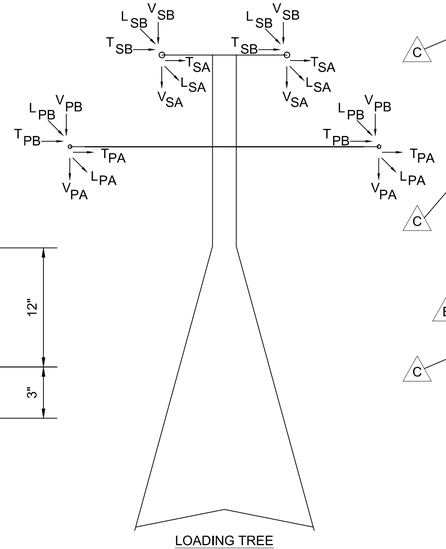
B





DETAIL 1





LOADING TREE

GENERAL NOTES:

1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, AND L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE, AND LONGITUDINAL AXIS RESPECTIVELY.
3. TEMPERATURE, RADIAL DESIGN ICE THICKNESS, AND WIND SPEED ARE INDICATED IN THE LOAD TABLE. THESE VALUES WERE USED TO CALCULATE THE VERTICAL, TRANSVERSE, AND LONGITUDINAL LOADS APPLIED TO THE STRUCTURE.
4. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.6 SHALL BE APPLIED TO THE WIND LOAD. WIND SHALL BE BLOWN ON TWO FACES OF THE LATTICE TOWER.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THETA (Θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION.
7. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE AND GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
8. EACH MEMBER, WHICH IS INCLINED AT AN ANGLE OF LESS THAN 45 DEGREES WITH THE HORIZONTAL SHALL BE OF SUFFICIENT SECTION TO WITHSTAND, INDEPENDENT OF ALL OTHER LOADS, A CONCENTRATED LOAD OF 350 POUNDS APPLIED NORMAL TO THE MEMBER ON ITS WEAKEST AXIS AT ANY POINT ALONG ITS LENGTH. CONCENTRATED LOAD SHALL BE MULTIPLIED BY AN OVERLOAD FACTOR OF 2.0.
9. LATTICE MEMBER ORIENTATION SHALL MINIMIZE SNOW ACCUMULATION ON THE STRUCTURE.
10. ELECTRICAL CLEARANCES MUST BE CHECKED TO THE SURFACE OF THE NEAREST MEMBER.
11. THE MAXIMUM SHIELDING ANGLE AT THE STRUCTURE SHALL BE 25 DEGREES.
12. ALL CLEARANCE CHECKS TO CONDUCTOR MUST BE CHECKED TO CLEARANCE ENVELOPE PROVIDED IN DETAIL 1.
13. SNUB ANGLES SHALL BE LIMITED TO A 15 DEGREE DEFLECTION ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
14. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR HELICOPTER AND CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
15. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
16. CROSSARMS, AND GROUND WIRE PEAKS SHALL BE DESIGNED WITH FALL ARREST ATTACHMENT POINTS. FALL ARREST ATTACHMENT POINTS SHALL SUPPORT A LOAD OF 3,000 POUNDS AND BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE. AT EACH FALL ARREST ATTACHMENT POINT, A GUSSET PLATE OR VANG WITH A 1-INCH DIAMETER HOLE SHALL BE PROVIDED.
17. CROSSARMS AND HORIZONTAL MEMBERS ADJACENT TO PHASES SHALL BE DESIGNED TO SUPPORT A LADDER LOAD OF 1,200 POUNDS. LADDER LOAD SHALL BE APPLIED AS TWO POINT LOADS OF 600 POUNDS SPACED AT 15 INCHES. LOAD SHALL BE APPLIED IN CONJUNCTION WITH THE MAINTENANCE LOAD CASE.
18. CLIMBING AND WORKING CLEARANCES MUST BE PROVIDED AS INDICATED IN THE ELEVATION VIEW.
19. STRUCTURE SHALL BE DESIGNED TO WITHSTAND UNEVEN LEG EXTENSION DIFFERENTIAL ASSUMING VERTICAL TO HORIZONTAL GROUND SLOPE RATIO OF (1:2).
20. STRUCTURES SHALL ALSO BE DESIGNED WITH UPLIFT LOADING. UPLIFT SHALL BE CONSIDERED UNDER LOAD CASE 1, LOAD CASE 2, & LOAD CASE 11. FOR LOAD CASE 1 REPLACE V_{SA} & V_{SB} WITH -0.2 KIPS AND V_{PA} & V_{PB} WITH -1 KIPS. FOR LOAD CASE 2 REPLACE V_{SA} & V_{SB} WITH -0.1 KIPS AND V_{PA} & V_{PB} WITH -1.6 KIPS. FOR LOAD CASE 13 REPLACE V_{SA} & V_{SB} WITH -0.2 KIPS AND V_{PA} & V_{PB} WITH -2.3 KIPS.

NOTES:

1. 5'-5" CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WORKING CLEARANCE.
2. 10'-9" CLEARANCE MUST BE CONSIDERED FROM TOWER BODY AND ARMS.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS	.	5/21/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	KAK	.	.

DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

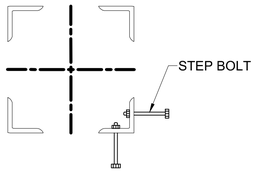
C

DRAWN: KAK
ENGINEER: AKO
CHECKED: TAB
APPROVED:
DATE: 5/1/15

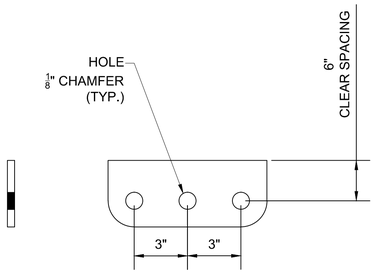
320kV DC LIGHT STRAIN 0°–45°
32–SCHLT–LSG–045
LOAD & DESIGN DRAWING

SCALE: NTS
FILE: LST-13-001.DWG
IMAGE:
DRAWING NO.: LST-13-001

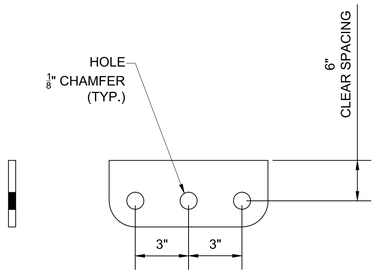
NU VER: 08/2012



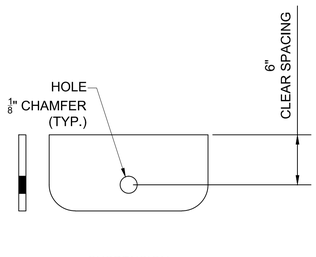
DETAIL 3
STEP BOLTS (TYP.) 2



DETAIL 4
CONDUCTOR ATTACHMENT 2



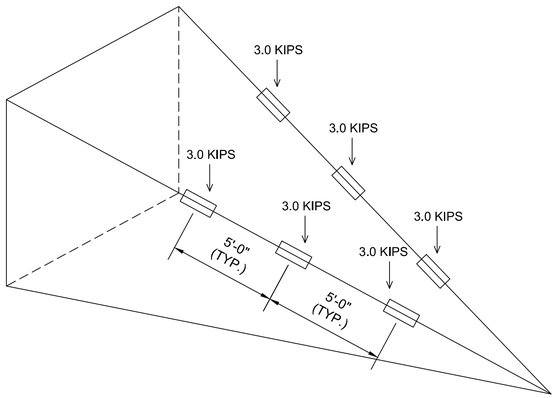
DETAIL 5
OHGW ATTACHMENT 2



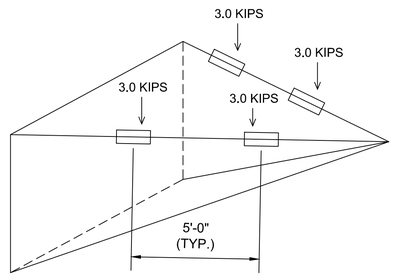
SUSPENSION

DETAIL 6
JUMPER ATTACHMENT 2

B



DETAIL 7
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL CONDUCTOR CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.) 2



DETAIL 8
FALL ARREST ATTACHMENT POINTS (TYPICAL FOR ALL OHSW CROSSARMS FRONT AND BACK, INCLUDING BOX ARMS.) 2

NOTES:

B
1. HOLE DIAMETERS AND VANG DIMENSIONS TO BE DETERMINED DURING DETAIL DESIGN THROUGH COORDINATION WITH TOWER VENDOR AND HARDWARE MANUFACTURER.
2. STEP BOLTS SHALL BE INSTALLED ON ALTERNATE FLANGES OF ONE LEG. SPACING SHALL NOT EXCEED 16 INCHES. STEP BOLTS SHALL BE PROVIDED FROM TOWER BASE TO TOP OF TOWER.
3. BOX ARMS SHALL HAVE PLATE ATTACHMENT HOLE AT EACH CORNER AND AT MIDPOINT.
4. FALL ARREST LOADS SHALL BE APPLIED SINGULARLY AT EACH LOCATION.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
B	MISC. REVISIONS	.	5/21/15	KAK	.	.
A	RELEASED FOR RFP BID	.	5/1/15	KAK	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

320kV DC LIGHT STRAIN 0°–45°
32–SCHLT–LSG–045
LOAD & DESIGN DRAWING

	B
DRAWN	KAK
ENGINEER	AKO
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	LST–13–002.DWG
IMAGE:	
DRAWING NO.	LST–13–002

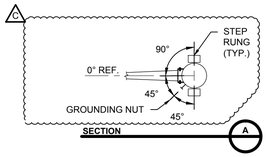
6/16/2015 4:14 PM – mspepich – N:\NUSCO\58479 – NPT\Overhead\Cadd\01–Record Worksheets\LST–13–002.dwg – SKETCH

NU VER: 08/2012

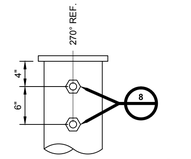
STRUCTURE NAME: 32-SCVSP-LTW-002
320-KV DC CONDUCTOR: 2 - 2933 KCMIL 91 STRAND AAAC PER PHASE (20000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 550
WEIGHT SPAN (FT): 850
LINE ANGLE: 0 - 2 DEGREES

LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.45	1.03	0.00	13.54	5.30	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.43	0.75	0.00	5.61	5.98	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	2.03	0.74	0.00	12.70	3.28	0.00	4.00	90.00	1.00
4	HQ EXTREME ICE	15.00	1.50	39.53	3.62	1.06	0.00	17.43	4.15	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.96	0.48	0.00	9.02	2.65	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.96	0.47	0.00	9.02	2.49	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.96	0.37	5.50	9.02	1.51	24.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.58	0.27	0.27	23.61	2.17	2.27	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.43	0.10	0.00	5.61	0.83	0.00	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.66	0.21	0.00	13.01	1.66	0.00	0.00	90.00	2.00

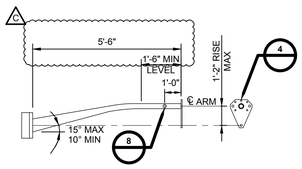
C



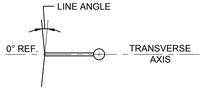
SECTION A



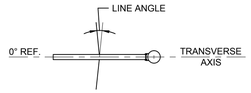
DETAIL 1
OHSW ATTACHMENT (1 PLACE)



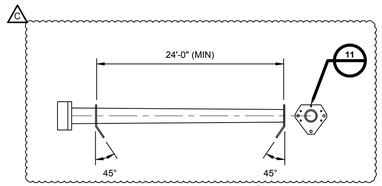
DETAIL 2
OHSW ARM ASSY
(1 PLACE)



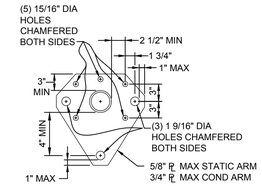
SHIELDWIRE PLAN VIEW



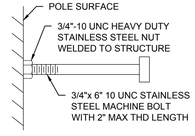
TRANSMISSION PLAN VIEW



DETAIL 3
320kV ARM ASSEMBLY
(2 PLACES)

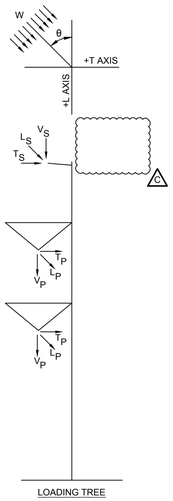


DETAIL 4
SUSPENSION/STRAIN PLATE
(1 PLACES)

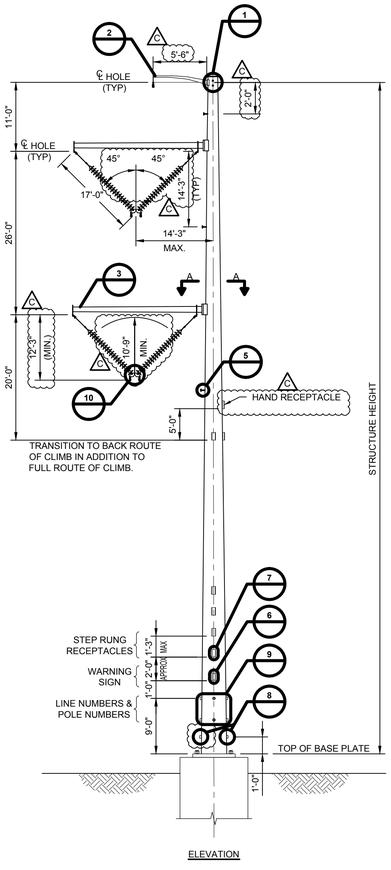


DETAIL 5
REMOVABLE GROUNDING BOLT
(3 PLACES)

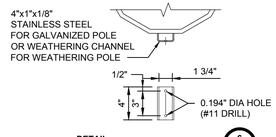
REFERENCES:
1. GROUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ADDITIONAL RECEPTACLE LOCATION: SKETCH D
7. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
8. LIFTING VANG PROVISIONS: SKETCH J + K
9. FALL PROTECTION VANGS: SKETCH N + Q
10. JACKING NUT LOCATIONS: SKETCH I



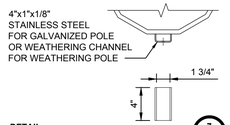
LOADING TREE



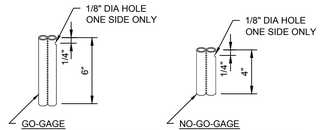
ELEVATION



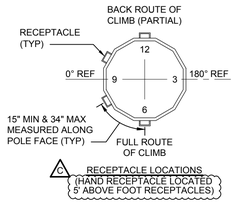
DETAIL 6
WARNING SIGN ATTACHMENT
(1 PLACE)



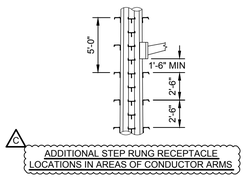
DETAIL 7
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)



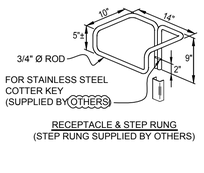
STEP RUNG RECEPTACLE GAGES



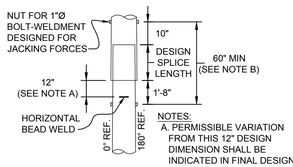
C RECEPTACLE LOCATIONS
(HAND RECEPTACLE LOCATED 5' ABOVE FOOT RECEPTACLES)



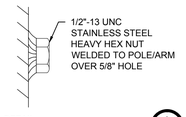
C ADDITIONAL STEP RUNG RECEPTACLE LOCATIONS IN AREAS OF CONDUCTOR ARMS



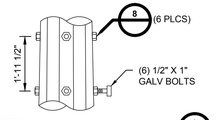
RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



NOTES:
A. PERMISSIBLE VARIATION FROM THIS 12" DESIGN DIMENSION SHALL BE INDICATED IN FINAL DESIGN AND ERECTION DRAWING.
B. THE 10" AND 1'-8" DIMENSIONS MAY BE INCREASED TO ACHIEVE THIS 60" MIN.

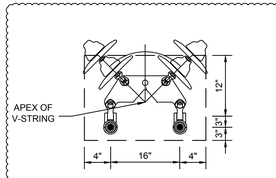


DETAIL 8
ATTACHMENT PROVISION LUG
(AERIAL BRACKET, LINE NUMBER, POLE NUMBER & GROUNDING)
C (11 PLACES)

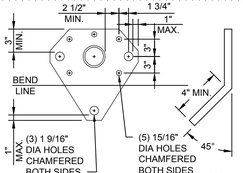


DETAIL 9
LINE & POLE NUMBER ATTACHMENT
(1 PLACE)

SPLICE DETAILS JACKING NUT LOCATIONS



DETAIL 10
V-STRING CLEARANCE ENVELOPE
(3 PLACES)



DETAIL 11
SUSPENSION/STRAIN PLATE
(4 PLACES)

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
7. SNUB ANGLES SHALL BE LIMITED TO A 2 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE 25°.
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°. CLEARANCES MUST BE CHECKED TO SUBCONDUCTOR ENVELOPE SHOWN IN DETAIL 10.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
12. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
13. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
14. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
15. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL POINTS OF THE CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNS TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
16. 5'-5" CLEARANCE SHALL BE CONSIDED FROM CLIMBING AND WORKING CLEARANCE.
17. 10'-9" CLEARANCE MUST BE CONSIDERED FROM POLE BODY AND ARMS.
18. FALL PROTECTION VANG FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

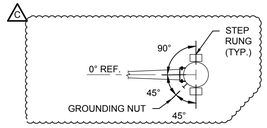
REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS		5/21/15	KAK		
B	MISC. REVISIONS		5/8/15	BLH		
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

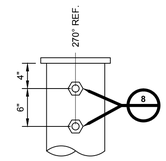
THE NORTHERN PASS

320kV DC LIGHT TANGENT 0-2°
32-SCVSP-LTW-002
LOAD & DESIGN DRAWING

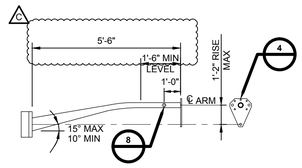
	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-01.DWG
IMAGE:	
DRAWING NO.	TSP-01-001

8/19/2015 2:20 PM — mspejcich — N:\NUSCO\58479 — NPT\Overhead\Cadd\01-Record Worksheets\TSP-01.dwg — 001

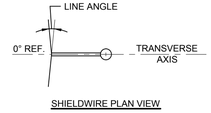




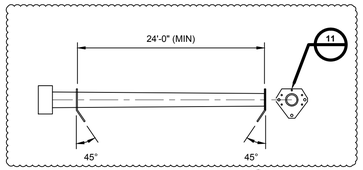
DETAIL
OHSW ATTACHMENT (1 PLACE) 1



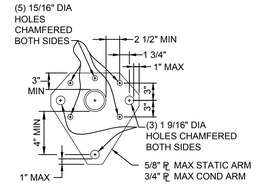
DETAIL
OHSW ARM ASSY
(1 PLACE) 2



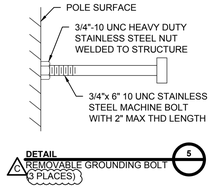
SHIELDWIRE PLAN VIEW



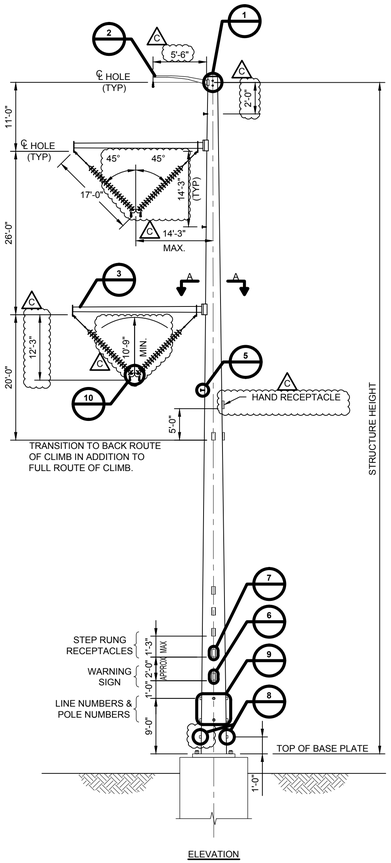
DETAIL
320kV ARM ASSEMBLY
(2 PLACES) 3



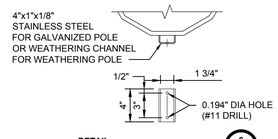
DETAIL
SUSPENSION/STRAIN PLATE
(6 PLACES) 4



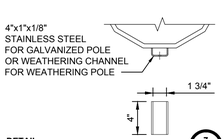
DETAIL
REMOVABLE GROUNDING BOLT
(6 PLACES) 5



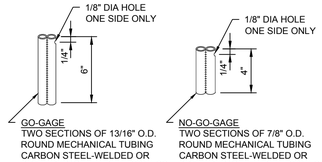
ELEVATION



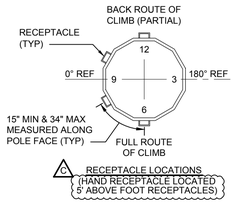
DETAIL
WARNING SIGN ATTACHMENT
(1 PLACE) 6



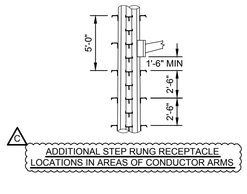
DETAIL
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D) 7



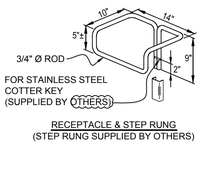
STEP RUNG RECEPTACLE GAGES



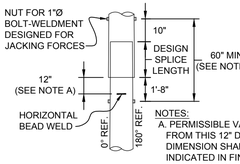
℄ RECEPTACLE LOCATIONS
(HAND RECEPTACLE LOCATED 5' ABOVE FOOT RECEPTACLES)



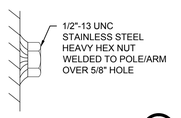
℄ ADDITIONAL STEP RUNG RECEPTACLE LOCATIONS IN AREAS OF CONDUCTOR ARMS



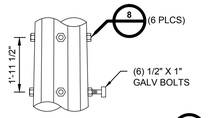
RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



NOTES:
A. PERMISSIBLE VARIATION FROM THIS 12" DESIGN DIMENSION SHALL BE INDICATED IN FINAL DESIGN AND ERECTION DRAWING.
B. THE 10" AND 1'-8" DIMENSIONS MAY BE INCREASED TO ACHIEVE THIS 60" MIN.

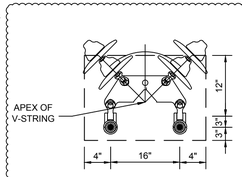


DETAIL
ATTACHMENT PROVISION LUG
(AERIAL BRACKET, LINE NUMBER, POLE NUMBER & GROUNDING)
(11 PLACES) 8

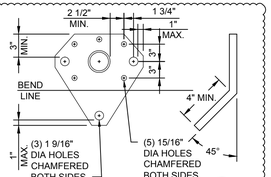


DETAIL
LINE & POLE NUMBER ATTACHMENT
(1 PLACE) 9

SPLICE DETAILS JACKING NUT LOCATIONS



DETAIL
V-STRING CLEARANCE ENVELOPE
(3 PLACES) 10

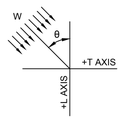


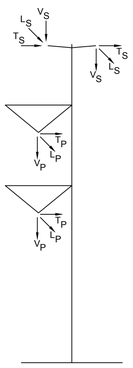
DETAIL
SUSPENSION/STRAIN PLATE
(4 PLACES) 11

STRUCTURE NAME: 32-SCVSP-MTW-002
320-KV DC CONDUCTOR: 2 - 2933 KCMIL 91 STRAND AAAC PER PHASE (20000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 750
WEIGHT SPAN (FT): 1200
LINE ANGLE: 0 - 2 DEGREES

LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	2.01	1.28	0.00	18.06	6.29	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.59	0.97	0.00	7.55	7.67	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	2.84	0.91	0.00	17.22	3.81	0.00	4.00	90.00	1.00
4	HQ EXTREME ICE	15.00	1.50	39.53	5.09	1.30	0.00	23.90	4.81	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	1.34	0.58	0.00	12.04	3.04	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	1.34	0.57	0.00	12.04	2.88	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	1.34	0.47	5.50	12.04	2.01	30.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.82	0.30	0.27	26.51	2.40	2.27	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.59	0.10	0.00	7.55	0.83	0.00	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.98	0.21	0.00	16.89	1.66	0.00	0.00	90.00	2.00

℄ **REFERENCES:**
1. GOUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ADDITIONAL RECEPTACLE LOCATION: SKETCH D
7. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
8. LIFTING VANG PROVISIONS: SKETCH J + K
9. FALL PROTECTION VANGS: SKETCH N + Q
10. JACKING NUT LOCATIONS: SKETCH I





LOADING TREE

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1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF ℄ 0 SHALL BE APPLIED TO THE WIND LOAD.
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   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
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13. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
14. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
15. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL POINTS OF THE CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNS TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
16. 5'-5" CLEARANCE SHALL BE CONSIDED FROM CLIMBING AND WORKING CLEARANCE.
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PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS		5/21/15	KAK		
B	MISC. REVISIONS		5/8/15	BLH		
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

320kV DC MEDIUM TANGENT 0-2°
32-SCVSP-MTW-002
LOAD & DESIGN DRAWING

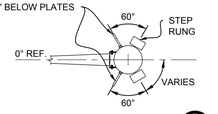
	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-02.DWG
IMAGE:	
DRAWING NO.	TSP-02-001

NU VER: 08/2012

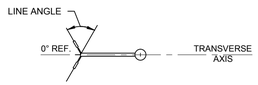
STRUCTURE NAME: 32-SCVSP-LDW-045
320-kV DC CONDUCTOR: 2 - 2933 KCMIL 91 STRAND AAAC PER PHASE (20000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 550 WIND SPAN BACK (FT): 550
WEIGHT SPAN AHEAD (FT): 825 WEIGHT SPAN BACK (FT): 825
LINE ANGLE: 0 - 45 DEGREES

LOADING CASE					DESIGN LOADS													
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.41	4.37	9.62	1.41	4.37	-9.62	13.36	30.89	73.59	13.36	30.89	-73.59	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.42	2.32	4.51	0.42	2.32	-4.51	5.52	19.43	38.67	5.52	19.43	-38.67	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	1.97	3.53	8.01	1.97	3.53	-8.01	12.47	21.41	52.13	12.47	21.41	-52.13	4.00	90.00	1.00
4	HQ EXTREME ICE	15.00	1.50	39.53	3.51	5.25	12.04	3.51	5.25	-12.04	16.96	27.33	66.65	16.96	27.33	-66.65	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.94	2.51	5.83	0.94	2.51	-5.83	8.91	18.16	44.60	8.91	18.16	-44.60	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.94	2.38	5.50	0.94	2.38	-5.50	8.91	16.40	40.00	8.91	16.40	-40.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.94	2.38	5.50	0.94	0.28	0.00	8.91	16.40	40.00	8.91	1.09	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	4.12	1.52	0.27	1.98	2.08	-5.23	30.33	12.71	2.27	9.63	17.56	-44.25	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.42	1.13	2.96	0.42	1.13	-2.96	5.52	9.08	23.72	5.52	9.08	-23.72	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.64	2.26	5.92	2.64	2.26	-5.92	12.84	18.16	47.44	12.84	18.16	-47.44	0.00	90.00	2.00
11	UPLIFT	-20.00	0.00	0.00	0.42	1.70	4.43	0.42	1.70	-4.43	5.52	16.59	43.34	5.52	16.59	-43.34	0.00	90.00	1.00

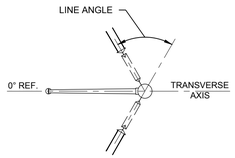
WIRE ATTACHMENT PLATE & GROUNDING NUT 2' BELOW PLATES



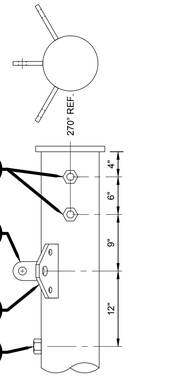
SECTION A



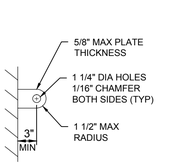
SHIELDWIRE PLAN VIEW



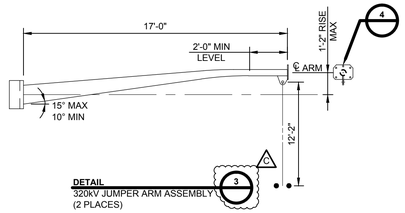
TRANSMISSION PLAN VIEW



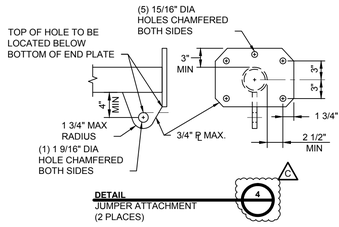
DETAIL 1
AERIAL MARKER & SHIELDWIRE ATTACHMENT
(1 PLACE)



DETAIL 2
VANG DETAIL
(1 PLACE)

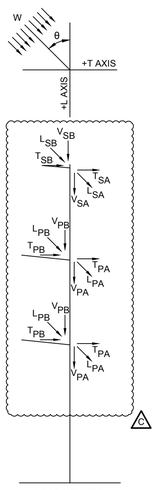


DETAIL 3
320kV JUMPER ARM ASSEMBLY
(2 PLACES)

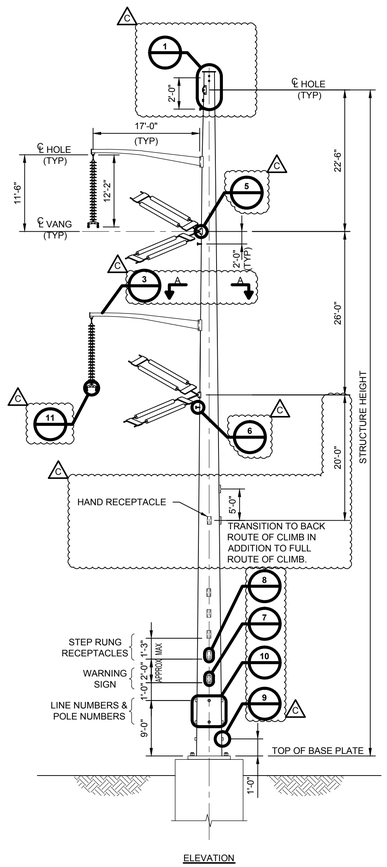


DETAIL 4
JUMPER ATTACHMENT
(2 PLACES)

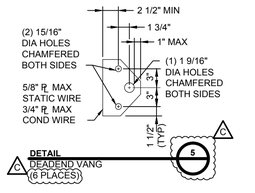
REFERENCES:
1. GOUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ADDITIONAL RECEPTACLE LOCATION: SKETCH D
7. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
8. LIFTING VANG PROVISIONS: SKETCH J + K
9. FALL PROTECTION VANGS: SKETCH N + Q
10. JACKING NUT LOCATIONS: SKETCH I



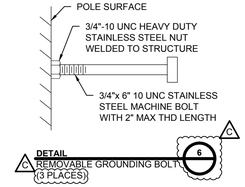
LOADING TREE



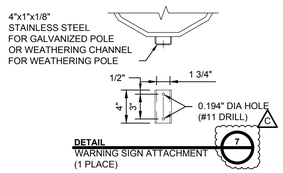
ELEVATION



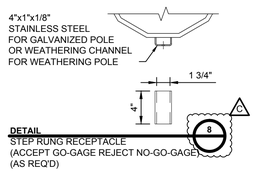
DETAIL 5
DEADEND VANG
(6 PLACES)



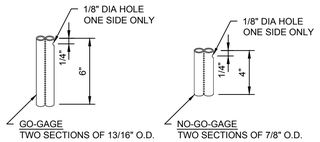
DETAIL 6
REMOVABLE GROUNDING BOLT
(3 PLACES)



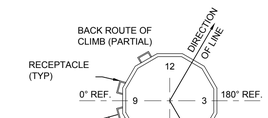
DETAIL 7
WARNING SIGN ATTACHMENT
(1 PLACE)



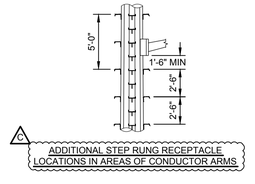
DETAIL 8
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)

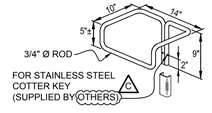


STEP RUNG RECEPTACLE GAGES

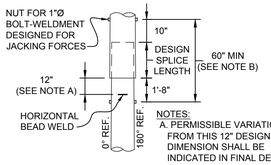


RECEPTACLE LOCATIONS
(HAND RECEPTACLE LOCATED 5' ABOVE FOOT RECEPTACLES)



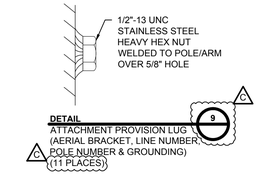


RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)

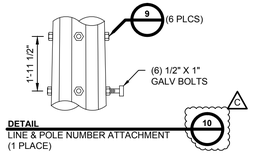


NOTES:
A. PERMISSIBLE VARIATION FROM THIS 12" DESIGN DIMENSION SHALL BE INDICATED IN FINAL DESIGN AND ERECTION DRAWING.
B. THE 10" AND 1'-8" DIMENSIONS MAY BE INCREASED TO ACHIEVE THIS 60" MIN.

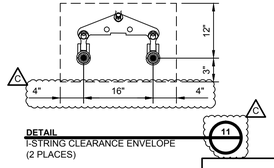
SPLICE DETAILS JACKING NUT LOCATIONS



DETAIL 9
ATTACHMENT PROVISION LUG
(AERIAL BRACKET, LINE NUMBER, POLE NUMBER & GROUNDING)
(11 PLACES)



DETAIL 10
LINE & POLE NUMBER ATTACHMENT
(1 PLACE)



DETAIL 11
I-STRING CLEARANCE ENVELOPE
(2 PLACES)

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
   D. AHEAD OR BACK CONDUCTORS AND GROUND WIRES ONLY.
7. SNUB ANGLES SHALL BE LIMITED TO A (15 DEGREE DEFLECTION) LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE 25°.
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°. CLEARANCES MUST BE CHECKED TO SUBCONDUCTOR ENVELOPE SHOWN IN DETAIL 12.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
14. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
15. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
16. JUMPER ARM SHALL BE DESIGNED FOR A VERTICAL LOAD OF 2,500 POUNDS.
17. 5'-5" CLEARANCE SHALL BE CONSIDED FROM CLIMBING AND WORKING CLEARANCE.
18. 10'-9" CLEARANCE MUST BE CONSIDERED FROM POLE BODY AND ARMS.
19. FALL PROTECTION VANG FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
B	MISC. REVISIONS		5/21/15	KAK		
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

C

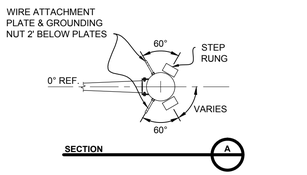
DRAWN BLH
ENGINEER CET
CHECKED TAB
APPROVED
DATE

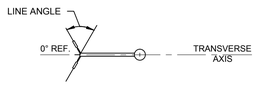
320kV DC LIGHT DEADEND 0-45°
32-SCVSP-LDW-045
LOAD & DESIGN DRAWING

SCALE NTS
FILE: TSP-03.DWG
IMAGE:
DRAWING NO. TSP-03-001

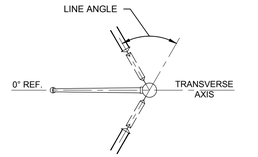
8/19/2015 2:19 PM — mspepich — N:\NUSCO\58479 — NPT\Overhead\Cadd\01-Record Worksheets\TSP-03.dwg — 001

NU VER: 05/2012

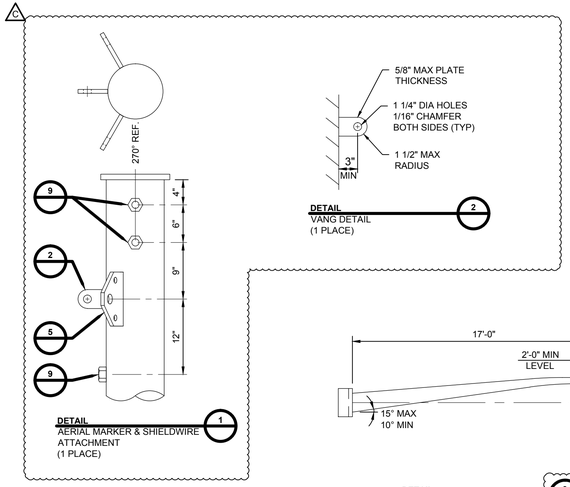


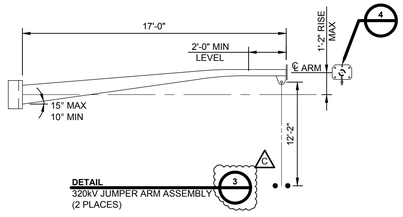


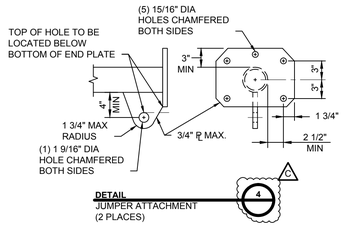
SHIELDWIRE PLAN VIEW

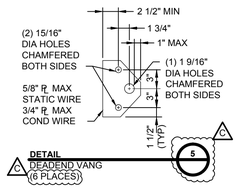


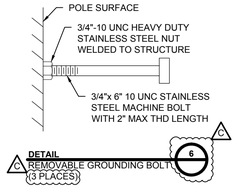
TRANSMISSION PLAN VIEW

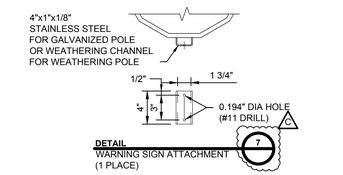


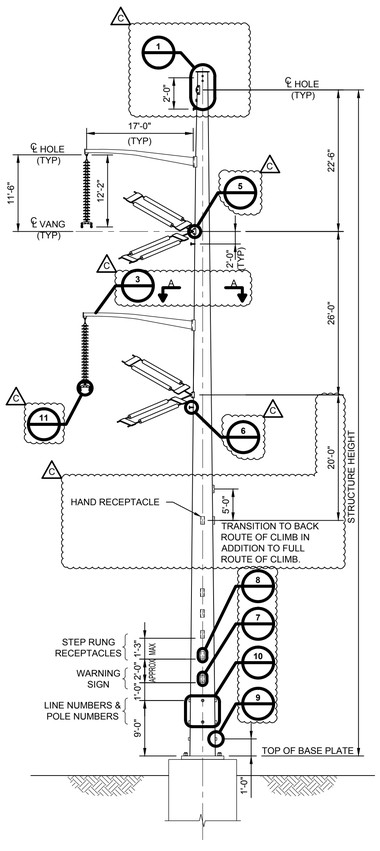




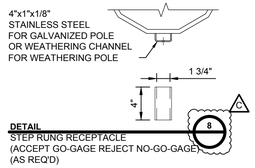


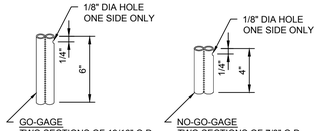




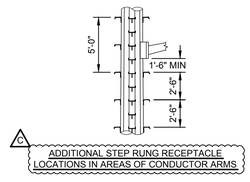


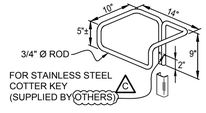
ELEVATION

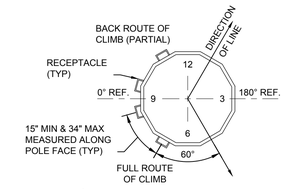


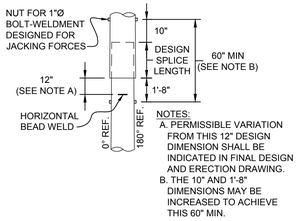


STEP RUNG RECEPTACLE GAGES

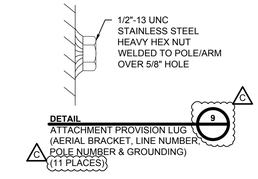


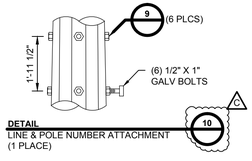


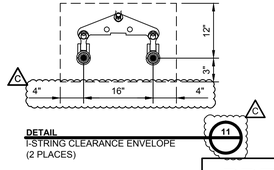




SPLICE DETAILS JACKING NUT LOCATIONS



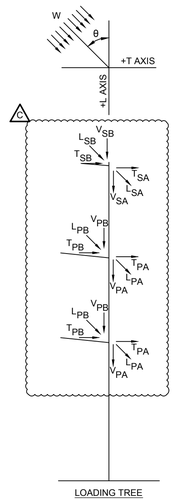




STRUCTURE NAME: 32-SCVSP-HDW-090
320-KV DC CONDUCTOR: 2 - 2933 KCMIL 91 STRAND AAAC PER PHASE (20000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 550 WIND SPAN BACK (FT): 550
WEIGHT SPAN AHEAD (FT): 825 WEIGHT SPAN BACK (FT): 825
LINE ANGLE: 45 - 90 DEGREES

LOADING CASE					DESIGN LOADS														
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.41	7.50	8.89	1.41	7.50	-8.89	13.36	54.76	67.99	13.36	54.76	-67.99	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.42	3.79	4.17	0.42	3.79	-4.17	5.52	31.98	35.73	5.52	31.98	-35.73	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	1.97	6.12	7.40	1.97	6.12	-7.40	12.47	38.32	48.17	12.47	38.32	-48.17	4.00	90.00	1.00
4	HQ EXTREME ICE	15.00	1.50	39.53	3.51	9.16	11.13	3.51	9.16	-11.13	16.96	48.95	61.57	16.96	48.95	-61.57	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.94	4.40	5.39	0.94	4.40	-5.39	8.91	32.63	41.21	8.91	32.63	-41.21	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.94	4.17	5.08	0.94	4.17	-5.08	8.91	29.38	36.96	8.91	29.38	-36.96	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.94	4.17	5.08	0.94	0.28	0.00	8.91	29.38	36.96	8.91	1.09	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	4.12	1.38	0.25	1.98	3.78	-4.83	30.33	11.55	2.10	9.63	31.91	-40.88	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.42	2.09	2.73	0.42	2.09	-2.73	5.52	16.77	21.92	5.52	16.77	-21.92	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.64	4.18	5.47	2.64	4.18	-5.47	12.84	33.55	43.83	12.84	33.55	-43.83	0.00	90.00	2.00
11	UPLIFT	-20.00	0.00	0.00	0.42	3.13	4.09	0.42	3.13	-4.09	5.52	30.65	40.04	5.52	30.65	-40.04	0.00	90.00	1.00

REFERENCES:
1. GOUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ADDITIONAL RECEPTACLE LOCATION: SKETCH D
7. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
8. LIFTING VANG PROVISIONS: SKETCH J + K
9. FALL PROTECTION VANGS: SKETCH N + Q
10. JACKING NUT LOCATIONS: SKETCH I



LOADING TREE

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
   D. AHEAD OR BACK CONDUCTORS AND GROUND WIRES ONLY.
7. SNUB ANGLES SHALL BE LIMITED TO A 15° DEGREE DEFLECTION LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE 25°.
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°. CLEARANCES MUST BE CHECKED TO SUBCONDUCTOR ENVELOPE SHOWN IN DETAIL 12.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
14. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
15. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
16. JUMPER ARM SHALL BE DESIGNED FOR A VERTICAL LOAD OF 2,500 POUNDS.
17. 5'-5" CLEARANCE SHALL BE CONSIDED FROM CLIMBING AND WORKING CLEARANCE.
18. 10'-9" CLEARANCE MUST BE CONSIDERED FROM POLE BODY AND ARMS.
19. FALL PROTECTION VANG FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS		5/21/15	KAK		
B	MISC. REVISIONS		5/8/15	BLH		
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

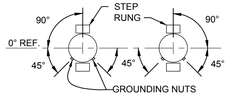
THE NORTHERN PASS

320kV DC HEAVY DEADEND 45-90°
32-SCVSP-HDW-090
LOAD & DESIGN DRAWING

C	
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	
SCALE	NTS
FILE:	TSP-04.DWG
IMAGE:	
DRAWING NO.	TSP-04-001

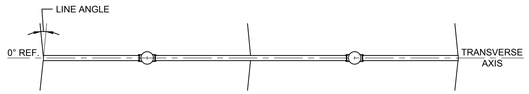
8/19/2015 2:22 PM - mspejch - N:\NUSCO\58479 - NPT\Overhead\Cadd\01-Record Worksheets\TSP-04.dwg - 001

NU VER: 08/2012

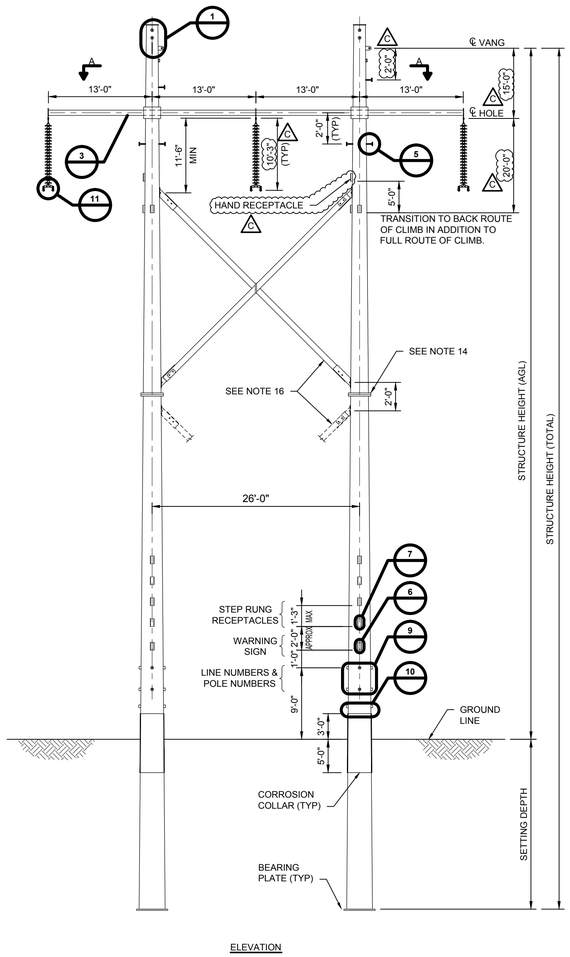


SECTION A

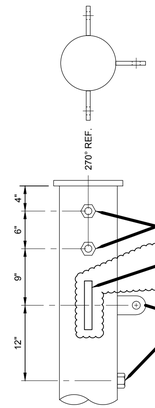
SHIELDWIRE PLAN VIEW



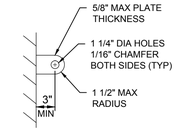
TRANSMISSION PLAN VIEW



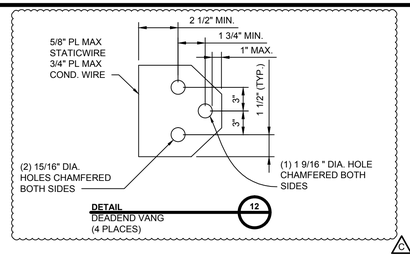
ELEVATION



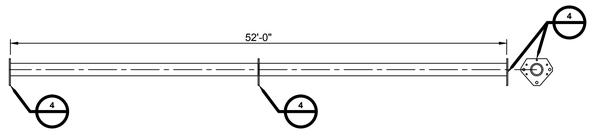
DETAIL 1
AERIAL MARKER & SHIELDWIRE ATTACHMENT
(2 PLACES)



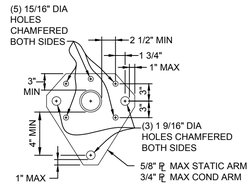
DETAIL 2
VANG DETAIL
(2 PLACES)



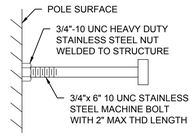
DETAIL 12
DEADEND VANG
(4 PLACES)



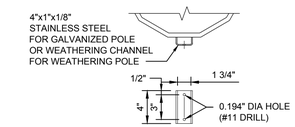
DETAIL 3
345kV ARM ASSEMBLY
(1 PLACE)



DETAIL 4
SUSPENSION/STRAIN PLATE
(3 PLACES)

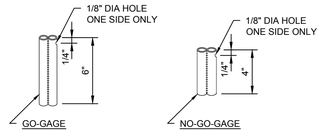


DETAIL 5
REMOVABLE GROUNDING BOLT
(6 PLACES)



DETAIL 6
WARNING SIGN ATTACHMENT
(2 PLACES)

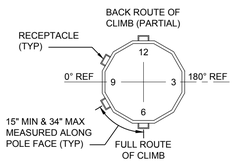
DETAIL 7
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)



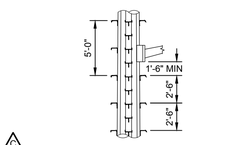
TWO SECTIONS OF 13/16" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

TWO SECTIONS OF 7/8" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

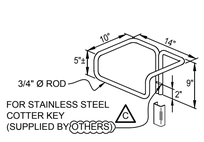
STEP RUNG RECEPTACLE GAGES



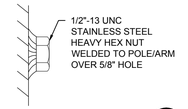
RECEPTACLE LOCATIONS
(HAND RECEPTACLES LOCATED 5' ABOVE FOOT RECEPTACLES)



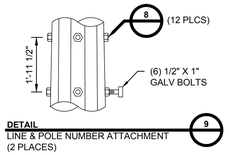
ADDITIONAL STEP RUNG RECEPTACLE LOCATIONS IN AREAS OF CONDUCTOR ARMS



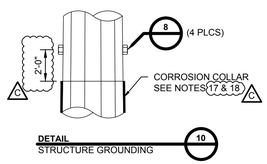
RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



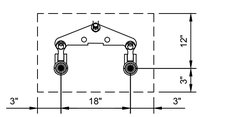
DETAIL 8
ATTACHMENT PROVISION LUG
(AERIAL BRACKET, LINE NUMBER, POLE NUMBER & GROUNDING)
(22 PLACES)



DETAIL 9
LINE & POLE NUMBER ATTACHMENT
(2 PLACES)



DETAIL 10
STRUCTURE GROUNDING

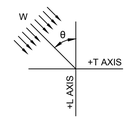


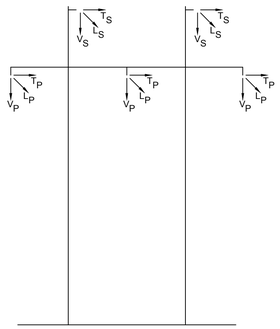
DETAIL 11
I-STRING CLEARANCE ENVELOPE
(3 PLACES)

STRUCTURE NAME: 30-SCHSP-LTW-002
345-KV AC CONDUCTOR: 2 - 1590 KCMIL 45/7 "LAPWING" ACSR PER PHASE (11400# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 800
WEIGHT SPAN (FT): 800
LINE ANGLE: 0 - 2 DEGREES

LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.37	1.34	0.00	8.49	4.78	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.41	1.03	0.00	3.31	5.94	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	1.91	0.95	0.00	8.65	2.97	0.00	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	2.60	1.15	0.00	10.51	3.43	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.91	0.61	0.00	5.66	2.21	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.91	0.59	0.00	5.66	2.13	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.91	0.50	5.50	5.66	1.57	13.68	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.55	0.30	0.27	13.60	1.52	1.21	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.41	0.10	0.00	3.31	0.47	0.00	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.62	0.21	0.00	8.43	0.93	0.00	0.00	90.00	2.00

REFERENCES:
1. GOUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ADDITIONAL RECEPTACLE LOCATION: SKETCH D
7. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
8. LIFTING VANG PROVISIONS: SKETCH J + K
9. FALL PROTECTION VANGS: SKETCH N + Q
10. JACKING NUT LOCATIONS: SKETCH I





LOADING TREE

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
7. SNUB ANGLES SHALL BE LIMITED TO A 2 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE 15°.
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°. CLEARANCES MUST BE CHECKED TO SUBCONDUCTOR ENVELOPE SHOWN IN DETAIL 11.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE GROUND LINE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
14. POLE SPLICES SHALL USE FLANGED DESIGN.
15. ARM AND X-BRACE SIZE, SHAPE AND MOUNTING HARDWARE REQUIRED SHALL BE DETERMINED AND FURNISHED BY POLE SUPPLIER.
16. SINGLE X-BRACE REQUIRED FOR STRUCTURES UP TO 95 FEET IN HEIGHT ABOVE GROUND LINE. TWO X-BRACES SHALL BE USED FOR STRUCTURES WITH HEIGHTS ABOVE GROUND LINE EXCEEDING 95 FEET.
17. STEEL PLATE, A MINIMUM OF 1/4" THICKNESS GREATER THAN THAT REQUIRED FOR COLUMN STRENGTH SHALL BE IN PLACE IN THE AREA 3'-0" ABOVE AND 5'-0" BELOW THE NOMINAL GROUND LINE.
18. APPLY COAL TAR EPOXY ON INSIDE AND OUTSIDE OF POLE FROM BUTT OF POLE TO 12" ABOVE TOP OF CORROSION COLLAR.
19. BELOW GROUND CORROSION PROTECTION COATING MATERIAL SHALL BE SUPPLIED (ONE QUART PER TWO STRUCTURES) TO "TOUCH UP" SCRATCHES OCCURRING IN SHIPPING AND HANDLING. A COPY OF THE MSDS SHEET SHALL BE SUPPLIED WITH THE "TOUCH UP" MATERIALS.
20. BRACING USE, CONFIGURATION AND LOCATIONS TO BE DETERMINED BY MANUFACTURER.
21. FALL PROTECTION VANG FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE #	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS	.	5/27/15	KAK	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE #	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

345kV AC LIGHT TANGENT 0-2°
30-SCHSP-LTW-002
LOAD & DESIGN DRAWING

	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-05.DWG
IMAGE:	
DRAWING NO.	TSP-05-001

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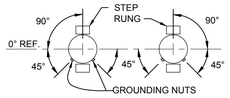
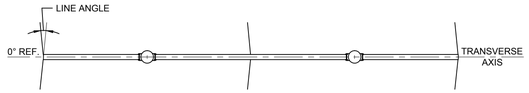
NU VER: 08/2012

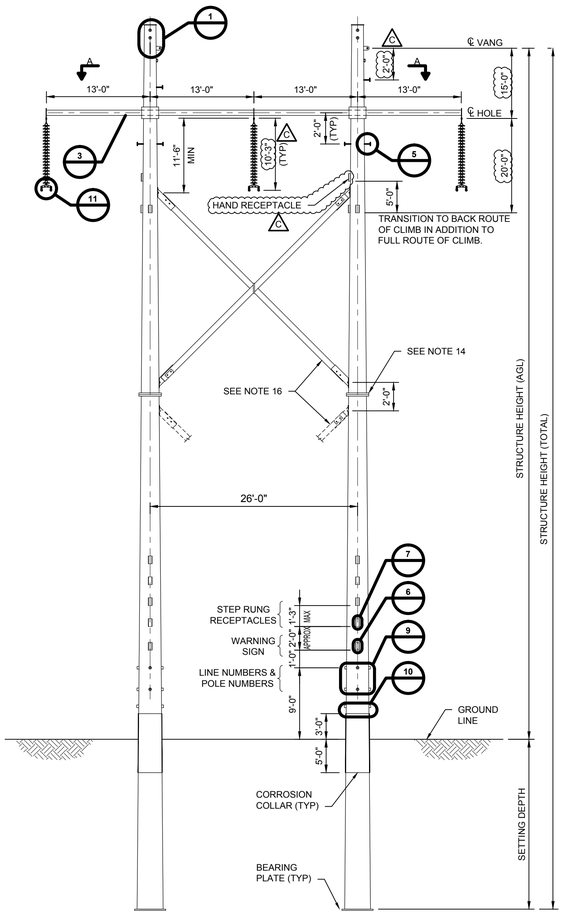


SECTION A

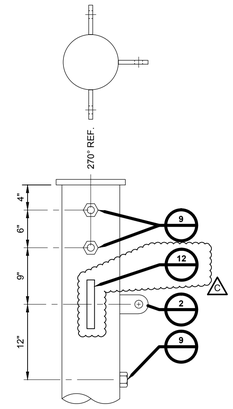
SHIELDWIRE PLAN VIEW



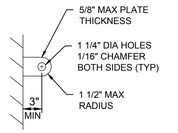
TRANSMISSION PLAN VIEW



ELEVATION

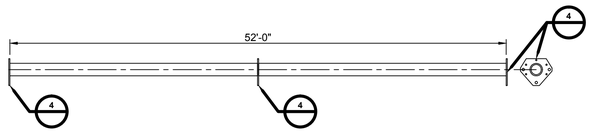


DETAIL 1
AERIAL MARKER & SHIELDWIRE ATTACHMENT
(2 PLACES)

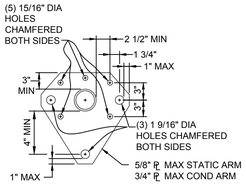


DETAIL 2
VANG DETAIL
(2 PLACES)

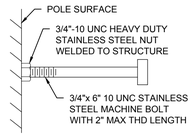
DETAIL 12
DEADEND VANG
(4 PLACES)



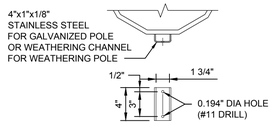
DETAIL 3
345KV ARM ASSEMBLY
(1 PLACE)



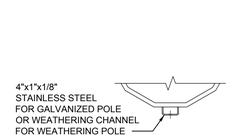
DETAIL 4
SUSPENSION/STRAIN PLATE
(3 PLACES)



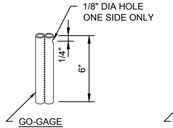
DETAIL 5
REMOVABLE GROUNDING BOLT
(6 PLACES)



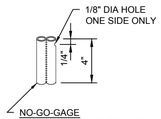
DETAIL 6
WARNING SIGN ATTACHMENT
(2 PLACES)



DETAIL 7
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)

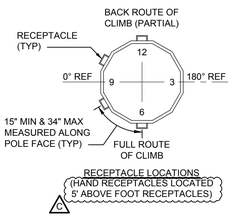


GO-GAGE
TWO SECTIONS OF 13/16" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

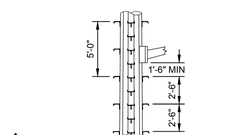


NO-GO-GAGE
TWO SECTIONS OF 7/8" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

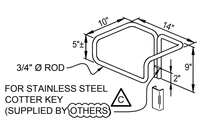
STEP RUNG RECEPTACLE GAGES



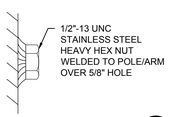
RECEPTACLE LOCATIONS
(HAND RECEPTACLES LOCATED 5' ABOVE FOOT RECEPTACLES)



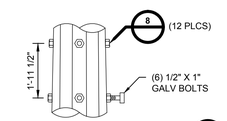
ADDITIONAL STEP RUNG RECEPTACLE LOCATIONS IN AREAS OF CONDUCTOR ARMS



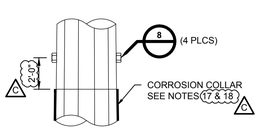
RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



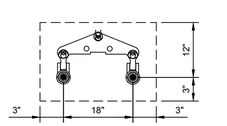
DETAIL 8
ATTACHMENT PROVISION LUG
(AERIAL BRACKET, LINE NUMBER, POLE NUMBER & GROUNDING)
(22 PLACES)



DETAIL 9
LINE & POLE NUMBER ATTACHMENT
(2 PLACES)



DETAIL 10
STRUCTURE GROUNDING

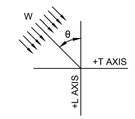


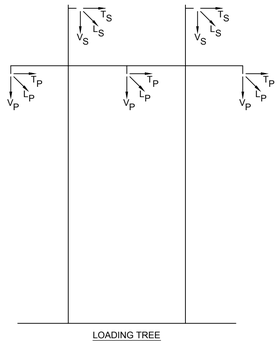
DETAIL 11
I-STRING CLEARANCE ENVELOPE
(3 PLACES)

STRUCTURE NAME: 30-SCHSP-MTW-002
345-KV AC CONDUCTOR: 2 - 1590 KCMIL 45/7 "LAPWING" ACSR PER PHASE (11400# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 800
WEIGHT SPAN (FT): 1100
LINE ANGLE: 0 - 2 DEGREES

LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.85	1.34	0.00	11.22	4.78	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.54	1.03	0.00	4.39	5.94	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	2.61	0.95	0.00	11.59	2.97	0.00	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	3.55	1.15	0.00	14.16	3.43	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	1.23	0.61	0.00	7.48	2.21	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	1.23	0.59	0.00	7.48	2.13	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	1.23	0.50	5.50	7.48	1.63	17.10	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.75	0.30	0.27	15.21	1.52	1.21	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.54	0.10	0.00	4.39	0.47	0.00	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.89	0.21	0.00	10.58	0.93	0.00	0.00	90.00	2.00

REFERENCES:
1. GOUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ADDITIONAL RECEPTACLE LOCATION: SKETCH D
7. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
8. LIFTING VANG PROVISIONS: SKETCH J + K
9. FALL PROTECTION VANGS: SKETCH N + Q
10. JACKING NUT LOCATIONS: SKETCH I





LOADING TREE

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
7. SNUB ANGLES SHALL BE LIMITED TO A 2 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE 15°.
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°. CLEARANCES MUST BE CHECKED TO SUBCONDUCTOR ENVELOPE SHOWN IN DETAIL 11.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE GROUND LINE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
14. POLE SPLICES SHALL USE FLANGED DESIGN.
15. ARM AND X-BRACE SIZE, SHAPE AND MOUNTING HARDWARE REQUIRED SHALL BE DETERMINED AND FURNISHED BY POLE SUPPLIER.
16. SINGLE X-BRACE REQUIRED FOR STRUCTURES UP TO 95 FEET IN HEIGHT ABOVE GROUND LINE. TWO X-BRACES SHALL BE USED FOR STRUCTURES WITH HEIGHTS ABOVE GROUND LINE EXCEEDING 95 FEET.
17. STEEL PLATE, A MINIMUM OF 1/4" THICKNESS GREATER THAN THAT REQUIRED FOR COLUMN STRENGTH SHALL BE IN PLACE IN THE AREA 3'-0" ABOVE AND 5'-0" BELOW THE NOMINAL GROUND LINE.
18. APPLY COAL TAR EPOXY ON INSIDE AND OUTSIDE OF POLE FROM BUTT OF POLE TO 12" ABOVE TOP OF CORROSION COLLAR.
19. BELOW GROUND CORROSION PROTECTION COATING MATERIAL SHALL BE SUPPLIED (ONE QUART PER TWO STRUCTURES) TO "TOUCH UP" SCRATCHES OCCURRING IN SHIPPING AND HANDLING. A COPY OF THE MSDS SHEET SHALL BE SUPPLIED WITH THE "TOUCH UP" MATERIALS.
20. BRACING USE, CONFIGURATION AND LOCATIONS TO BE DETERMINED BY MANUFACTURER.
21. FALL PROTECTION VANG FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVSIONS	.	5/27/15	KAK	.	.
B	MISC. REVSIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

345kV AC MEDIUM TANGENT 0-2°
30-SCHSP-MTW-002
LOAD & DESIGN DRAWING

	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-06.DWG
IMAGE:	
DRAWING NO.	TSP-06-001

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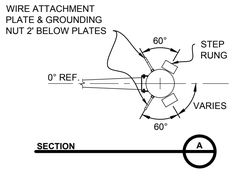
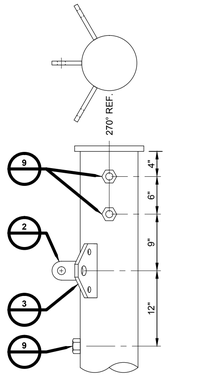
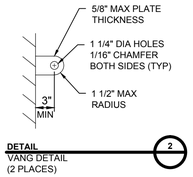
NU VER: 08/2012



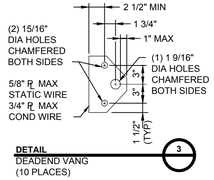
SECTION A



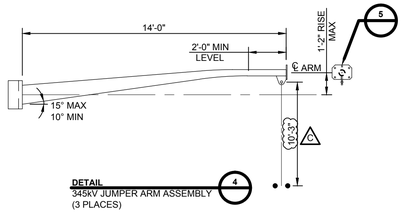
DETAIL
AERIAL MARKER & SHIELDWIRE ATTACHMENT
(2 PLACES) 1



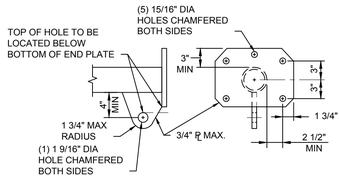
DETAIL
VANG DETAIL
(2 PLACES) 2



DETAIL
DEADEND VANG
(10 PLACES) 3

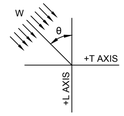


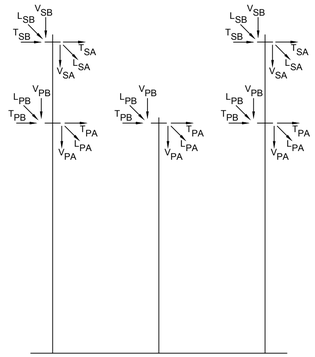
DETAIL
345kV JUMPER ARM ASSEMBLY
(3 PLACES) 4



DETAIL
JUMPER ATTACHMENT
(3 PLACES) 5

C **REFERENCES:**
1. GOUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ADDITIONAL RECEPTACLE LOCATION: SKETCH D
7. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
8. LIFTING VANG PROVISIONS: SKETCH J + K
9. FALL PROTECTION VANGS: SKETCH N + Q
10. JACKING NUT LOCATIONS: SKETCH I



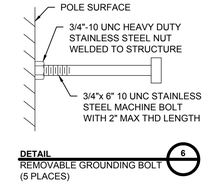


LOADING TREE

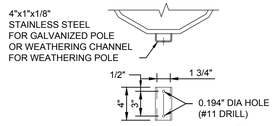
STRUCTURE NAME: 30-SCHSP-LDW-045
345-KV AC CONDUCTOR: 2 - 1590 KCMIL 45/7 "LAPWING" ACSR PER PHASE (11400# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 475 WIND SPAN BACK (FT): 475
WEIGHT SPAN AHEAD (FT): 625 WEIGHT SPAN BACK (FT): 625
LINE ANGLE: 0 - 45 DEGREES

LOADING CASE					DESIGN LOADS													
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.08	4.28	9.62	1.08	4.28	-9.62	7.87	17.76	41.24	7.87	17.76	-41.24	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.33	2.24	4.51	0.33	2.24	-4.51	3.01	11.89	23.11	3.01	11.89	-23.11	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	1.50	3.46	8.01	1.50	3.46	-8.01	7.58	13.17	31.53	7.58	13.17	-31.53	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	2.04	4.27	9.92	2.04	4.27	-9.92	9.04	15.42	36.98	9.04	15.42	-36.98	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.72	2.47	5.83	0.72	2.47	-5.83	5.25	10.36	24.99	5.25	10.36	-24.99	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.72	2.34	5.50	0.72	2.34	-5.50	5.25	9.52	22.80	5.25	9.52	-22.80	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.72	2.34	5.50	0.72	0.24	0.00	5.25	9.52	22.80	5.25	0.79	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.85	1.50	0.27	1.85	2.07	-5.23	16.51	6.91	1.21	5.87	9.40	-23.49	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.33	1.13	2.96	0.33	1.13	-2.96	3.01	5.10	13.34	3.01	5.10	-13.34	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.46	2.26	5.92	2.46	2.26	-5.92	7.83	10.21	26.68	7.83	10.21	-26.68	0.00	90.00	2.00
11	UPLIFT	-20.00	0.00	0.00	0.33	1.70	4.43	0.33	1.70	-4.43	3.01	7.92	20.69	3.01	7.92	-20.69	0.00	90.00	1.00

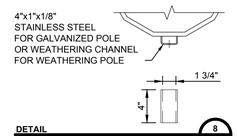
C



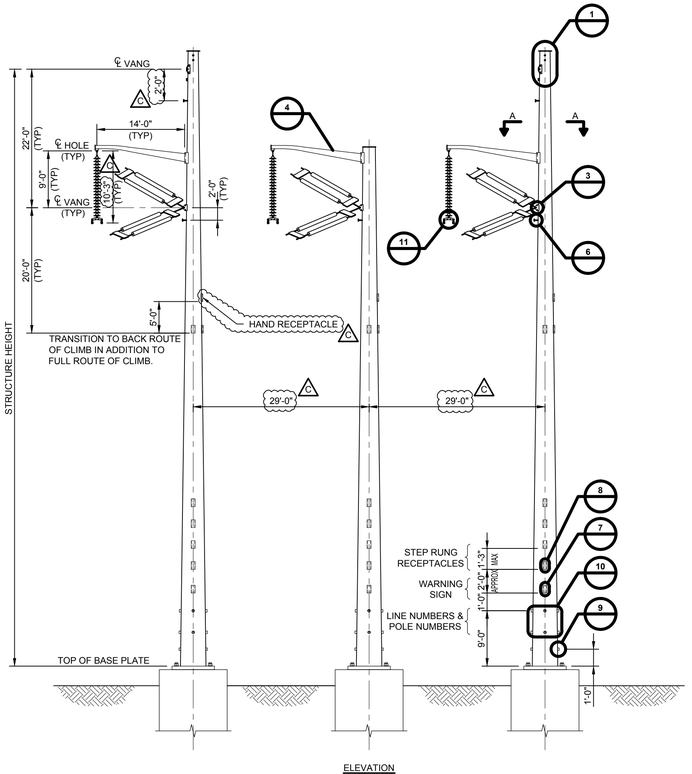
DETAIL
REMOVABLE GROUNDING BOLT
(5 PLACES) 6



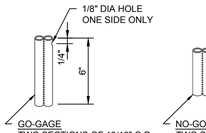
DETAIL
WARNING SIGN ATTACHMENT
(3 PLACES) 7



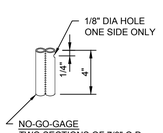
DETAIL
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D) 8



ELEVATION

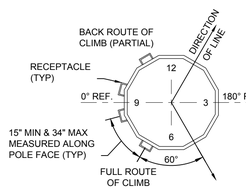


GO-GAGE
TWO SECTIONS OF 13/16" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

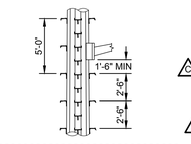


NO-GO-GAGE
TWO SECTIONS OF 7/8" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

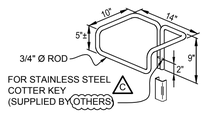
STEP RUNG RECEPTACLE GAGES



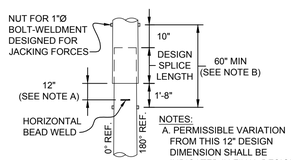
RECEPTACLE LOCATIONS
(HAND RECEPTACLES LOCATED 5' ABOVE FOOT RECEPTACLES)
C



C ADDITIONAL STEP RUNG RECEPTACLE LOCATIONS IN AREAS OF CONDUCTOR ARMS

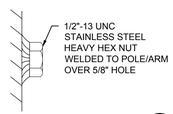


RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)

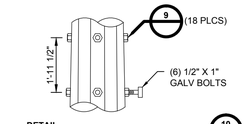


NOTES:
A. PERMISSIBLE VARIATION FROM THIS 12" DESIGN DIMENSION SHALL BE INDICATED IN FINAL DESIGN AND ERECTION DRAWING.
B. THE 10" AND 1'-8" DIMENSIONS MAY BE INCREASED TO ACHIEVE THIS 60" MIN.

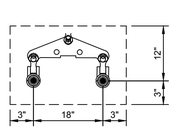
SPLICE DETAILS JACKING NUT LOCATIONS



DETAIL
ATTACHMENT PROVISION LUG
(AERIAL BRACKET, LINE NUMBER, POLE NUMBER & GROUNDING)
(30 PLACES) 9
C



DETAIL
LINE & POLE NUMBER ATTACHMENT
(3 PLACES) 10



DETAIL
I-STRING CLEARANCE ENVELOPE
(3 PLACES) 11

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
   D. AHEAD OR BACK CONDUCTORS AND GROUND WIRES ONLY INSTALLED.
7. SNUB ANGLES SHALL BE LIMITED TO A 15° DEFLECTION ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE 15°.
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°. CLEARANCES MUST BE CHECKED TO SUBCONDUCTOR ENVELOPE SHOWN IN DETAIL 11.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
14. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
15. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
16. JUMPER ARMS SHALL BE DESIGNED FOR A VERTICAL LOAD OF 2,000 POUNDS.
17. FALL PROTECTION VANG FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVSIONS	.	5/27/15	MSP	.	.
B	MISC. REVSIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

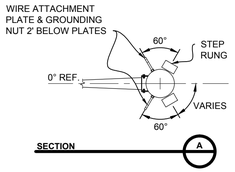
THE NORTHERN PASS

345kV AC LIGHT DEADEND 0-45°
30-SCHSP-LOW-045
LOAD & DESIGN DRAWING

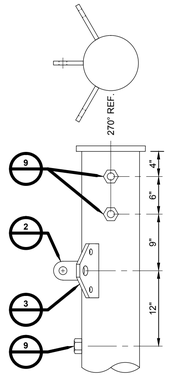
	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-07.DWG
IMAGE:	
DRAWING NO.	TSP-07-001

8/19/2015 2:26 PM - mpepich - N:\NUSCO\58479 - NPT\Overhead\Cadd\01-Record Worksheets\TSP-07.dwg - 001

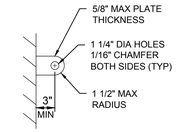
NU VER: 08/2012



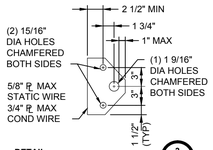
SECTION A



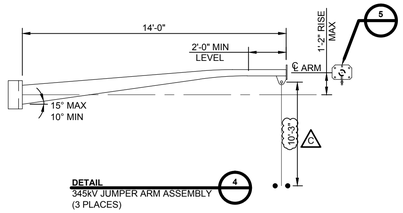
DETAIL 1
AERIAL MARKER & SHIELDWIRE ATTACHMENT
(2 PLACES)



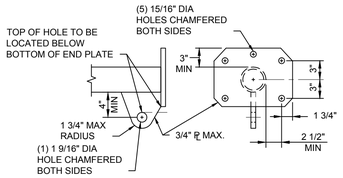
DETAIL 2
VANG DETAIL
(2 PLACES)



DETAIL 3
DEADEND VANG
(10 PLACES)



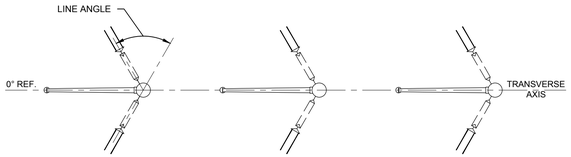
DETAIL 4
345kV JUMPER ARM ASSEMBLY
(3 PLACES)



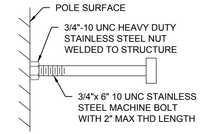
DETAIL 5
JUMPER ATTACHMENT
(3 PLACES)

C **REFERENCES:**
1. GOUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ADDITIONAL RECEPTACLE LOCATION: SKETCH D
7. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
8. LIFTING VANG PROVISIONS: SKETCH J + K
9. FALL PROTECTION VANGS: SKETCH N + Q
10. JACKING NUT LOCATIONS: SKETCH I

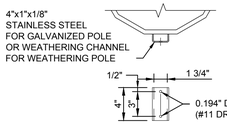
SHIELDWIRE PLAN VIEW



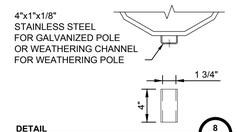
TRANSMISSION PLAN VIEW



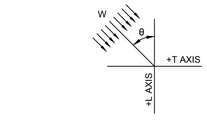
DETAIL 6
REMOVABLE GROUNDING BOLT
(5 PLACES)

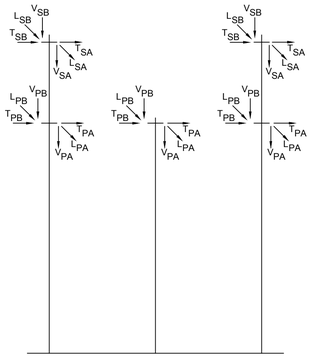


DETAIL 7
WARNING SIGN ATTACHMENT
(3 PLACES)



DETAIL 8
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)



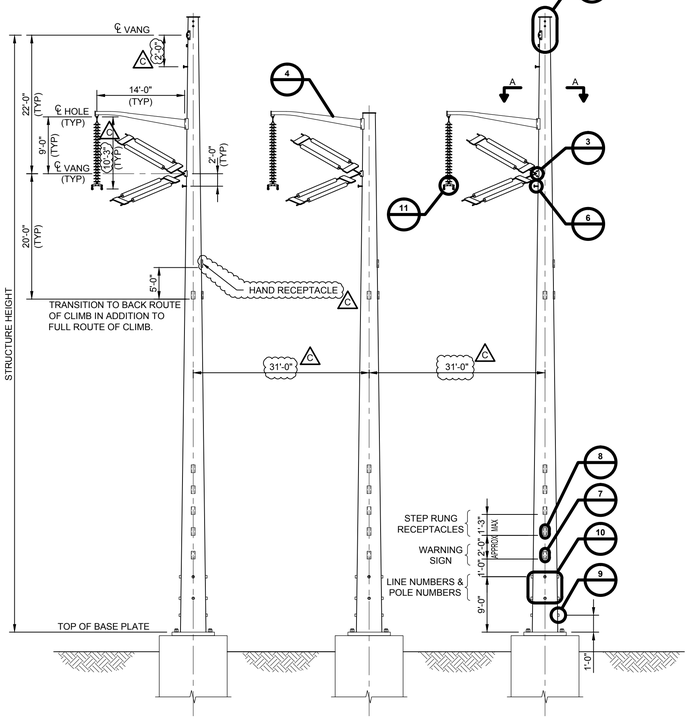


LOADING TREE

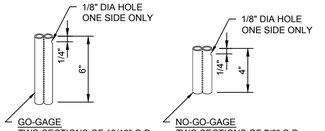
STRUCTURE NAME: 30-SCHSP-MDW-065
345-KV AC CONDUCTOR: 2 - 1590 KCMIL 45/7 "LAPWING" ACSR PER PHASE (11400# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 275 WIND SPAN BACK (FT): 275
WEIGHT SPAN AHEAD (FT): 300 WEIGHT SPAN BACK (FT): 300
LINE ANGLE: 45 - 65 DEGREES

LOADING CASE					DESIGN LOADS													
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	0.56	5.52	8.89	0.56	5.52	-8.89	4.91	23.30	38.10	4.91	23.30	-38.10	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.18	2.72	4.17	0.18	2.72	-4.17	1.85	14.18	21.35	1.85	14.18	-21.35	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	0.75	4.53	7.40	0.75	4.53	-7.40	4.39	17.58	29.13	4.39	17.58	-29.13	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	1.00	5.61	9.17	1.00	5.61	-9.17	5.09	20.60	34.16	5.09	20.60	-34.16	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.37	3.27	5.39	0.37	3.27	-5.39	3.27	13.89	23.09	3.27	13.89	-23.09	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.37	3.09	5.08	0.37	3.09	-5.08	3.27	12.71	21.06	3.27	12.71	-21.06	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.37	3.09	5.08	0.37	0.14	0.00	3.27	12.71	21.06	3.27	0.46	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.41	1.40	0.25	1.63	2.85	-4.83	13.01	6.40	1.12	4.12	12.86	-21.70	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.18	1.59	2.73	0.18	1.59	-2.73	1.85	7.17	12.32	1.85	7.17	-12.32	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.17	3.18	5.47	2.17	3.18	-5.47	5.50	14.33	24.65	5.50	14.33	-24.65	0.00	90.00	2.00
11	UPLIFT	-20.00	0.00	0.00	0.18	2.38	4.09	0.18	2.38	-4.09	1.85	11.11	19.11	1.85	11.11	-19.11	0.00	90.00	1.00

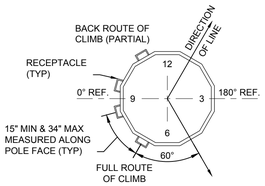
C



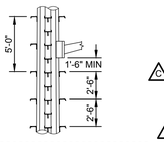
ELEVATION



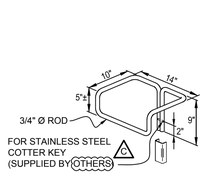
STEP RUNG RECEPTACLE GAGES



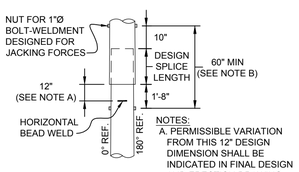
RECEPTACLE LOCATIONS
(HAND RECEPTACLES LOCATED 5' ABOVE FOOT RECEPTACLES)



ADDITIONAL STEP RUNG RECEPTACLE LOCATIONS IN AREAS OF CONDUCTOR ARMS

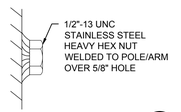


RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)

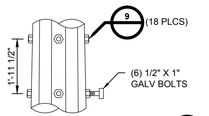


NOTES:
A. PERMISSIBLE VARIATION FROM THIS 12" DESIGN DIMENSION SHALL BE INDICATED IN FINAL DESIGN AND ERECTION DRAWING.
B. THE 10" AND 1'-8" DIMENSIONS MAY BE INCREASED TO ACHIEVE THIS 60" MIN.

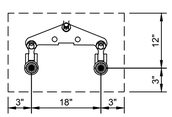
SPLICE DETAILS JACKING NUT LOCATIONS



DETAIL 9
ATTACHMENT PROVISION LUG
(AERIAL BRACKET, LINE NUMBER, POLE NUMBER & GROUNDING)
(30 PLACES)



DETAIL 10
LINE & POLE NUMBER ATTACHMENT
(3 PLACES)



DETAIL 11
I-STRING CLEARANCE ENVELOPE
(3 PLACES)

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
   D. AHEAD OR BACK CONDUCTORS AND GROUND WIRES ONLY INSTALLED.
7. SNUB ANGLES SHALL BE LIMITED TO A (15° DEFLECTION) ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE 15°.
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°. CLEARANCES MUST BE CHECKED TO SUBCONDUCTOR ENVELOPE SHOWN IN DETAIL 11.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
14. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
15. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
16. JUMPER ARMS SHALL BE DESIGNED FOR A VERTICAL LOAD OF 2,000 POUNDS.
17. FALL PROTECTION VANG FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS	.	5/27/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

345kV AC MEDIUM DEADEND 45-65°
30-SCHSP-MDW-065
LOAD & DESIGN DRAWING

C	
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-08.DWG
IMAGE:	
DRAWING NO.	TSP-08-001

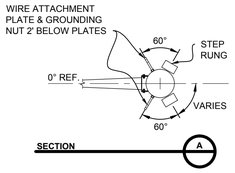
8/19/2015 2:27 PM - mpepich - N:\NUSCO\58479 - NPT\Overhead\Cadd\01-Record Worksheets\TSP-08.dwg - 001

NU VER: 08/2012

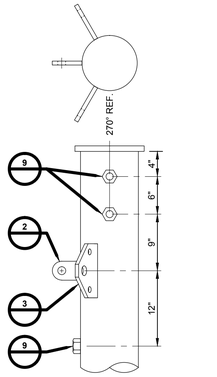
STRUCTURE NAME: 30-SCHSP-HDW-090
345-KV AC CONDUCTOR: 2 - 1590 KCMIL 45/7 "LAPWING" ACSR PER PHASE (11400# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 325 WIND SPAN BACK (FT): 325
WEIGHT SPAN AHEAD (FT): 475 WEIGHT SPAN BACK (FT): 475
LINE ANGLE: 65 - 90 DEGREES

LOADING CASE					DESIGN LOADS														
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	0.84	7.21	8.12	0.84	7.21	-8.12	6.50	30.52	34.78	6.50	30.52	-34.78	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.26	3.54	3.81	0.26	3.54	-3.81	2.48	18.43	19.49	2.48	18.43	-19.49	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	1.15	5.94	6.76	1.15	5.94	-6.76	6.11	23.05	26.59	6.11	23.05	-26.59	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	1.56	7.34	8.37	1.56	7.34	-8.37	7.22	27.01	31.19	7.22	27.01	-31.19	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.56	4.29	4.92	0.56	4.29	-4.92	4.33	18.21	21.08	4.33	18.21	-21.08	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.56	4.05	4.64	0.56	4.05	-4.64	4.33	16.66	19.23	4.33	16.66	-19.23	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.56	4.05	4.64	0.56	0.16	0.00	4.33	16.66	19.23	4.33	0.54	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.65	1.32	0.23	1.74	3.74	-4.41	14.89	6.03	1.02	5.06	16.89	-19.81	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.26	2.09	2.49	0.26	2.09	-2.49	2.48	9.43	11.25	2.48	9.43	-11.25	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.33	4.18	4.99	2.33	4.18	-4.99	6.75	18.86	22.50	6.75	18.86	-22.50	0.00	90.00	2.00
11	UPLIFT	-20.00	0.00	0.00	0.26	3.13	3.74	0.26	3.13	-3.74	2.48	14.63	17.45	2.48	14.63	-17.45	0.00	90.00	1.00

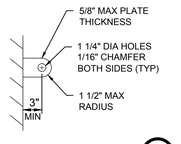
C



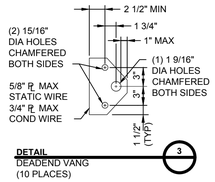
SECTION A



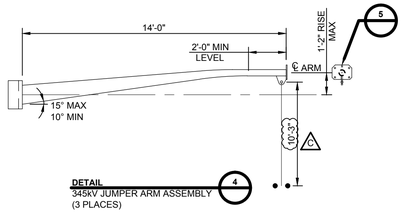
DETAIL AERIAL MARKER & SHIELDWIRE ATTACHMENT (2 PLACES) 1



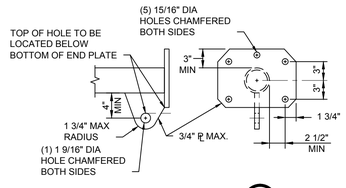
DETAIL VANG DETAIL (2 PLACES) 2



DETAIL DEADEND VANG (10 PLACES) 3

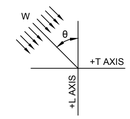


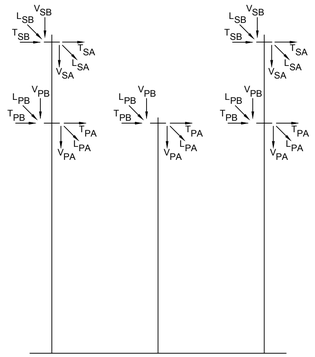
DETAIL 345kV JUMPER ARM ASSEMBLY (3 PLACES) 4



DETAIL JUMPER ATTACHMENT (3 PLACES) 5

C **REFERENCES:**
1. GOUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ADDITIONAL RECEPTACLE LOCATION: SKETCH D
7. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
8. LIFTING VANG PROVISIONS: SKETCH J + K
9. FALL PROTECTION VANGS: SKETCH N + Q
10. JACKING NUT LOCATIONS: SKETCH I





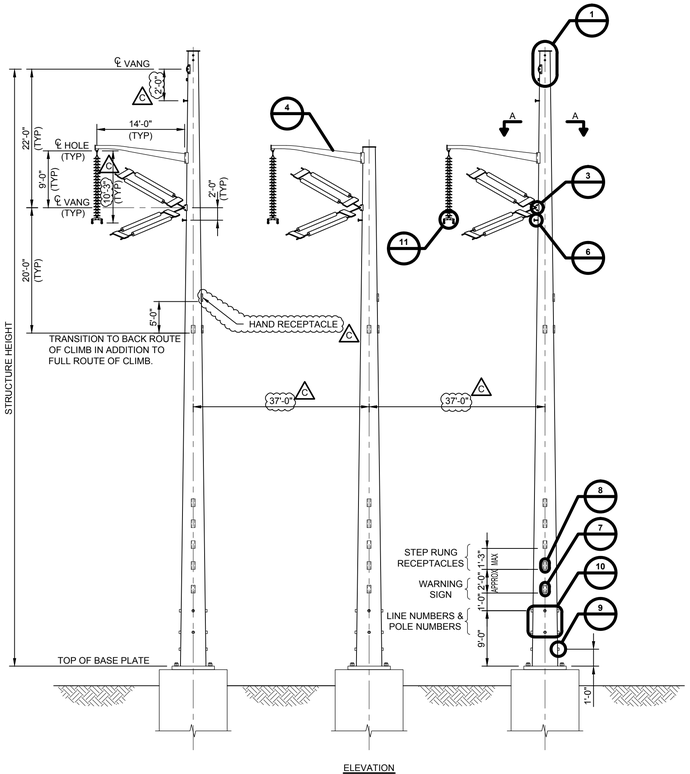
LOADING TREE

LINE ANGLE
0° REF.
TRANSVERSE AXIS

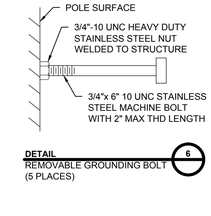
SHIELDWIRE PLAN VIEW

LINE ANGLE
0° REF.
TRANSVERSE AXIS

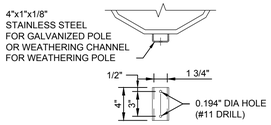
TRANSMISSION PLAN VIEW



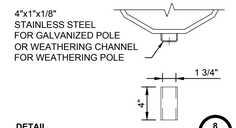
ELEVATION



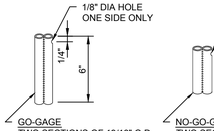
DETAIL REMOVABLE GROUNDING BOLT (5 PLACES) 6



DETAIL WARNING SIGN ATTACHMENT (3 PLACES) 7



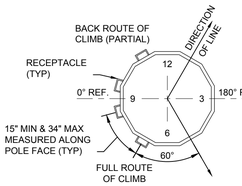
DETAIL STEP RUNG RECEPTACLE (ACCEPT GO-GAGE REJECT NO-GO-GAGE) (AS REQ'D) 8



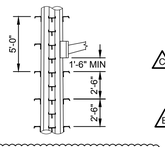
GO-GAGE
TWO SECTIONS OF 13/16" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

NO-GO-GAGE
TWO SECTIONS OF 7/8" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

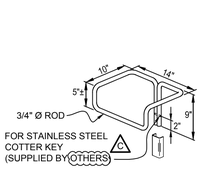
STEP RUNG RECEPTACLE GAGES



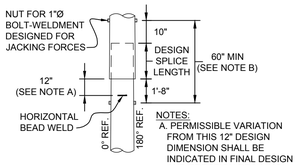
RECEPTACLE LOCATIONS
(HAND RECEPTACLES LOCATED 5' ABOVE FOOT RECEPTACLES)



ADDITIONAL STEP RUNG RECEPTACLE LOCATIONS IN AREAS OF CONDUCTOR ARMS



RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



NOTES:
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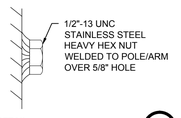
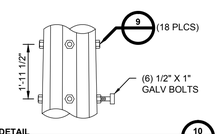
B. THE 10" AND 1'-8" DIMENSIONS MAY BE INCREASED TO ACHIEVE THIS 60° MIN.

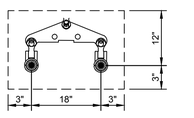
SPLICE DETAILS JACKING NUT LOCATIONS



DETAIL ATTACHMENT PROVISION LUG (AERIAL BRACKET, LINE NUMBER, POLE NUMBER & GROUNDING) (60 PLACES) 9



DETAIL LINE & POLE NUMBER ATTACHMENT (3 PLACES) 10



DETAIL I-STRING CLEARANCE ENVELOPE (3 PLACES) 11

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
   D. AHEAD OR BACK CONDUCTORS AND GROUND WIRES ONLY INSTALLED.
7. SNUB ANGLES SHALL BE LIMITED TO A 15° DEFLECTION ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE 15°.
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°. CLEARANCES MUST BE CHECKED TO SUBCONDUCTOR ENVELOPE SHOWN IN DETAIL 11.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
14. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
15. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
16. JUMPER ARMS SHALL BE DESIGNED FOR A VERTICAL LOAD OF 2,000 POUNDS.
17. FALL PROTECTION VANG FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISONS	.	5/27/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.

DWG REV | CONT/PE# | DATE | DRN | CHKD | APPR

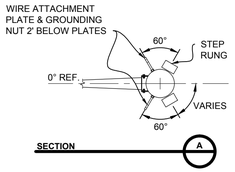
THE NORTHERN PASS

345kV AC HEAVY DEADEND 65-90°
30-SCHSP-HDW-090
LOAD & DESIGN DRAWING

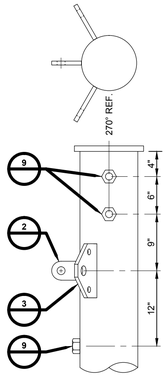
C	
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-09.DWG
IMAGE:	
DRAWING NO.	TSP-09-001

8/19/2015 2:28 PM - mpepich - N:\NUSCO\58479 - NPT\Overhead\Cadd\01-Record Worksheets\TSP-09.dwg - 001

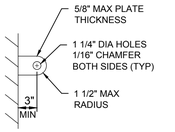
NU VER: 08/2012



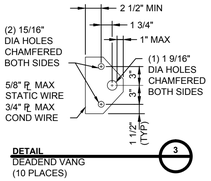
SECTION A



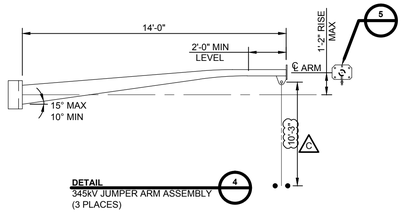
DETAIL 1
AERIAL MARKER & SHIELDWIRE ATTACHMENT
(2 PLACES)



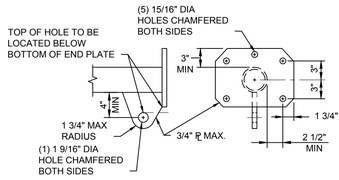
DETAIL 2
VANG DETAIL
(2 PLACES)



DETAIL 3
DEADEND VANG
(10 PLACES)



DETAIL 4
345kV JUMPER ARM ASSEMBLY
(3 PLACES)



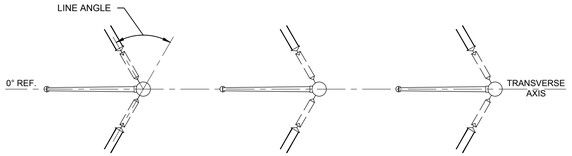
DETAIL 5
JUMPER ATTACHMENT
(3 PLACES)

STRUCTURE NAME: 30-SCHSP-HDW-140
345-KV AC CONDUCTOR: 2 - 1590 KCMIL 45/7 "LAPWING" ACSR PER PHASE (11400# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 225 WIND SPAN BACK (FT): 225
WEIGHT SPAN AHEAD (FT): 350 WEIGHT SPAN BACK (FT): 350
LINE ANGLE: 130 - 140 DEGREES

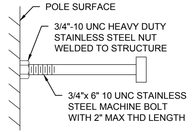
LOADING CASE					DESIGN LOADS													
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	0.64	9.33	4.07	0.64	9.33	-4.07	5.36	39.69	17.43	5.36	39.69	-17.43	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.21	4.48	1.91	0.21	4.48	-1.91	2.03	23.16	9.77	2.03	23.16	-9.77	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	0.86	7.72	3.39	0.86	7.72	-3.39	4.88	30.15	13.32	4.88	30.15	-13.32	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	1.16	9.55	4.19	1.16	9.55	-4.19	5.70	35.35	15.63	5.70	35.35	-15.63	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.43	5.59	2.47	0.43	5.59	-2.47	3.58	23.86	10.56	3.58	23.86	-10.56	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.43	5.28	2.32	0.43	5.28	-2.32	3.58	21.80	9.64	3.58	21.80	-9.64	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.43	5.28	2.32	0.43	0.11	0.00	3.58	21.80	9.64	3.58	0.38	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.48	0.92	0.12	1.66	4.94	-2.21	13.55	4.21	0.51	4.39	22.27	-9.93	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.21	2.78	1.25	0.21	2.78	-1.25	2.03	12.53	5.64	2.03	12.53	-5.64	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.21	5.56	2.50	2.21	5.56	-2.50	5.86	25.07	11.27	5.86	25.07	-11.27	0.00	90.00	2.00
11	UPLIFT	-20.00	0.00	0.00	0.21	4.16	1.87	0.21	4.16	-1.87	2.03	19.44	8.74	2.03	19.44	-8.74	0.00	90.00	1.00

C

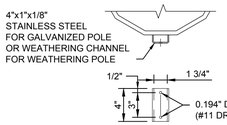
SHIELDWIRE PLAN VIEW



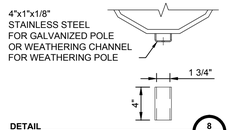
TRANSMISSION PLAN VIEW



DETAIL 6
REMOVABLE GROUNDING BOLT
(5 PLACES)



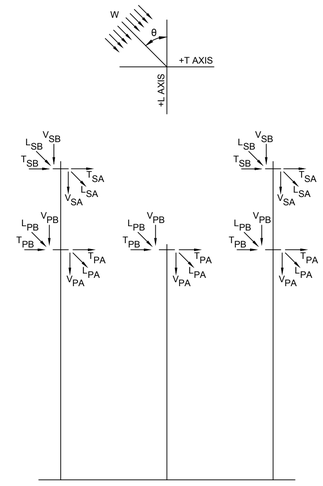
DETAIL 7
WARNING SIGN ATTACHMENT
(3 PLACES)



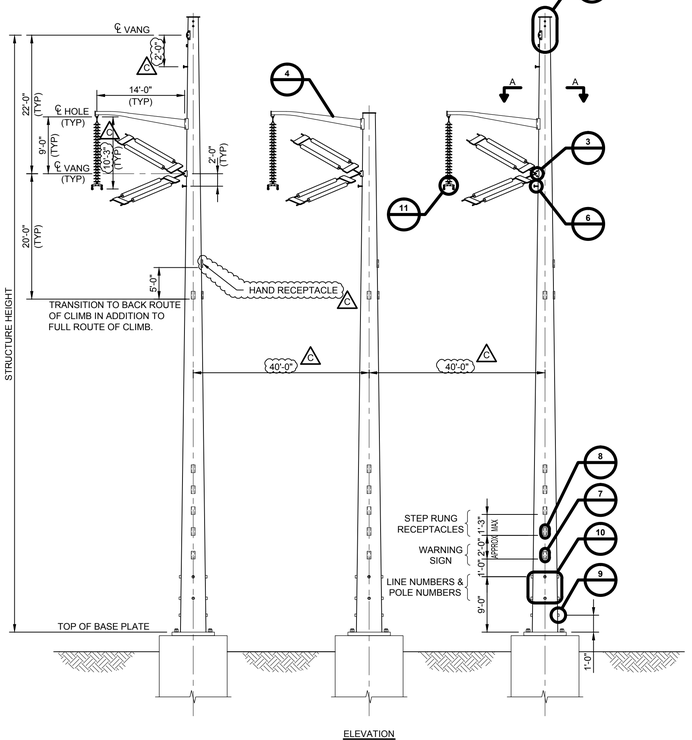
DETAIL 8
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)

C

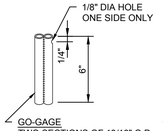
REFERENCES:
1. GOUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ADDITIONAL RECEPTACLE LOCATION: SKETCH D
7. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
8. LIFTING VANG PROVISIONS: SKETCH J + K
9. FALL PROTECTION VANGS: SKETCH N + Q
10. JACKING NUT LOCATIONS: SKETCH I



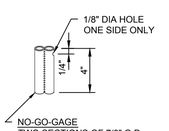
LOADING TREE



ELEVATION

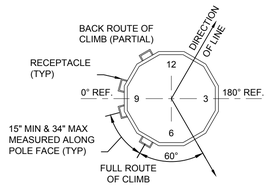


GO-GAGE
TWO SECTIONS OF 13/16" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

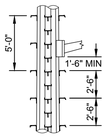


NO-GO-GAGE
TWO SECTIONS OF 7/8" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

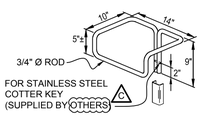
STEP RUNG RECEPTACLE GAGES



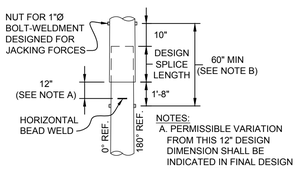
RECEPTACLE LOCATIONS
(HAND RECEPTACLES LOCATED 5' ABOVE FOOT RECEPTACLES)



ADDITIONAL STEP RUNG RECEPTACLE LOCATIONS IN AREAS OF CONDUCTOR ARMS

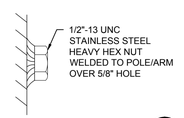


RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)

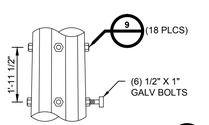


NOTES:
A. PERMISSIBLE VARIATION FROM THIS 12" DESIGN DIMENSION SHALL BE INDICATED IN FINAL DESIGN AND ERECTION DRAWING.
B. THE 10" AND 1'-8" DIMENSIONS MAY BE INCREASED TO ACHIEVE THIS 60" MIN.

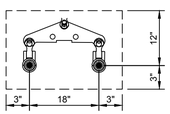
SPLICE DETAILS JACKING NUT LOCATIONS



DETAIL 9
ATTACHMENT PROVISION LUG
(AERIAL BRACKET, LINE NUMBER, POLE NUMBER & GROUNDING)
(30 PLACES)



DETAIL 10
LINE & POLE NUMBER ATTACHMENT
(3 PLACES)



DETAIL 11
I-STRING CLEARANCE ENVELOPE
(3 PLACES)

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
   D. AHEAD OR BACK CONDUCTORS AND GROUND WIRES ONLY INSTALLED.
7. SNUB ANGLES SHALL BE LIMITED TO A 15° DEFLECTION ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE 15°.
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°. CLEARANCES MUST BE CHECKED TO SUBCONDUCTOR ENVELOPE SHOWN IN DETAIL 11.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
14. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
15. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
16. JUMPER ARMS SHALL BE DESIGNED FOR A VERTICAL LOAD OF 2,000 POUNDS.
17. FALL PROTECTION VANG FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS	.	5/27/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

345kV AC HEAVY DEADEND 130-140°
30-SCHSP-HDW-140
LOAD & DESIGN DRAWING

C	
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-10.DWG
IMAGE:	
DRAWING NO.	TSP-10-001

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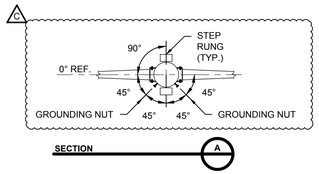
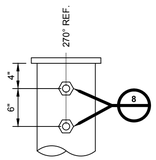
STRUCTURE NAME: 32-SCHSP-LTW-002
320-KV DC CONDUCTOR: 2 - 2933 KCMIL 91 STRAND AAAC PER PHASE (20000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 550
WEIGHT SPAN (FT): 850
WEIGHT SPAN (FT): 850

LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.45	1.03	0.00	13.54	5.30	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.43	0.75	0.00	5.61	5.98	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	2.03	0.74	0.00	12.70	3.28	0.00	4.00	90.00	1.00
4	HQ EXTREME ICE	15.00	1.50	39.53	3.62	1.06	0.00	17.43	4.15	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.96	0.48	0.00	9.02	2.65	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.96	0.47	0.00	9.02	2.49	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.96	0.37	5.50	9.02	1.51	24.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.58	0.27	0.27	23.61	2.17	2.27	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.43	0.10	0.00	5.61	0.83	0.00	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.66	0.21	0.00	13.01	1.66	0.00	0.00	90.00	2.00

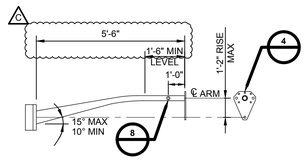
C



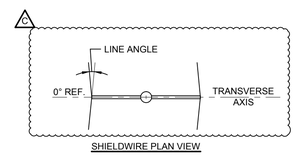
SECTION A



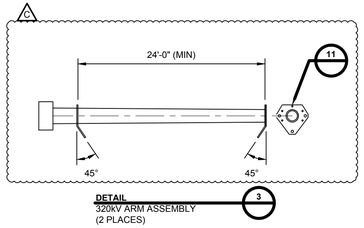
DETAIL 1
AERIAL MARKER ATTACHMENT
(1 PLACE)



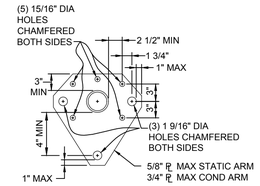
DETAIL 2
OHSW ARM ASSY
(2 PLACE)



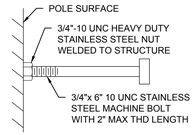
SHIELDWIRE PLAN VIEW



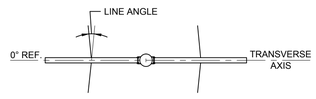
DETAIL 3
320kV ARM ASSEMBLY
(2 PLACES)



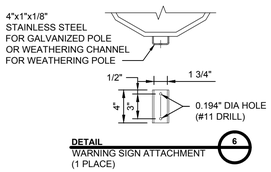
DETAIL 4
C SUSPENSION/STRAIN PLATE (2 PLACES)



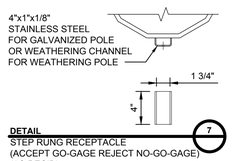
DETAIL 5
REMOVABLE GROUNDING BOLT
(4 PLACES)



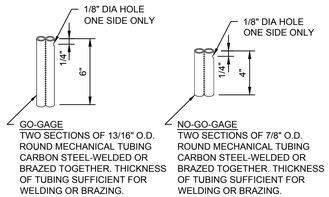
TRANSMISSION PLAN VIEW



DETAIL 6
WARNING SIGN ATTACHMENT
(1 PLACE)



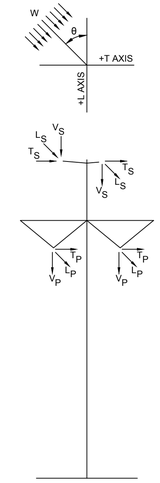
DETAIL 7
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)



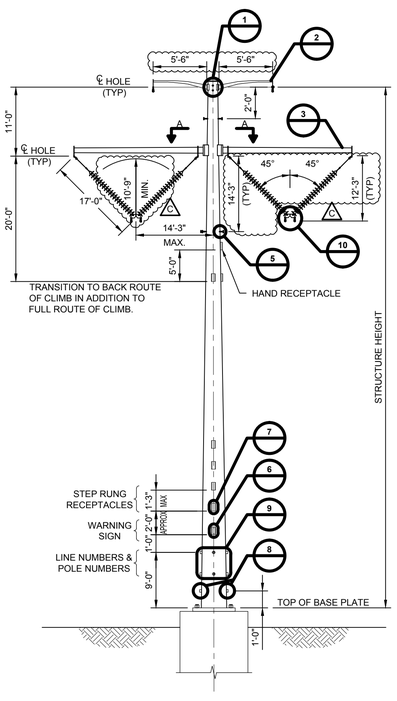
STEP RUNG RECEPTACLE GAGES

C

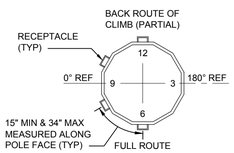
REFERENCES:
1. GOUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ADDITIONAL RECEPTACLE LOCATION: SKETCH D
7. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
8. LIFTING VANG PROVISIONS: SKETCH J + K
9. FALL PROTECTION VANGS: SKETCH N + Q
10. JACKING NUT LOCATIONS: SKETCH I



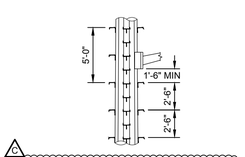
LOADING TREE



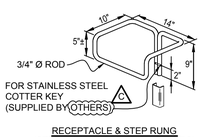
ELEVATION



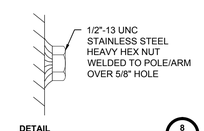
C RECEPTACLE LOCATIONS
(HAND RECEPTACLE LOCATED 5' ABOVE FOOT RECEPTACLES)



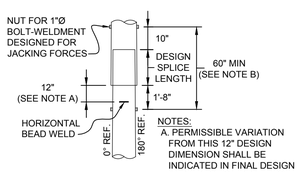
C ADDITIONAL STEP RUNG RECEPTACLE LOCATIONS IN AREAS OF CONDUCTOR ARMS



RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)

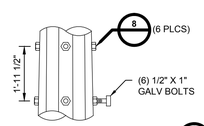


DETAIL 8
ATTACHMENT PROVISION LUG
(AERIAL BRACKET, LINE NUMBER, POLE NUMBER & GROUNDING)
(12 PLACES)

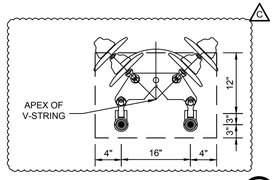


NOTES:
A. PERMISSIBLE VARIATION FROM THIS 12" DESIGN DIMENSION SHALL BE INDICATED IN FINAL DESIGN AND ERECTION DRAWING.
B. THE 10" AND 1'-8" DIMENSIONS MAY BE INCREASED TO ACHIEVE THIS 60" MIN.

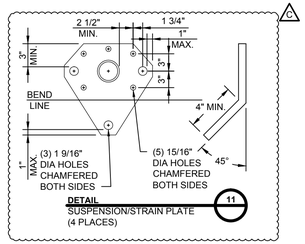
SPLICE DETAILS JACKING NUT LOCATIONS



DETAIL 9
LINE & POLE NUMBER ATTACHMENT
(1 PLACE)



DETAIL 10
V-STRING CLEARANCE ENVELOPE
(2 PLACES)



DETAIL 11
SUSPENSION/STRAIN PLATE
(4 PLACES)

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
7. SNUB ANGLES SHALL BE LIMITED TO A 2 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE 25°.
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°. CLEARANCES MUST BE CHECKED TO SUBCONDUCTOR ENVELOPE SHOWN IN DETAIL 10.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
14. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
15. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
16. 5'-5" CLEARANCE SHALL BE CONSIDED FROM CLIMBING AND WORKING CLEARANCE.
17. 10'-9" CLEARANCE MUST BE CONSIDERED FROM POLE BODY AND ARMS.
18. FALL PROTECTION VANG FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS		5/21/15	KAK		
B	MISC. REVISIONS		5/8/15	BLH		
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

320kV DC LIGHT TANGENT 0-2°
32-SCHSP-LTW-002
LOAD & DESIGN DRAWING

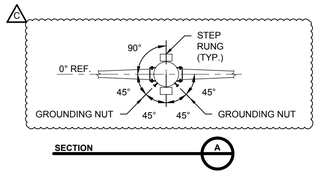
	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-11.DWG
IMAGE:	
DRAWING NO.	TSP-11-001

NU VER: 05/2012

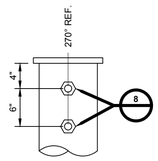
STRUCTURE NAME: 32-SCHSP-MTW-002
320-KV DC CONDUCTOR: 2 - 2933 KCMIL 91 STRAND AAAC PER PHASE (20000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 750
WEIGHT SPAN (FT): 1200
LINE ANGLE: 0 - 2 DEGREES

LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	2.01	1.28	0.00	18.06	6.29	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.59	0.97	0.00	7.55	7.67	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	2.84	0.91	0.00	17.22	3.81	0.00	4.00	90.00	1.00
4	HQ EXTREME ICE	15.00	1.50	39.53	5.09	1.30	0.00	23.90	4.81	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	1.34	0.58	0.00	12.04	3.04	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	1.34	0.57	0.00	12.04	2.88	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	1.34	0.47	5.50	12.04	2.01	30.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.82	0.30	0.27	26.51	2.40	2.27	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.59	0.10	0.00	7.55	0.83	0.00	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.98	0.21	0.00	16.89	1.66	0.00	0.00	90.00	2.00

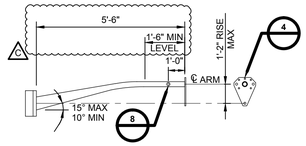
C



SECTION A

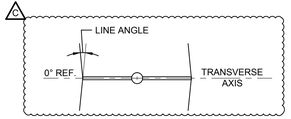


DETAIL 1
AERIAL MARKER ATTACHMENT
(1 PLACE)

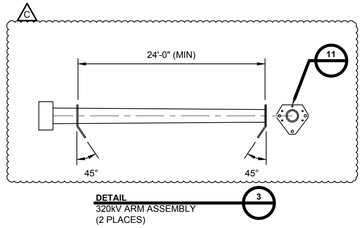


DETAIL 2
OHSW ARM ASSY
(2 PLACE)

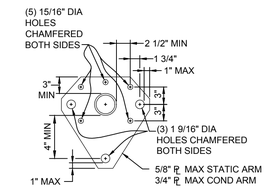
C



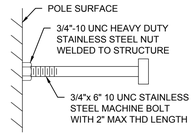
SHIELDWIRE PLAN VIEW



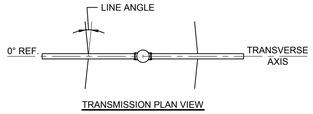
DETAIL 3
320kV ARM ASSEMBLY
(2 PLACES)



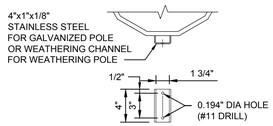
DETAIL 4
SUSPENSION/STRAIN PLATE
(2 PLACES)



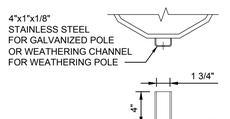
DETAIL 5
REMOVABLE GROUNDING BOLT
(4 PLACES)



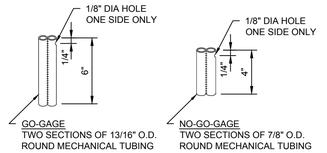
TRANSMISSION PLAN VIEW



DETAIL 6
WARNING SIGN ATTACHMENT
(1 PLACE)



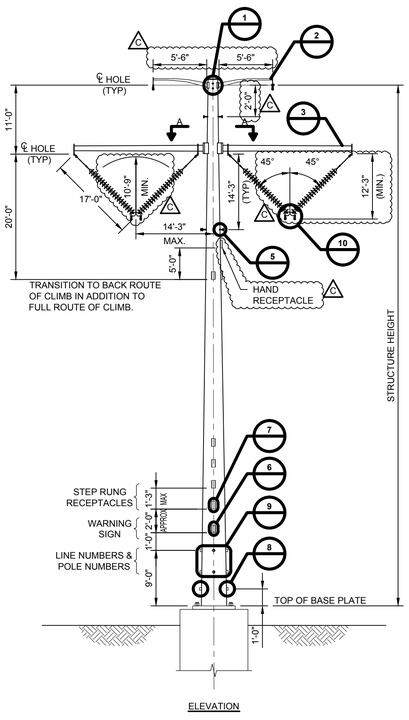
DETAIL 7
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)



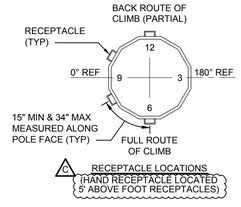
GO-GAGE
TWO SECTIONS OF 13/16" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

NO-GO-GAGE
TWO SECTIONS OF 7/8" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

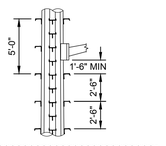
STEP RUNG RECEPTACLE GAGES



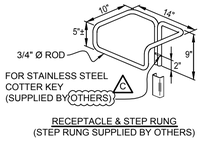
ELEVATION



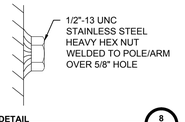
C RECEPTACLE LOCATIONS
(HAND RECEPTACLE LOCATED 5' ABOVE FOOT RECEPTACLES)



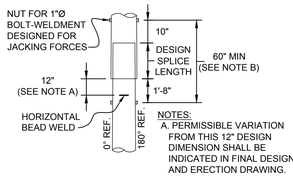
C ADDITIONAL STEP RUNG RECEPTACLE LOCATIONS IN AREAS OF CONDUCTOR ARMS



RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)

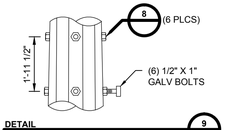


DETAIL 8
ATTACHMENT PROVISION LUG
(AERIAL BRACKET, LINE NUMBER, POLE NUMBER & GROUNDING)
(12 PLACES)

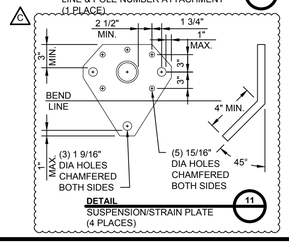


NOTES:
A. PERMISSIBLE VARIATION FROM THIS 12" DESIGN DIMENSION SHALL BE INDICATED IN FINAL DESIGN AND ERECTION DRAWING.
B. THE 10" AND 1'-8" DIMENSIONS MAY BE INCREASED TO ACHIEVE THIS 60" MIN.

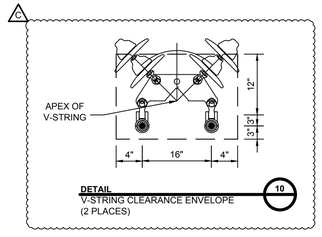
SPLICE DETAILS JACKING NUT LOCATIONS



DETAIL 9
LINE & POLE NUMBER ATTACHMENT
(1 PLACE)

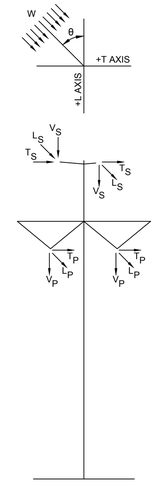


DETAIL 11
SUSPENSION/STRAIN PLATE
(4 PLACES)



DETAIL 10
V-STRING CLEARANCE ENVELOPE
(2 PLACES)

REFERENCES:
1. GOUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ADDITIONAL RECEPTACLE LOCATION: SKETCH D
7. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
8. LIFTING VANG PROVISIONS: SKETCH J + K
9. FALL PROTECTION VANGS: SKETCH N + Q
10. JACKING NUT LOCATIONS: SKETCH I



LOADING TREE

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
7. SNUB ANGLES SHALL BE LIMITED TO A 2 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE 25°.
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°. CLEARANCES MUST BE CHECKED TO SUBCONDUCTOR ENVELOPE SHOWN IN DETAIL 10.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
14. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
15. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
16. 5'-5" CLEARANCE SHALL BE CONSIDED FROM CLIMBING AND WORKING CLEARANCE.
17. 10'-9" CLEARANCE MUST BE CONSIDERED FROM POLE BODY AND ARMS.
18. FALL PROTECTION VANG FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS		5/21/15	KAK		
B	MISC. REVISIONS		5/8/15	BLH		
A	RELEASE FOR RFP BID		5/1/15	BLH		
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

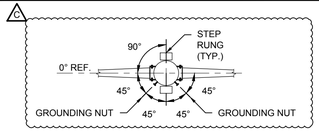
THE NORTHERN PASS

320kV DC MEDIUM TANGENT 0-2°
32-SCHSP-MTW-002
LOAD & DESIGN DRAWING

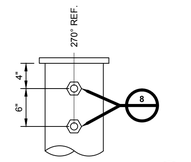
C	
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-12.DWG
IMAGE:	
DRAWING NO.	TSP-12-001

8/19/2015 2:33 PM — mspepich — N:\NUSCO\58479 — NPT\Overhead\Cadd\01-Record Worksheets\TSP-12.dwg — 001

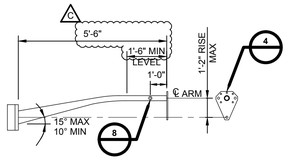
NU VER: 08/2012



SECTION A



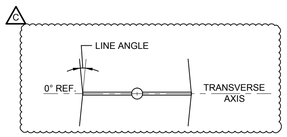
DETAIL 1
AERIAL MARKER ATTACHMENT
(1 PLACE)



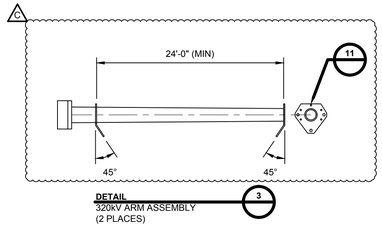
DETAIL 2
OHSW ARM ASSY
(2 PLACE)

STRUCTURE NAME: 32-SCHSP-HTW-002
320-KV DC CONDUCTOR: 2 - 2933 KCMIL 91 STRAND AAAC PER PHASE (20000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 950
WEIGHT SPAN (FT): 1850
LINE ANGLE: 0 - 2 DEGREES

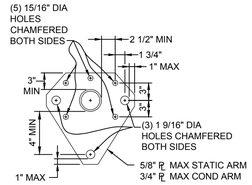
LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	3.06	1.53	0.00	26.46	7.28	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.88	1.19	0.00	11.15	9.36	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	4.35	1.07	0.00	25.63	4.34	0.00	4.00	90.00	1.00
4	HQ EXTREME ICE	15.00	1.50	39.53	7.81	1.53	0.00	35.93	5.48	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	2.04	0.68	0.00	17.64	3.44	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	2.04	0.67	0.00	17.64	3.28	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	2.04	0.57	5.50	17.64	2.58	40.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	4.25	0.33	0.27	31.91	2.63	2.27	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.88	0.10	0.00	11.15	0.83	0.00	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	3.56	0.21	0.00	24.09	1.66	0.00	0.00	90.00	2.00



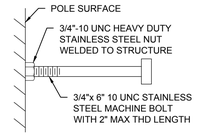
SHIELDWIRE PLAN VIEW



DETAIL 3
320kV ARM ASSEMBLY
(2 PLACES)



DETAIL 4
SUSPENSION/STRAIN PLATE
(2 PLACES)



DETAIL 5
REMOVABLE GROUNDING BOLT
(4 PLACES)

REFERENCES:
1. GROUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ADDITIONAL RECEPTACLE LOCATION: SKETCH D
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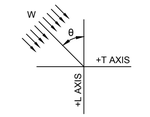
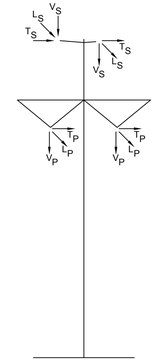
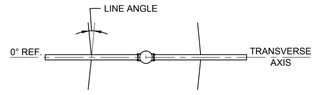
8. LIFTING VANG PROVISIONS: SKETCH J + K
9. FALL PROTECTION VANGS: SKETCH N + Q
10. JACKING NUT LOCATIONS: SKETCH I

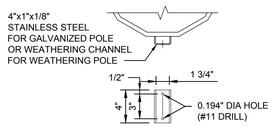




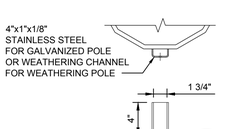
LOADING TREE



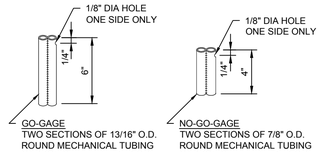
TRANSMISSION PLAN VIEW



DETAIL 6
WARNING SIGN ATTACHMENT
(1 PLACE)



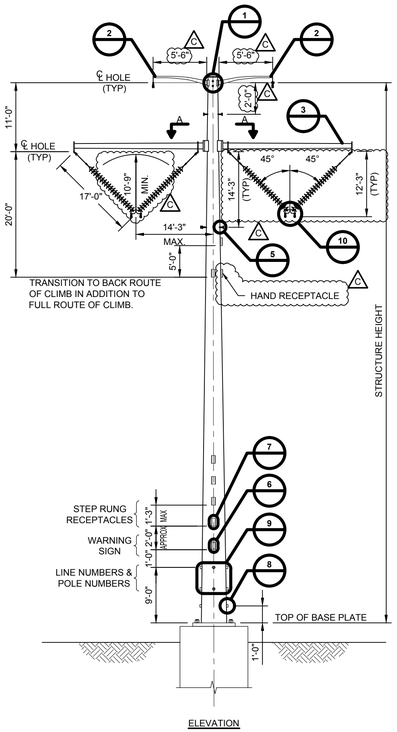
DETAIL 7
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)



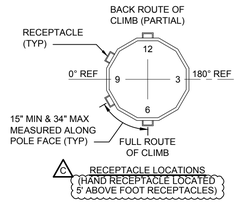
GO-GAGE
TWO SECTIONS OF 13/16" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

NO-GO-GAGE
TWO SECTIONS OF 7/8" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

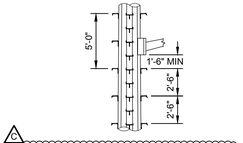
STEP RUNG RECEPTACLE GAGES



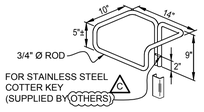
ELEVATION



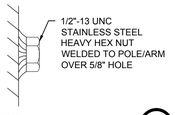
A RECEPTACLE LOCATIONS
(HAND RECEPTACLE LOCATED 5' ABOVE FOOT RECEPTACLES)



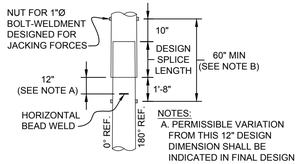
C ADDITIONAL STEP RUNG RECEPTACLE LOCATIONS IN AREAS OF CONDUCTOR ARMS



RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



DETAIL 8
ATTACHMENT PROVISION LUG
(AERIAL BRACKET, LINE NUMBER, POLE NUMBER & GROUNDING)
(12 PLACES)



NOTES:
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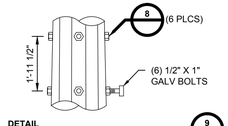
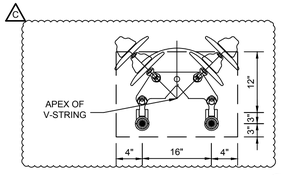
B. THE 10" AND 1'-8" DIMENSIONS MAY BE INCREASED TO ACHIEVE THIS 60" MIN.

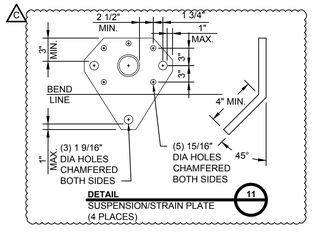
SPLICE DETAILS JACKING NUT LOCATIONS



DETAIL 9
LINE & POLE NUMBER ATTACHMENT
(1 PLACE)



DETAIL 10
V-STRING CLEARANCE ENVELOPE
(2 PLACES)



DETAIL 11
SUSPENSION/STRAIN PLATE
(4 PLACES)

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
7. SNUB ANGLES SHALL BE LIMITED TO A 2 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE 25°.
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°. CLEARANCES MUST BE CHECKED TO SUBCONDUCTOR ENVELOPE SHOWN IN DETAIL 10.
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12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
14. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
15. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
16. 5'-5" CLEARANCE SHALL BE CONSIDED FROM CLIMBING AND WORKING CLEARANCE.
17. 10'-9" CLEARANCE MUST BE CONSIDERED FROM POLE BODY AND ARMS.
18. FALL PROTECTION VANG FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS	.	5/27/15	KAK	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.

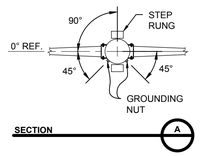
DWG REV | EPN/DESCRIPTION | CONT/PE# | DATE | DRN | CHKD | APPR

THE NORTHERN PASS

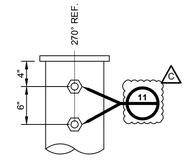
320kV DC HEAVY TANGENT 0-2°
32-SCHSP-HTW-002
LOAD & DESIGN DRAWING

	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-13.DWG
IMAGE:	
DRAWING NO.	TSP-13-001

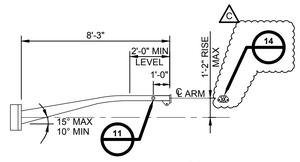
8/19/2015 2:34 PM - mspepich - N:\NUSCO\58479 - NPT\Overhead\Cadd\01-Record Worksheets\TSP-13.dwg - 001



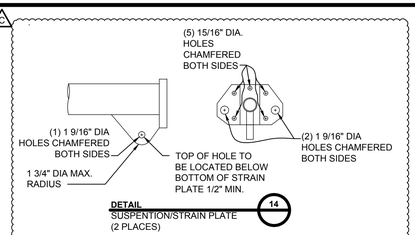
SECTION A



DETAIL 1
AERIAL MARKER ATTACHMENT
(1 PLACE)



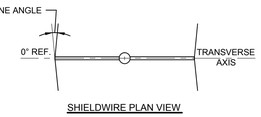
DETAIL 2
OHSW ARM ASSEMBLY
(2 PLACES)



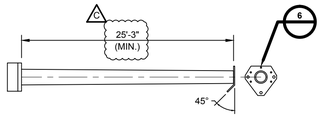
DETAIL 14
SUSPENTION/STRAIN PLATE
(2 PLACES)

STRUCTURE NAME: 32-SCHSP-LAW-010
320-KV DC CONDUCTOR: 2 - 2933 KCMIL 91 STRAND AAAC PER PHASE (20000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 900
WEIGHT SPAN (FT): 1250
LINE ANGLE: 2 - 10 DEGREES

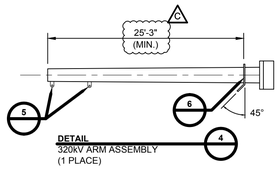
LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	2.09	2.81	0.00	18.70	17.29	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.61	1.76	0.00	7.82	14.32	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	2.96	2.15	0.00	17.87	11.47	0.00	4.00	90.00	1.00
4	HQ EXTREME ICE	15.00	1.50	39.53	5.30	3.15	0.00	24.83	14.60	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	1.40	1.47	0.00	12.47	9.56	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	1.40	1.41	0.00	12.47	8.76	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	1.40	0.93	5.50	12.47	3.88	24.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.85	1.05	0.27	26.93	8.74	2.27	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.61	0.52	0.00	7.82	4.14	0.00	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	3.02	1.03	0.00	17.45	8.27	0.00	0.00	90.00	2.00



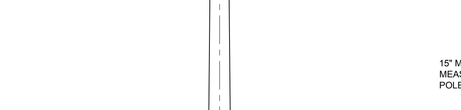
SHIELDWIRE PLAN VIEW



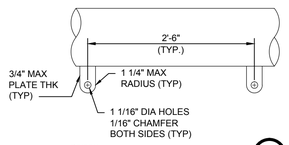
DETAIL 3
320kV ARM ASSEMBLY
(1 PLACE)



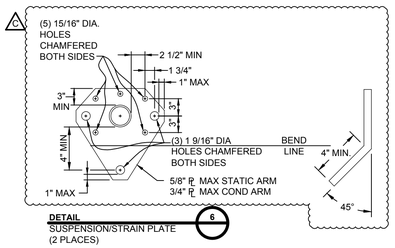
DETAIL 4
320kV ARM ASSEMBLY
(1 PLACE)



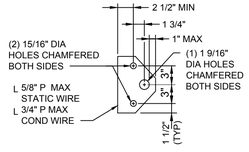
TRANSMISSION PLAN VIEW



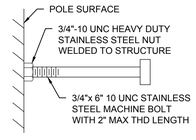
DETAIL 5
SWING BRACKET VANGS
(1 PLACE)



DETAIL 6
SUSPENSION/STRAIN PLATE
(2 PLACES)



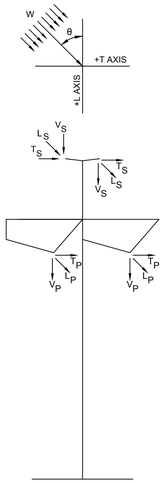
DETAIL 7
CONDUCTOR VANG
(1 PLACE)



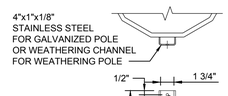
DETAIL 8
REMOVABLE GROUNDING BOLT
(4 PLACES)

REFERENCES:
1. GOUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ADDITIONAL RECEPTACLE LOCATION: SKETCH D
7. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
8. LIFTING VANG PROVISIONS: SKETCH J + K
9. FALL PROTECTION VANGS: SKETCH N + Q
10. JACKING NUT LOCATIONS: SKETCH I

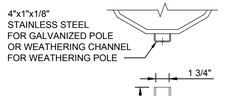
ELEVATION



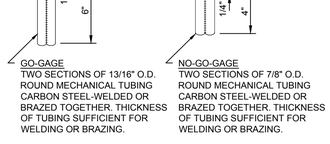
LOADING TREE



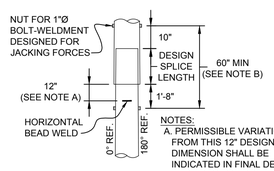
DETAIL 9
WARNING SIGN ATTACHMENT
(1 PLACE)



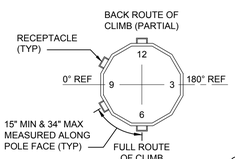
DETAIL 10
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)



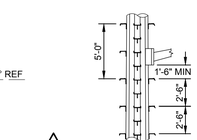
STEP RUNG RECEPTACLE GAGES



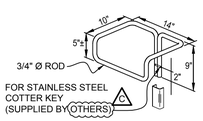
SPLICE DETAILS JACKING NUT LOCATIONS



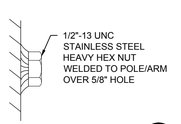
RECEPTACLE LOCATIONS
(HAND RECEPTACLE LOCATED 5' ABOVE FOOT RECEPTACLES)



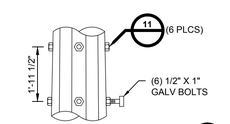
ADDITIONAL STEP RUNG RECEPTACLE LOCATIONS IN AREAS OF CONDUCTOR ARMS



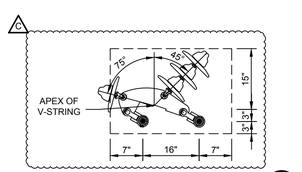
RECEPTACLE & STEP RUNG
(STEP RUNGS SUPPLIED BY OTHERS)



DETAIL 11
ATTACHMENT PROVISION LUG
(AERIAL BRACKET, LINE NUMBER, POLE NUMBER & GROUNDING)
(12 PLACES)



DETAIL 12
LINE & POLE NUMBER ATTACHMENT
(1 PLACE)



DETAIL 13
RUNNING ANGLE CLEARANCE
ENVELOPE (2 PLACES)

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
7. SNUB ANGLES SHALL BE LIMITED TO A 10 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE 25°.
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°. CLEARANCES MUST BE CHECKED TO SUBCONDUCTOR ENVELOPE SHOWN IN DETAIL 13.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
14. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
15. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
16. 5'-5" CLEARANCE SHALL BE CONSIDERED FROM CLIMBING AND WORKING CLEARANCE
17. 10'-9" CLEARANCE MUST BE CONSIDERED FROM POLE BODY AND ARMS
18. FALL PROTECTION VANG FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS	.	5/27/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.

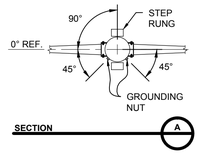
DWG REV | EPN/DESCRIPTION | CONT/PE# | DATE | DRN | CHKD | APPR

THE NORTHERN PASS

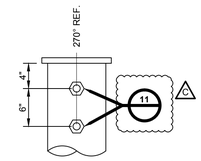
320kV DC LIGHT ANGLE 2-10°
32-SCHSP-LAW-010
LOAD & DESIGN DRAWING

	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-14.DWG
IMAGE:	
DRAWING NO.	TSP-14-001

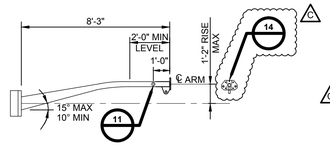
NU VER: 08/2012



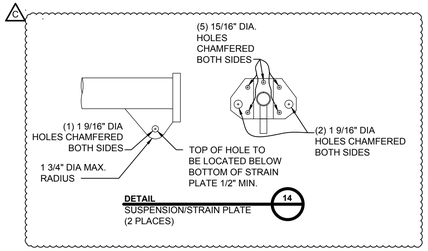
SECTION A



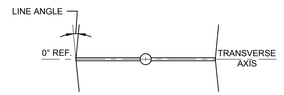
DETAIL 1
AERIAL MARKER ATTACHMENT
(1 PLACE)



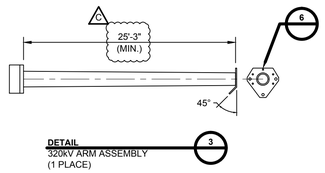
DETAIL 2
OHSW ARM ASSEMBLY
(2 PLACES)



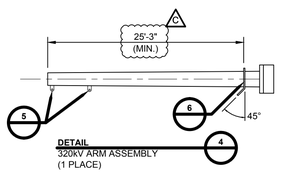
DETAIL 14
SUSPENSION/STRAIN PLATE
(2 PLACES)



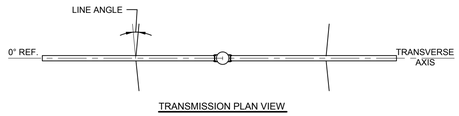
SHIELDWIRE PLAN VIEW



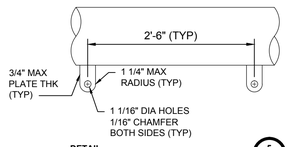
DETAIL 3
320kV ARM ASSEMBLY
(1 PLACE)



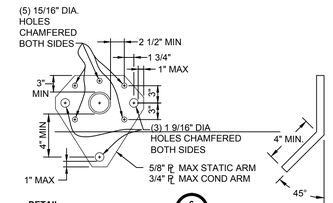
DETAIL 4
320kV ARM ASSEMBLY
(1 PLACE)



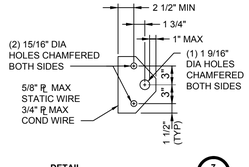
TRANSMISSION PLAN VIEW



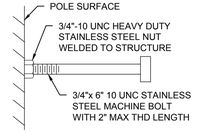
DETAIL 5
SWING BRACKET VANGS
(1 PLACE)



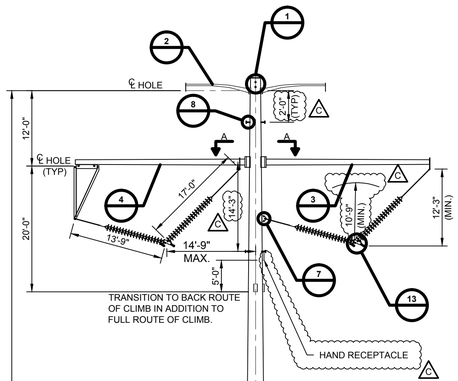
DETAIL 6
SUSPENSION/STRAIN PLATE
(2 PLACES)



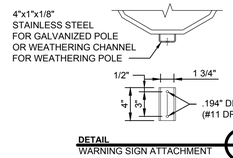
DETAIL 7
CONDUCTOR VANG
(1 PLACE)



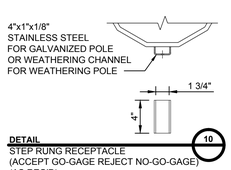
DETAIL 8
REMOVABLE GROUNDING BOLT
(4 PLACES)



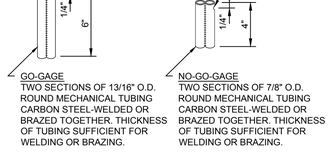
ELEVATION



DETAIL 9
WARNING SIGN ATTACHMENT
(1 PLACE)



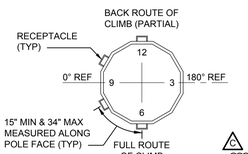
DETAIL 10
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)



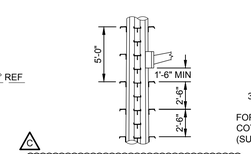
GO-GAGE
TWO SECTIONS OF 13/16" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

NO-GO-GAGE
TWO SECTIONS OF 7/8" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

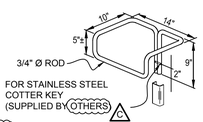
STEP RUNG RECEPTACLE GAGES



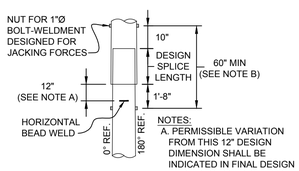
RECEPTACLE LOCATIONS
(HAND RECEPTACLE LOCATED 5' ABOVE FOOT RECEPTACLES)



ADDITIONAL STEP RUNG RECEPTACLE LOCATIONS IN AREAS OF CONDUCTOR ARMS

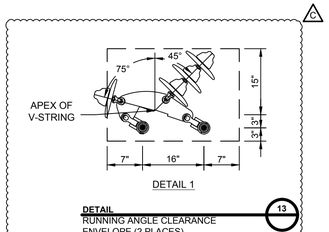


RECEPTACLE & STEP RUNG
(STEP RUNGS SUPPLIED BY OTHERS)



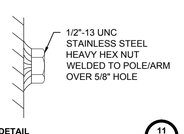
NOTES:
A. PERMISSIBLE VARIATION FROM THIS 12" DESIGN DIMENSION SHALL BE INDICATED IN FINAL DESIGN AND ERECTION DRAWING.
B. THE 10" AND 1'-8" DIMENSIONS MAY BE INCREASED TO ACHIEVE THIS 60" MIN.

SPLICE DETAILS JACKING NUT LOCATIONS

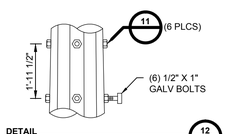


DETAIL 1

DETAIL 13
RUNNING ANGLE CLEARANCE ENVELOPE (2 PLACES)



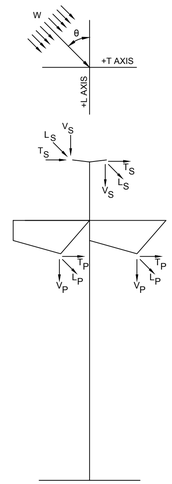
DETAIL 11
ATTACHMENT PROVISION LUG
(AERIAL BRACKET, LINE NUMBER, POLE NUMBER & GROUNDING)
(12 PLACES)



DETAIL 12
LINE & POLE NUMBER ATTACHMENT
(1 PLACE)

STRUCTURE NAME: 32-SCHSP-HAW-025
320-kV DC CONDUCTOR: 2 - 2933 KCMIL 91 STRAND AAAC PER PHASE (20000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 900
WEIGHT SPAN (FT): 1250
LINE ANGLE: 10 - 25 DEGREES

LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	2.09	5.30	0.00	18.70	36.32	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.61	2.93	0.00	7.82	24.32	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	2.96	4.22	0.00	17.87	24.95	0.00	4.00	90.00	1.00
4	HQ EXTREME ICE	15.00	1.50	39.53	5.30	6.27	0.00	24.83	31.83	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	1.40	2.98	0.00	12.47	21.09	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	1.40	2.83	0.00	12.47	19.10	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	1.40	1.64	5.48	12.47	10.44	39.85	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.85	2.40	0.27	26.93	20.18	2.27	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.61	1.28	0.00	7.82	10.27	0.00	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	3.02	2.56	0.00	17.45	20.54	0.00	0.00	90.00	2.00



LOADING TREE

REFERENCES:
1. GOUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ADDITIONAL RECEPTACLE LOCATION: SKETCH D
7. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
8. LIFTING VANG PROVISIONS: SKETCH J + K
9. FALL PROTECTION VANGS: SKETCH N + Q
10. JACKING NUT LOCATIONS: SKETCH I

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
7. SNUB ANGLES SHALL BE LIMITED TO A 15 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE 25°.
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°. CLEARANCES MUST BE CHECKED TO SUBCONDUCTOR ENVELOPE SHOWN IN DETAIL 13.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
14. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
15. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
16. 5'-5" CLEARANCE SHALL BE CONSIDED FROM CLIMBING AND WORKING CLEARANCE.
17. 10'-9" CLEARANCE MUST BE CONSIDERED FROM POLE BODY AND ARMS.
18. FALL PROTECTION VANG FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS	.	5/27/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

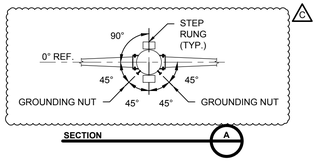
THE NORTHERN PASS

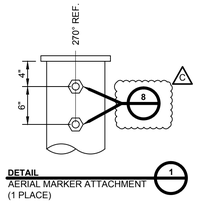
320kV DC HEAVY ANGLE 10-25°
32-SCHSP-HAW-025
LOAD & DESIGN DRAWING

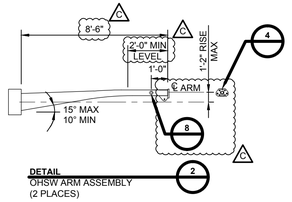
	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-15.DWG
IMAGE:	
DRAWING NO.	TSP-15-001

8/19/2015 2:37 PM - mspeich - N:\NUSCO\58479 - NPT\Overhead\Cadd\01-Record Worksheets\TSP-15.dwg - 001

NU VER: 08/2012

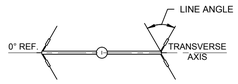




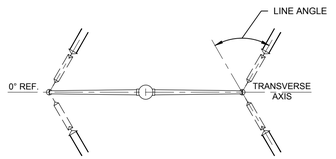


STRUCTURE NAME: 3Z-SCHSP-LDW-045
320-kV DC CONDUCTOR: 2 - 2933 KCMIL 91 STRAND AAAC PER PHASE (20000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 550 WIND SPAN BACK (FT): 550
WEIGHT SPAN AHEAD (FT): 825 WEIGHT SPAN BACK (FT): 825
INE ANGLE: 0 - 45 DEGREES

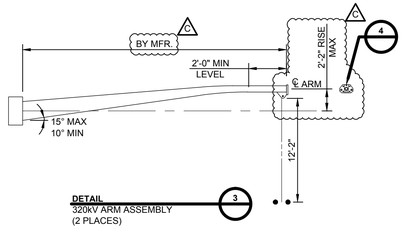
NO.	DESCRIPTION	LOADING CASE TEMP (°F)	ICE (in)	WIND (mph)	DESIGN LOADS VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.41	4.37	9.62	1.41	4.37	-9.62	13.36	30.89	73.59	13.36	30.89	-73.59	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.42	2.32	4.51	0.42	2.32	-4.51	5.52	19.43	38.67	5.52	19.43	-38.67	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	1.97	3.53	8.01	1.97	3.53	-8.01	12.47	21.41	52.13	12.47	21.41	-52.13	4.00	90.00	1.00
4	HQ EXTREME ICE	15.00	1.50	39.53	3.51	5.25	12.04	3.51	5.25	-12.04	16.96	27.33	66.65	16.96	27.33	-66.65	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.94	2.51	5.83	0.94	2.51	-5.83	8.91	18.16	44.60	8.91	18.16	-44.60	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.94	2.38	5.50	0.94	2.38	-5.50	8.91	16.40	40.00	8.91	16.40	-40.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.94	2.38	5.50	0.94	0.28	0.00	8.91	16.40	40.00	8.91	1.09	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	4.12	1.52	0.27	1.98	2.08	-5.23	30.33	12.71	2.27	9.63	17.56	-44.25	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.42	1.13	2.96	0.42	1.13	-2.96	5.52	9.08	23.72	5.52	9.08	-23.72	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.64	2.26	5.92	2.64	2.26	-5.92	12.84	18.16	47.44	12.84	18.16	-47.44	0.00	90.00	2.00
11	UPLIFT	-20.00	0.00	0.00	0.42	1.70	4.43	0.42	1.70	-4.43	5.52	16.59	43.34	5.52	16.59	-43.34	0.00	90.00	1.00

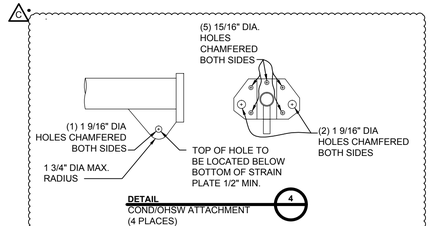


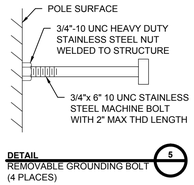
SHIELDWIRE PLAN VIEW

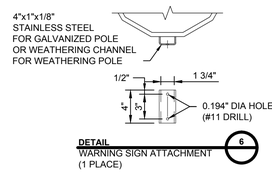


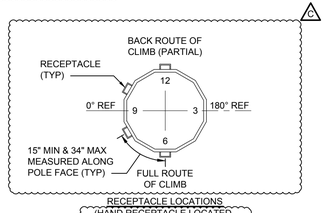
TRANSMISSION PLAN VIEW

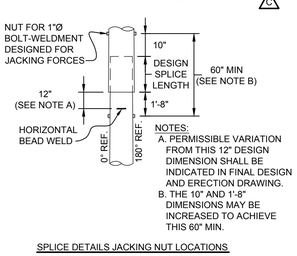




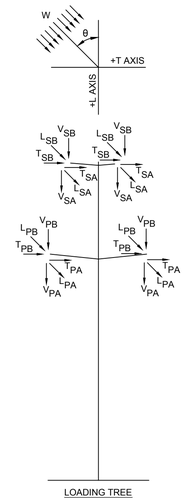




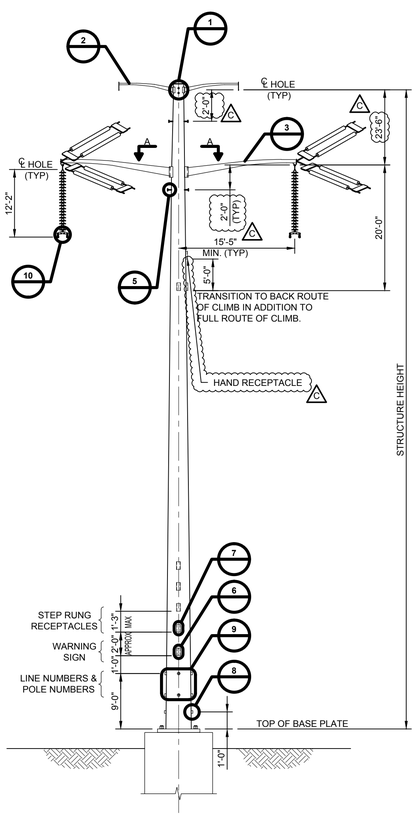




SPLICE DETAILS JACKING NUT LOCATIONS



REFERENCES:
1. GOUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ADDITIONAL RECEPTACLE LOCATION: SKETCH D
7. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
8. LIFTING VANG PROVISIONS: SKETCH J + K
9. FALL PROTECTION VANGS: SKETCH N + Q
10. JACKING NUT LOCATIONS: SKETCH I



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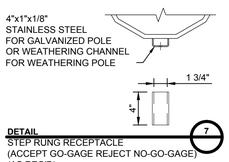
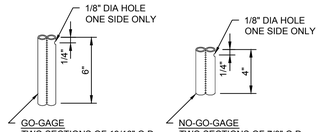
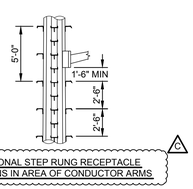
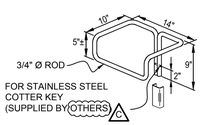
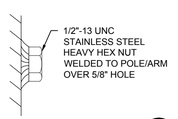


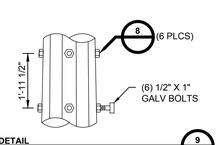


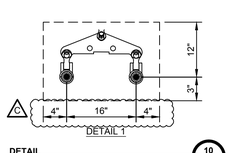
STEP RUNG RECEPTACLE GAGES











NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
   D. AHEAD OR BACK CONDUCTORS AND GROUND WIRES ONLY.
7. SNUB ANGLES SHALL BE LIMITED TO A 15° DEFLECTION ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE 25°.
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°. CLEARANCES MUST BE CHECKED TO SUBCONDUCTOR ENVELOPE SHOWN IN DETAIL 10.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
14. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
15. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
16. 5'-5" CLEARANCE SHALL BE CONSIDED FROM CLIMBING AND WORKING CLEARANCE.
17. 10'-9" CLEARANCE MUST BE CONSIDERED FROM POLE BODY AND ARMS.
18. FALL PROTECTION VANG FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS	.	5/27/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

320kV DC LIGHT DEADEND 0-45°
32-SCHSP-LDW-045
LOAD & DESIGN DRAWING

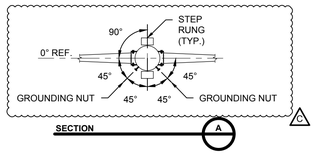
	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE: TSP-16.DWG	
IMAGE:	
DRAWING NO.	TSP-16-001

8/19/2015 2:38 PM - mspepich - N:\NUSCO\58479 - NPT\Overhead\Cadd\01-Record Worksheets\TSP-16.dwg - 001

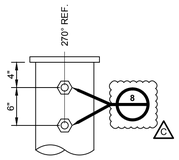
NU VER: 08/2012

STRUCTURE NAME: 32-SCHSP-HDW-090
320-kV DC CONDUCTOR: 2 - 2933 KCMIL 91 STRAND AAAC PER PHASE (20000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 550 WIND SPAN BACK (FT): 550
WEIGHT SPAN AHEAD (FT): 825 WEIGHT SPAN BACK (FT): 825
LINE ANGLE: 45 - 90 DEGREES

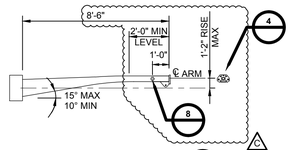
LOADING CASE					DESIGN LOADS													
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.41	7.50	8.89	1.41	7.50	-8.89	13.36	54.76	67.99	13.36	54.76	-67.99	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.42	3.79	4.17	0.42	3.79	-4.17	5.52	31.98	35.73	5.52	31.98	-35.73	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	1.97	6.12	7.40	1.97	6.12	-7.40	12.47	38.32	48.17	12.47	38.32	-48.17	4.00	90.00	1.00
4	HQ EXTREME ICE	15.00	1.50	39.53	3.51	9.16	11.13	3.51	9.16	-11.13	16.96	48.95	61.57	16.96	48.95	-61.57	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.94	4.40	5.39	0.94	4.40	-5.39	8.91	32.63	41.21	8.91	32.63	-41.21	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.94	4.17	5.08	0.94	4.17	-5.08	8.91	29.38	36.96	8.91	29.38	-36.96	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.94	4.17	5.08	0.94	0.28	0.00	8.91	29.38	36.96	8.91	1.09	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	4.12	1.38	0.25	1.98	3.78	-4.83	30.33	11.55	2.10	9.63	31.91	-40.88	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.42	2.09	2.73	0.42	2.09	-2.73	5.52	16.77	21.92	5.52	16.77	-21.92	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.64	4.18	5.47	2.64	4.18	-5.47	12.84	33.55	43.83	12.84	33.55	-43.83	0.00	90.00	2.00
11	UPLIFT	-20.00	0.00	0.00	0.42	3.13	4.09	0.42	3.13	-4.09	5.52	30.65	40.04	5.52	30.65	-40.04	0.00	90.00	1.00



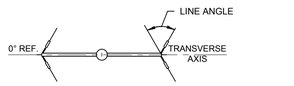
SECTION A



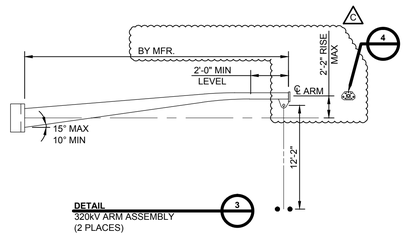
DETAIL 1
AERIAL MARKER ATTACHMENT
(1 PLACE)



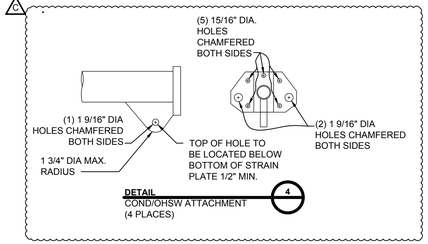
DETAIL 2
OHSW ARM ASSEMBLY
(2 PLACES)



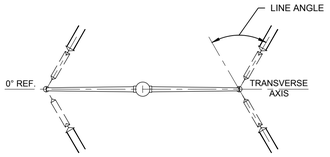
SHIELDWIRE PLAN VIEW



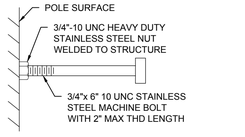
DETAIL 3
320kV ARM ASSEMBLY
(2 PLACES)



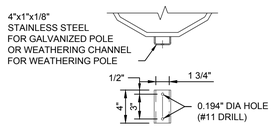
DETAIL 4
COND/OHSW ATTACHMENT
(4 PLACES)



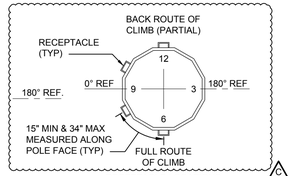
TRANSMISSION PLAN VIEW



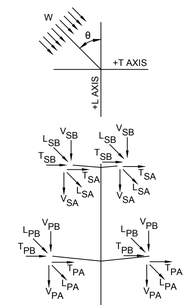
DETAIL 5
REMOVABLE GROUNDING BOLT
(4 PLACES)



DETAIL 6
WARNING SIGN ATTACHMENT
(1 PLACE)

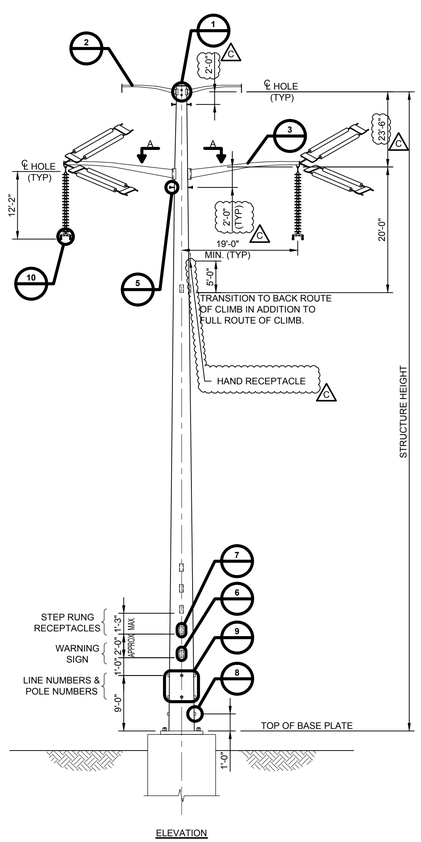


RECEPTACLE LOCATIONS
(HAND RECEPTACLE LOCATED 5' ABOVE FOOT RECEPTACLE)



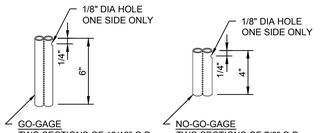
LOADING TREE

REFERENCES:
1. GROUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ADDITIONAL RECEPTACLE LOCATION: SKETCH D
7. ATTACHMENT PROVISIONS FOR GROUNDING AND SIGNS: SKETCH F
8. LIFTING VANG PROVISIONS: SKETCH J + K
9. FALL PROTECTION VANGS: SKETCH N + Q
10. JACKING NUT LOCATIONS: SKETCH I

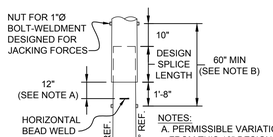


ELEVATION

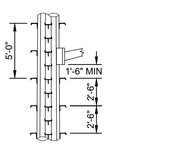
DETAIL 7
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)



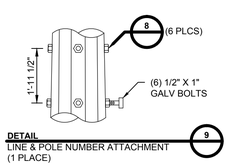
STEP RUNG RECEPTACLE GAGES



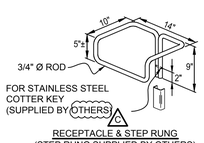
SPLICE DETAILS JACKING NUT LOCATIONS



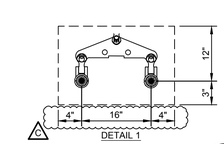
ADDITIONAL STEP RUNG RECEPTACLE LOCATIONS IN AREAS OF CONDUCTOR ARMS



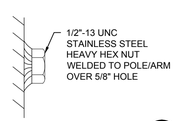
DETAIL 9
LINE & POLE NUMBER ATTACHMENT
(1 PLACE)



RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



DETAIL 1
DETAIL 10
I-STRING CLEARANCE ENVELOPE
(2 PLACES)



DETAIL 8
ATTACHMENT PROVISION LUG
(AERIAL BRACKET, LINE NUMBER, POLE NUMBER & GROUNDING)
(12 PLACES)

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
   D. AHEAD OR BACK CONDUCTORS AND GROUND WIRES ONLY.
7. SNUB ANGLES SHALL BE LIMITED TO A 15° DEFLECTION LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE 25°.
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°. CLEARANCES MUST BE CHECKED TO SUBCONDUCTOR ENVELOPE SHOWN IN DETAIL 10.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
14. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
15. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
16. 5'-5" CLEARANCE SHALL BE CONSIDED FROM CLIMBING AND WORKING CLEARANCE.
17. 10'-9" CLEARANCE MUST BE CONSIDERED FROM POLE BODY AND ARMS.
18. FALL PROTECTION VANG FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. REVISIONS	.	5/27/15	KAK	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

320kV DC LIGHT DEADEND 45-90°
32-SCHSP-HDW-090
LOAD & DESIGN DRAWING

	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-17.DWG
IMAGE:	
DRAWING NO.	TSP-17-001

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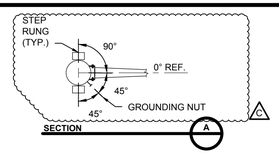
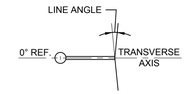
NU VER: 05/2012

STRUCTURE NAME: 30-SCVSP-LTW-002
345-KV AC CONDUCTOR: 2 - 1590 KCMIL 45/7 "LAPWING" ACSR PER PHASE (11400# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 850
WEIGHT SPAN (FT): 1550
LINE ANGLE: 0 - 2 DEGREES

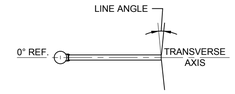
LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	2.58	1.40	0.00	15.32	4.99	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.75	1.08	0.00	6.00	6.26	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	3.65	0.99	0.00	16.00	3.09	0.00	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	4.98	1.20	0.00	19.62	3.56	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	1.72	0.63	0.00	10.21	2.29	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	1.72	0.62	0.00	10.21	2.21	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	1.72	0.52	5.50	10.21	1.82	22.80	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	4.05	0.31	0.27	17.63	1.56	1.21	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.75	0.10	0.00	6.00	0.47	0.00	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	3.29	0.21	0.00	13.80	0.93	0.00	0.00	90.00	2.00

C

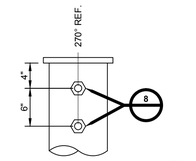




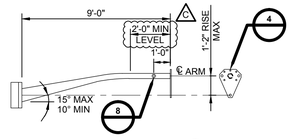
SHIELDWIRE PLAN VIEW



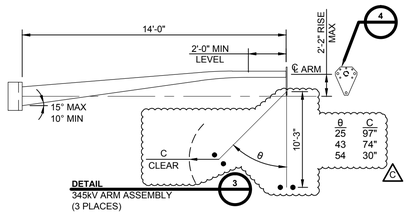
TRANSMISSION PLAN VIEW



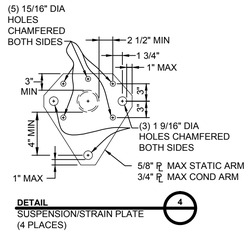
DETAIL 1
AERIAL MARKER ATTACHMENT
(1 PLACE)



DETAIL 2
OHSW ARM ASSEMBLY
(1 PLACE)



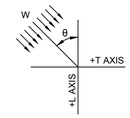
DETAIL 3
345kV ARM ASSEMBLY
(3 PLACES)

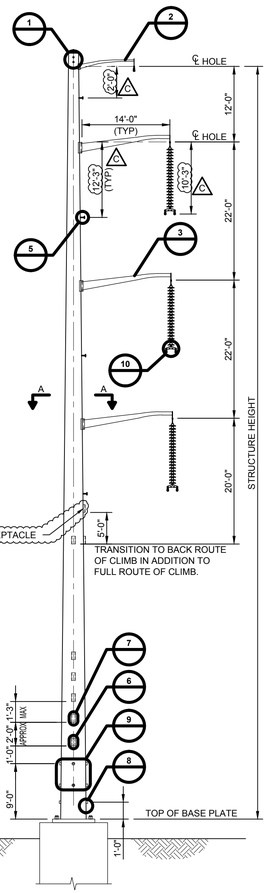


DETAIL 4
SUSPENSION/STRAIN PLATE
(4 PLACES)

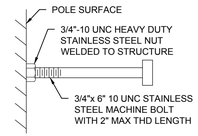
C

REFERENCES:
1. GOUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ADDITIONAL RECEPTACLE LOCATION: SKETCH D
7. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
8. LIFTING VANG PROVISIONS: SKETCH J + K
9. FALL PROTECTION VANGS: SKETCH N + Q
10. JACKING NUT LOCATIONS: SKETCH I

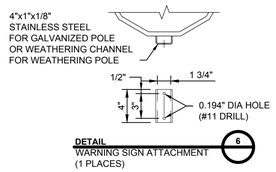




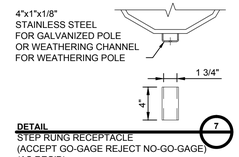
ELEVATION



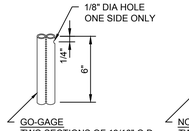
DETAIL 5
REMOVABLE GROUNDING BOLT
(4 PLACES)



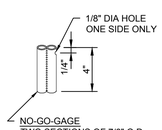
DETAIL 6
WARNING SIGN ATTACHMENT
(1 PLACES)



DETAIL 7
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)

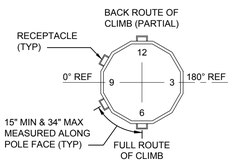


GO-GAGE
TWO SECTIONS OF 13/16" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

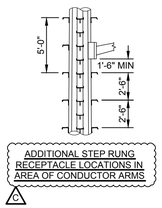


NO-GO-GAGE
TWO SECTIONS OF 7/8" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

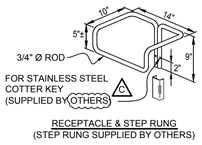
STEP RUNG RECEPTACLE GAGES



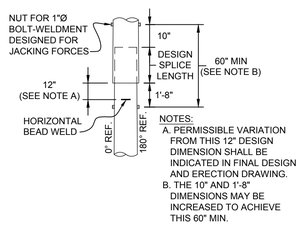
RECEPTACLE LOCATIONS
(HAND RECEPTACLES LOCATED 5' ABOVE FOOT RECEPTACLES)
C



ADDITIONAL STEP RUNG RECEPTACLE LOCATIONS IN AREA OF CONDUCTOR ARMS
C

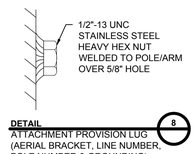


RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)

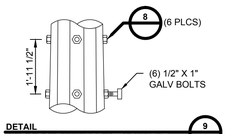


NOTES:
A. PERMISSIBLE VARIATION FROM THIS 12" DESIGN DIMENSION SHALL BE INDICATED IN FINAL DESIGN AND ERECTION DRAWING.
B. THE 10" AND 1'-8" DIMENSIONS MAY BE INCREASED TO ACHIEVE THIS 60" MIN.

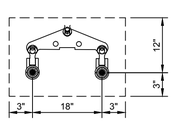
SPLICE DETAILS JACKING NUT LOCATIONS



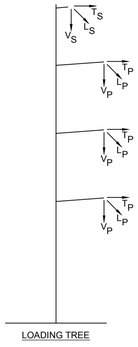
DETAIL 8
ATTACHMENT PROVISION LUG
(AERIAL BRACKET, LINE NUMBER, POLE NUMBER & GROUNDING)
C (11) PLACES)



DETAIL 9
LINE & POLE NUMBER ATTACHMENT
(1 PLACES)



DETAIL 10
I-STRING CLEARANCE ENVELOPE
C (3) PLACES)



LOADING TREE

NOTES:
C
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
B 6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
7. SNUB ANGLES SHALL BE LIMITED TO A 2 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE 15°.
C 9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°. CLEARANCES MUST BE CHECKED TO SUBCONDUCTOR ENVELOPE SHOWN IN DETAIL 10.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
12. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
C 13. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
14. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL POINTS OF THE CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNS TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
C 15. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
16. FALL PROTECTION VANG FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. UPDATES		5/22/15	MSP		
B	MISC. REVISIONS		5/5/15	BLH		
A	RELEASE FOR RFP BID		5/1/15	BLH		
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

345kV AC HEAVY TANGENT 0-2°
30-SCVSP-LTW-002
LOAD & DESIGN DRAWING

	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-18.DWG
IMAGE:	
DRAWING NO.	TSP-18-001

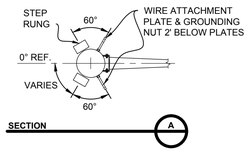
8/19/2015 2:40 PM - mspepich - N:\WUSCO\58479 - NPT\Overhead\Cadd\01-Record Worksheets\TSP-18.dwg - 001

NU VER: 05/2012

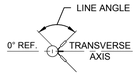
STRUCTURE NAME: 30-SCVSP-LDW-060
345-KV AC CONDUCTOR: 2 - 1590 KCMIL 45/7 "LAPWING" ACSR PER PHASE (11400# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 400 WIND SPAN BACK (FT): 400
WEIGHT SPAN AHEAD (FT): 475 WEIGHT SPAN BACK (FT): 475
LINE ANGLE: 0 - 60 DEGREES

LOADING CASE					DESIGN LOADS													
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	0.84	5.32	9.62	0.84	5.32	-9.62	6.50	22.29	41.24	6.50	22.29	-41.24	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.26	2.69	4.51	0.26	2.69	-4.51	2.48	14.12	23.11	2.48	14.12	-23.11	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	1.15	4.34	8.01	1.15	4.34	-8.01	6.11	16.70	31.53	6.11	16.70	-31.53	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	1.56	5.36	9.92	1.56	5.36	-9.92	7.22	19.56	36.98	7.22	19.56	-36.98	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.56	3.12	5.83	0.56	3.12	-5.83	4.33	13.16	24.99	4.33	13.16	-24.99	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.56	2.95	5.50	0.56	2.95	-5.50	4.33	12.07	22.80	4.33	12.07	-22.80	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.56	2.95	5.50	0.56	0.20	0.00	4.33	12.07	22.80	4.33	0.67	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.65	1.45	0.27	1.74	2.67	-5.23	14.89	6.67	1.21	5.06	12.09	-23.49	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.26	1.48	2.96	0.26	1.48	-2.96	2.48	6.67	13.34	2.48	6.67	-13.34	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.33	2.96	5.92	2.33	2.96	-5.92	6.75	13.34	26.68	6.75	13.34	-26.68	0.00	90.00	2.00
11	UPLIFT	-20.00	0.00	0.00	0.26	2.22	4.43	0.26	2.22	-4.43	2.48	10.34	20.69	2.48	10.34	-20.69	0.00	90.00	1.00

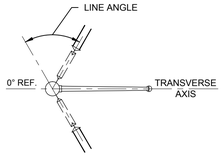
C



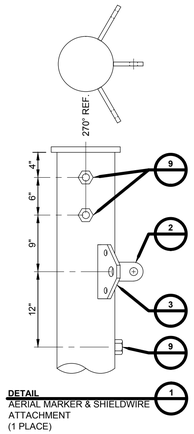
SECTION A



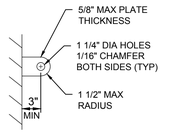
SHIELDWIRE PLAN VIEW



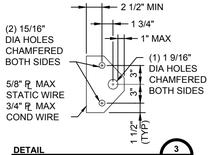
TRANSMISSION PLAN VIEW



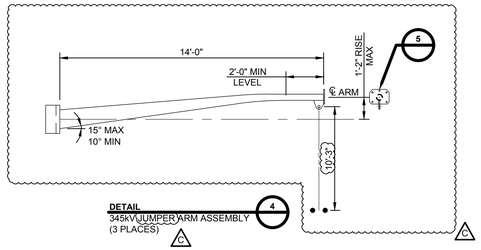
DETAIL 1
AERIAL MARKER & SHIELDWIRE ATTACHMENT
(1 PLACE)



DETAIL 2
VANG DETAIL
(1 PLACE)

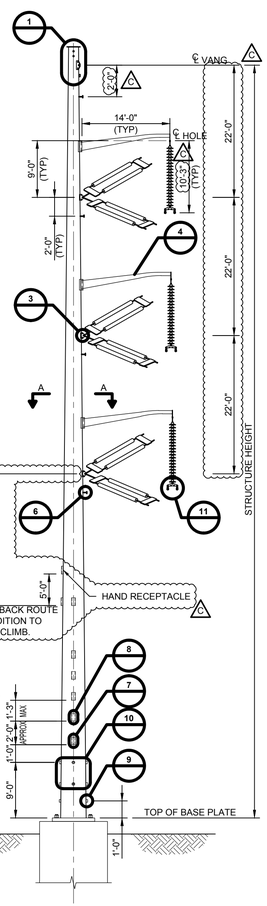


DETAIL 3
DEADEND VANG
(8 PLACES)

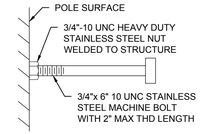


DETAIL 4
345kV JUMPER ARM ASSEMBLY
(3 PLACES)

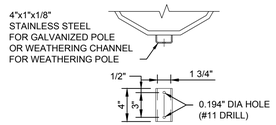
C



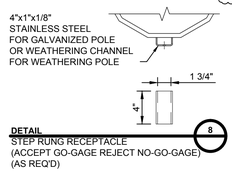
ELEVATION



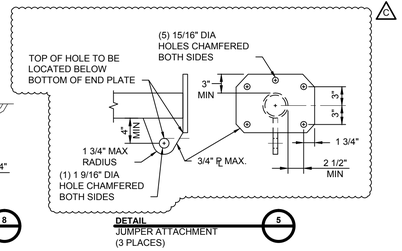
DETAIL 6
REMOVABLE GROUNDING BOLT
(4 PLACES)



DETAIL 7
WARNING SIGN ATTACHMENT
(1 PLACES)

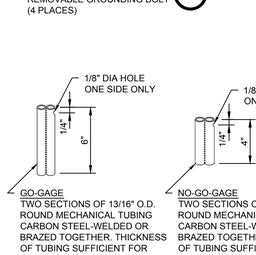


DETAIL 8
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)

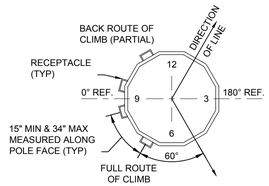


DETAIL 5
JUMPER ATTACHMENT
(3 PLACES)

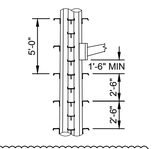
C



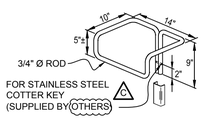
STEP RUNG RECEPTACLE GAGES



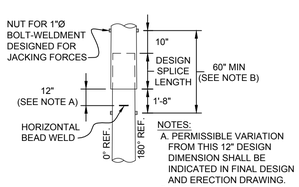
RECEPTACLE LOCATIONS
(HAND RECEPTACLES LOCATED 5' ABOVE FOOT RECEPTACLES)
C



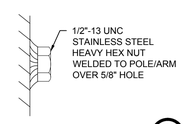
ADDITIONAL STEP RUNG RECEPTACLE LOCATIONS IN AREA OF CONDUCTORS ARMS
C



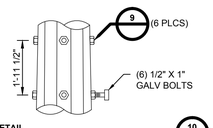
RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



SPLICE DETAILS JACKING NUT LOCATIONS

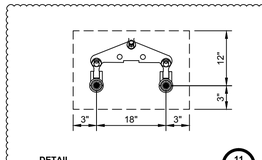


DETAIL 9
ATTACHMENT PROVISION LUG
(AERIAL BRACKET, LINE NUMBER, POLE NUMBER & GROUNDING)
(11 PLACES)

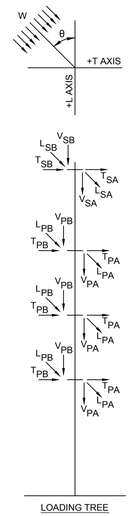


DETAIL 10
LINE & POLE NUMBER ATTACHMENT
(1 PLACES)

C



DETAIL 11
I-STRING CLEARANCE ENVELOPE
(3 PLACES)



LOADING TREE

C

REFERENCES:
1. GOUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ADDITIONAL RECEPTACLE LOCATION: SKETCH D
7. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
8. LIFTING VANG PROVISIONS: SKETCH J + K
9. FALL PROTECTION VANGS: SKETCH N + Q
10. JACKING NUT LOCATIONS: SKETCH I

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
   D. AHEAD OR BACK CONDUCTORS AND GROUND WIRES ONLY INSTALLED.
7. SNUB ANGLES SHALL BE LIMITED TO A 15° DEFLECTION ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE 15°.
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°. CLEARANCES MUST BE CHECKED TO SUBCONDUCTOR ENVELOPE SHOWN IN DETAIL 1.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
14. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
15. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
16. JUMPER ARMS SHALL BE DESIGNED FOR A VERTICAL LOAD OF 2,000 POUNDS.
17. FALL PROTECTION VANG FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. UPDATES		5/22/15	MSP		
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

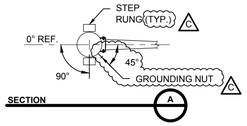
THE NORTHERN PASS

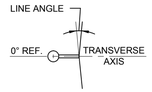
345kV AC LIGHT DEADEND 0-60°
30-SCVSP-LDW-060
LOAD & DESIGN DRAWING

C	
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-19.DWG
IMAGE:	
DRAWING NO.	TSP-19-001

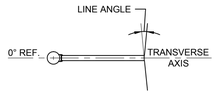
8/19/2015 2:41 PM - mspepich - N:\NUSCO\58479 - NPT\Overhead\Cadd\01-Record Worksheets\TSP-19.dwg - 001

NU VER: 08/2012

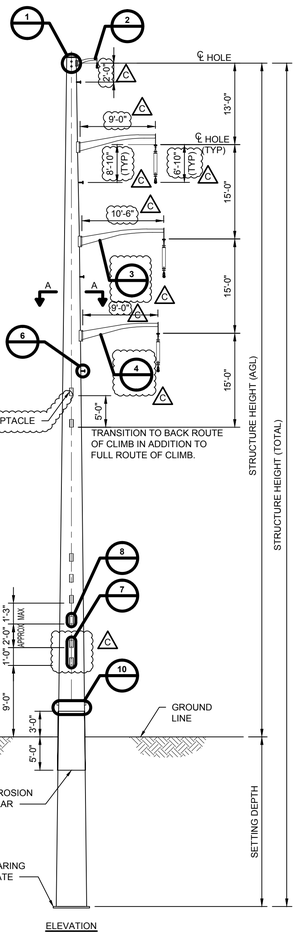




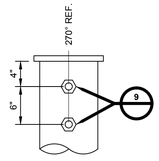
SHIELDWIRE PLAN VIEW



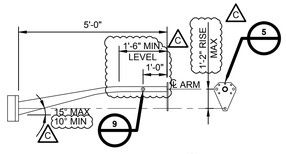
TRANSMISSION PLAN VIEW



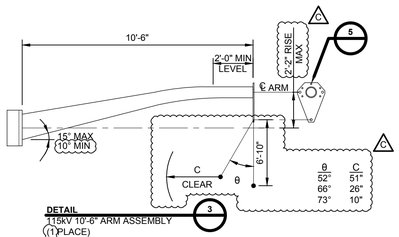
ELEVATION



DETAIL
AERIAL MARKER ATTACHMENT
(1 PLACE) 1

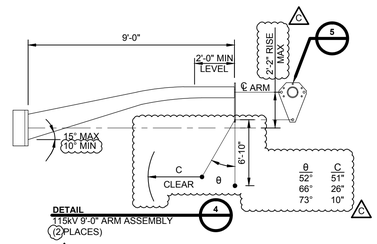


DETAIL
OHSW ARM ASSEMBLY
(1 PLACE) 2



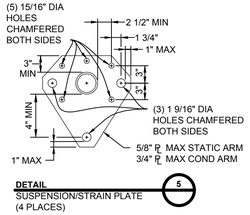
DETAIL
115kV 10'-6" ARM ASSEMBLY
(11 PLACE) 3

C

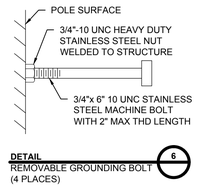


DETAIL
115kV 9'-0" ARM ASSEMBLY
(12 PLACES) 4

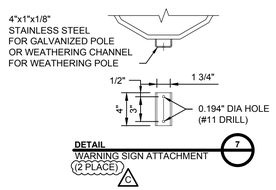
C



DETAIL
SUSPENSION/STRAIN PLATE
(4 PLACES) 5

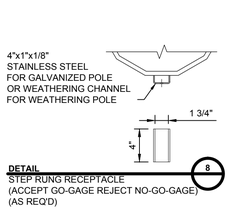


DETAIL
REMOVABLE GROUNDING BOLT
(4 PLACES) 6

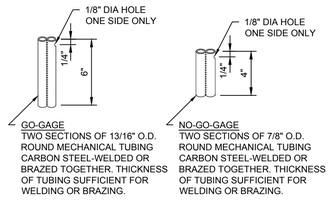


DETAIL
WARNING SIGN ATTACHMENT
(2 PLACE) 7

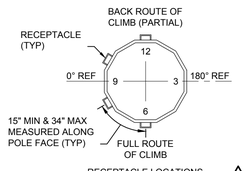
C



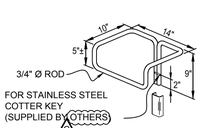
DETAIL
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D) 8



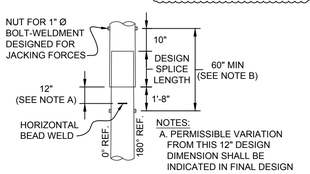
STEP RUNG RECEPTACLE GAGES



RECEPTACLE LOCATIONS
(HAND RECEPTACLES LOCATED 5' ABOVE FOOT RECEPTACLES)
C

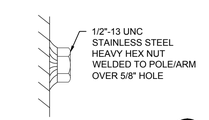


RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



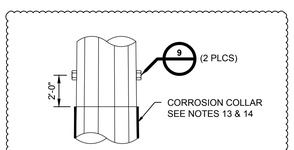
NOTES:
A. PERMISSIBLE VARIATION FROM THIS 12" DESIGN DIMENSION SHALL BE INDICATED IN FINAL DESIGN AND ERECTION DRAWING.
B. THE 10" AND 1'-8" DIMENSIONS MAY BE INCREASED TO ACHIEVE THIS 60" MIN.

SPLICE DETAILS JACKING NUT LOCATIONS



DETAIL
ATTACHMENT PROVISION LUG
(AERIAL BRACKET & GROUNDING)
(15 PLACES) 9

C



DETAIL
STRUCTURE GROUNDING 10

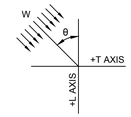
C

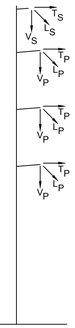
STRUCTURE NAME: 10-SCVSP-LTW-002
115-KV AC CONDUCTOR: 1 - 795 KCMIL 26/7 "DRAKE" ACSR PER PHASE (9000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 800
WEIGHT SPAN (FT): 1250
LINE ANGLE: 0 - 2 DEGREES

NO.	DESCRIPTION	LOADING CASE TEMP (°F)	ICE (in)	WIND (mph)	DESIGN LOADS VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.50	2.09	1.34	0.00	4.52	1.96	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.61	1.03	0.00	1.62	2.20	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.50	2.96	0.94	0.00	5.04	1.27	0.00	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.30	39.50	4.03	1.14	0.00	6.35	1.47	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.50	1.40	0.61	0.00	3.02	0.90	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.50	1.40	0.59	0.00	3.02	0.80	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.50	1.40	0.50	5.50	3.02	0.68	6.75	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	30.00	3.85	0.30	0.27	6.55	0.58	0.48	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.61	0.10	0.00	1.62	0.18	0.00	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	3.02	0.21	0.00	5.03	0.36	0.00	0.00	90.00	2.00

C

C **REFERENCES:**
1. CLIMBING FACILITIES: SKETCH B
2. GROUNDING NUTS: SKETCH B
3. HAND + FOOT RECEPTACLE LOCATIONS: SKETCH C
4. STEP RUNG: SKETCH E
5. ATTACHMENT PROVISIONS FOR SIGNS + GROUNDING: SKETCH F
6. JACKING NUT LOCATIONS: SKETCH I
7. LIFTING VANGS: SKETCH J + K
8. STEP RUNG RECEPTACLE GAGES: SKETCH L
9. FALL PROTECTION VANGS: SKETCH N + Q





LOADING TREE

NOTES:
C 1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
3 5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
C 7. SNUB ANGLES SHALL BE LIMITED TO A 2 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
C 8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE TBD.
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE GROUND LINE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
C 13. STEEL PLATE, A MINIMUM OF 1/4" THICKNESS GREATER THAN THAT REQUIRED FOR COLUMN STRENGTH SHALL BE IN PLACE IN THE AREA 3'-0" ABOVE AND 5'-0" BELOW THE NOMINAL GROUND LINE.
14. APPLY COAL TAR EPOXY ON INSIDE AND OUTSIDE OF POLE FROM BUTT OF POLE TO 12" ABOVE TOP OF CORROSION COLLAR.
15. BELOW GROUND CORROSION PROTECTION COATING MATERIAL SHALL BE SUPPLIED (ONE QUART PER TWO STRUCTURES) TO "TOUCH UP" SCRATCHES OCCURRING IN SHIPPING AND HANDLING. A COPY OF THE MSDS SHEET SHALL BE SUPPLIED WITH THE "TOUCH UP" MATERIALS.
C 16. FALL PROTECTION VANGS FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION & ON REFERENCE SKETCHES N + Q.
17. 3'-2" CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WORKING SPACE. CLIMBING CORRIDOR IS 3 FEET WIDE CENTERED ON CLIMBING ROUTE.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. UPDATES	.	5/29	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

115kV AC TANGENT 0-2°
10-SCVSP-LTW-002
LOAD & DESIGN DRAWING

	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-20.DWG
IMAGE:	
DRAWING NO.	TSP-20-001

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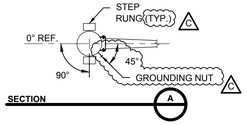
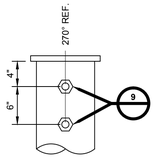
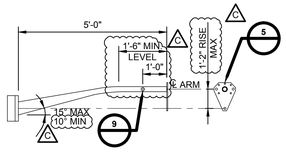
NU VER: 08/2012

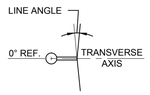




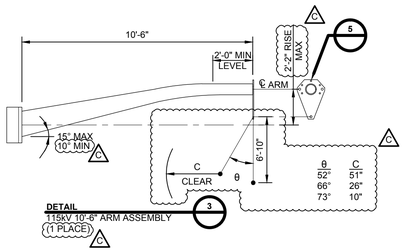
DETAIL
AERIAL MARKER ATTACHMENT
(1 PLACE)
1



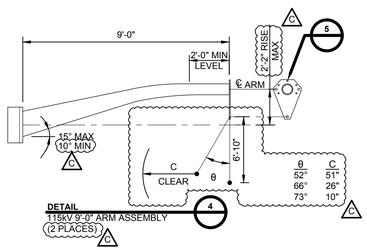
DETAIL
OHSW ARM ASSEMBLY
(1 PLACE)
2



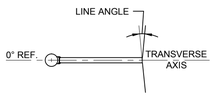
SHIELDWIRE PLAN VIEW



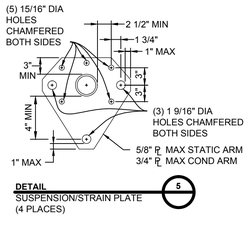
DETAIL
115kV 10'-6" ARM ASSEMBLY
(1 PLACE)
3



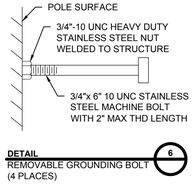
DETAIL
115kV 9'-0" ARM ASSEMBLY
(2 PLACES)
4



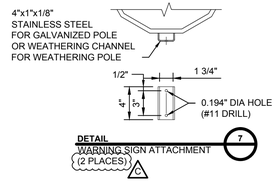
TRANSMISSION PLAN VIEW



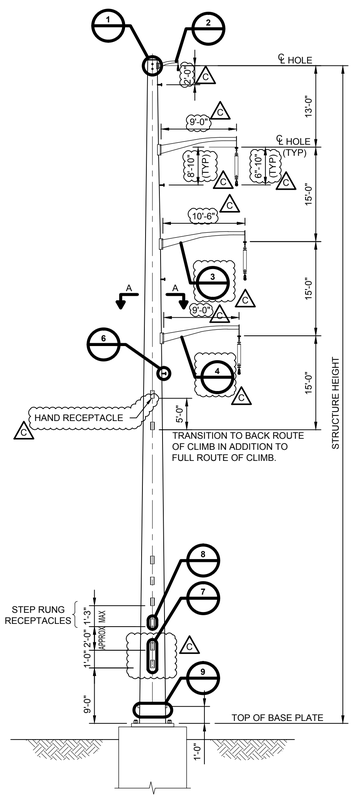
DETAIL
SUSPENSION/STRAIN PLATE
(4 PLACES)
5



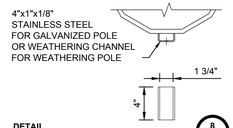
DETAIL
REMOVABLE GROUNDING BOLT
(4 PLACES)
6



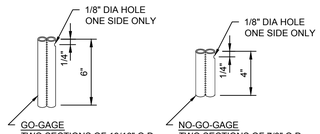
DETAIL
WARNING SIGN ATTACHMENT
(2 PLACES)
C
7



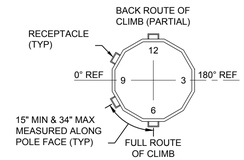
ELEVATION



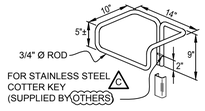
DETAIL
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)
8



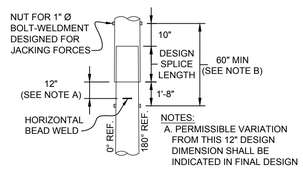
STEP RUNG RECEPTACLE GAGES



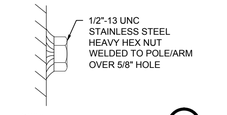
RECEPTACLE LOCATIONS
(HAND RECEPTACLES LOCATED 5' ABOVE FOOT RECEPTACLES)
C



RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



SPLICE DETAILS JACKING NUT LOCATIONS



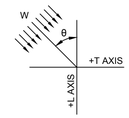
DETAIL
ATTACHMENT PROVISION LUG
(AERIAL BRACKET & GROUNDING)
(2 PLACES)
C
9

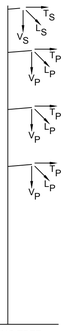
STRUCTURE NAME: 10-SCVSP-LTW-002
115-KV AC CONDUCTOR: 1 - 795 KCMIL 26/7 "DRAKE" ACSR PER PHASE (9000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 800
WEIGHT SPAN (FT): 1250
LINE ANGLE: 0 - 2 DEGREES

LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.50	2.09	1.34	0.00	4.52	1.96	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.61	1.03	0.00	1.62	2.20	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.50	2.96	0.94	0.00	5.04	1.27	0.00	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.30	39.50	4.03	1.14	0.00	6.35	1.47	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.50	1.40	0.61	0.00	3.02	0.90	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.50	1.40	0.59	0.00	3.02	0.80	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.50	1.40	0.50	5.50	3.02	0.68	6.75	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	30.00	3.85	0.30	0.27	6.55	0.58	0.48	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.61	0.10	0.00	1.62	0.18	0.00	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	3.02	0.21	0.00	5.03	0.36	0.00	0.00	90.00	2.00

C

REFERENCES:
1. GROUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
7. LIFTING VANG PROVISIONS: SKETCH J + K
8. FALL PROTECTION VANGS: SKETCH N + Q
9. JACKING NUT LOCATIONS: SKETCH I





LOADING TREE

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
7. SNUB ANGLES SHALL BE LIMITED TO A 2 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE (TBD)
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE GROUND LINE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
14. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
15. FALL PROTECTION VANGS FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.
16. 3'-2" CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WORKING SPACE. CLIMBING CORRIDOR IS 3 FEET WIDE CENTERED ON CLIMBING ROUTE.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. UPDATES	.	5/29	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.

DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

115kV AC TANGENT 0-2°
10-SCVSP-LTW-002
LOAD & DESIGN DRAWING

	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
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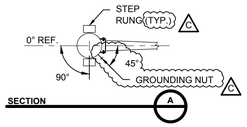
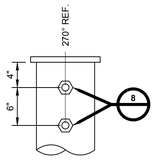
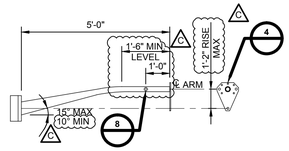
NU VER: 08/2012

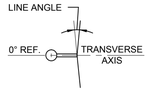




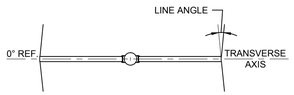
DETAIL
AERIAL MARKER ATTACHMENT
(1 PLACE)
1



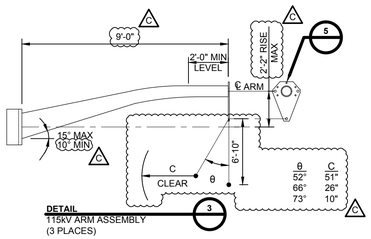
DETAIL
OHSW ARM ASSEMBLY
(1 PLACE)
2



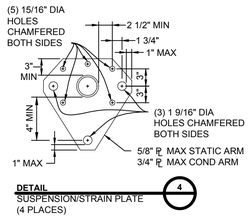
SHIELDWIRE PLAN VIEW



TRANSMISSION PLAN VIEW



DETAIL
115kV ARM ASSEMBLY
(3 PLACES)
3

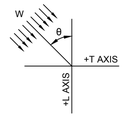


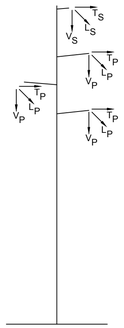
DETAIL
SUSPENSION/STRAIN PLATE
(4 PLACES)
4

STRUCTURE NAME: 10-SCDSP-LTW-002
115-KV AC CONDUCTOR: 1 - 795 KCMIL 26/7 "DRAKE" ACSR PER PHASE (9000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 800
WEIGHT SPAN (FT): 1000
LINE ANGLE: 0 - 2 DEGREES

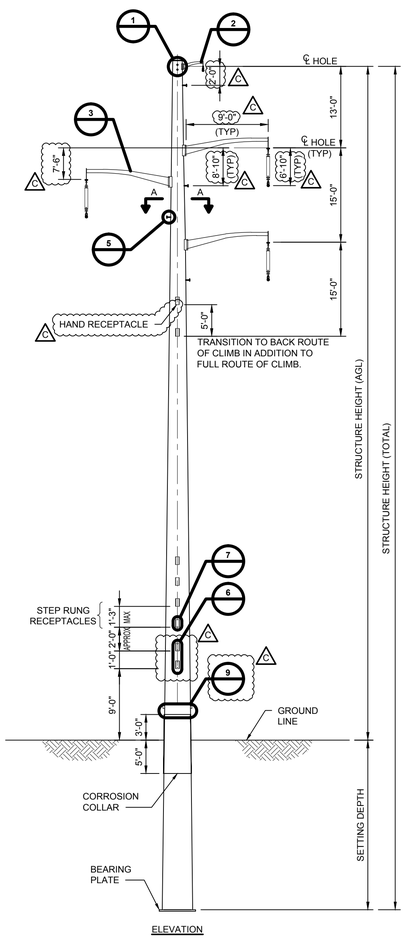
LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.50	1.69	1.34	0.00	3.74	1.96	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.50	1.03	0.00	1.34	2.20	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.50	2.38	0.94	0.00	4.11	1.27	0.00	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.30	39.50	3.23	1.14	0.00	5.16	1.47	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.50	1.13	0.61	0.00	2.49	0.90	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.50	1.13	0.59	0.00	2.49	0.80	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.50	1.13	0.50	5.50	2.49	0.68	6.75	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	30.00	3.68	0.30	0.27	6.14	0.58	0.48	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.50	0.10	0.00	1.34	0.18	0.00	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.80	0.21	0.00	4.49	0.36	0.00	0.00	90.00	2.00

C
REFERENCES:
1. GROUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
7. LIFTING VANG PROVISIONS: SKETCH J + K
8. FALL PROTECTION VANGS: SKETCH N + Q
9. JACKING NUT LOCATIONS: SKETCH I

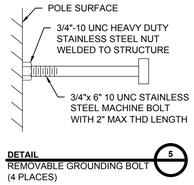




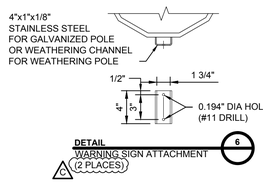
LOADING TREE



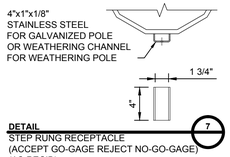
ELEVATION



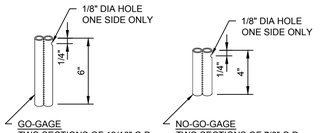
DETAIL
REMOVABLE GROUNDING BOLT
(4 PLACES)
5



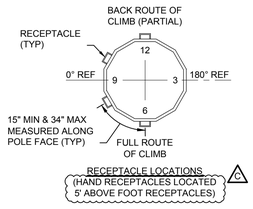
DETAIL
WARNING SIGN ATTACHMENT
(2 PLACES)
6

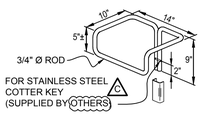


DETAIL
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)
7

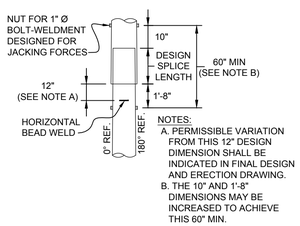


STEP RUNG RECEPTACLE GAGES

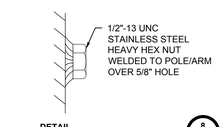




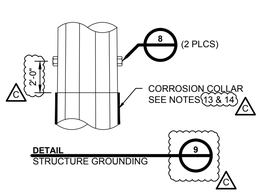
RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



SPLICE DETAILS JACKING NUT LOCATIONS



DETAIL
ATTACHMENT PROVISION LUG
(AERIAL BRACKET & GROUNDING)
(15 PLACES)
8



DETAIL
STRUCTURE GROUNDING
9

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
7. SNUB ANGLES SHALL BE LIMITED TO A 2 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE (TBD)
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE GROUND LINE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. STEEL PLATE, A MINIMUM OF 1/4" THICKNESS GREATER THAN THAT REQUIRED FOR COLUMN STRENGTH SHALL BE IN PLACE IN THE AREA 3'-0" ABOVE AND 5'-0" BELOW THE NOMINAL GROUND LINE.
14. APPLY COAL TAR EPOXY ON INSIDE AND OUTSIDE OF POLE FROM BUTT OF POLE TO 12" ABOVE TOP OF CORROSION COLLAR.
15. BELOW GROUND CORROSION PROTECTION COATING MATERIAL SHALL BE SUPPLIED (ONE QUART PER TWO STRUCTURES) TO "TOUCH UP" SCRATCHES OCCURRING IN SHIPPING AND HANDLING. A COPY OF THE MSDS SHEET SHALL BE SUPPLIED WITH THE "TOUCH UP" MATERIALS.
16. FALL PROTECTION VANGS FOR CLIMBING AND WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.
17. 3'-0" CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WORKING SPACE. CLIMBING CORRIDOR IS 3 FEET WIDE CENTERED ON CLIMBING ROUTE.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. UPDATES	.	5/29/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.

THE NORTHERN PASS

115kV AC TANGENT 0-2°
10-SCDSP-LTW-002
LOAD & DESIGN DRAWING

C	
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-21.DWG
IMAGE:	
DRAWING NO.	TSP-21-001

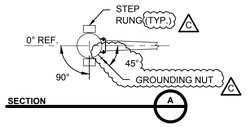
8/19/2015 2:46 PM — mspepich — N:\NUSCO\58479 — NPT\Overhead\Cadd\01-Record Worksheets\TSP-21.dwg — 001

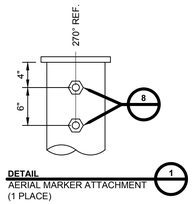
NU VER: 08/2012

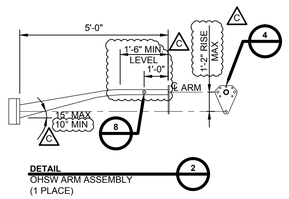
STRUCTURE NAME: 10-SCDSP-LTW-002
115-KV AC CONDUCTOR: 1 - 795 KCMIL 26/7 "DRAKE" ACSR PER PHASE (9000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 800
WEIGHT SPAN (FT): 1000
LINE ANGLE: 0 - 2 DEGREES

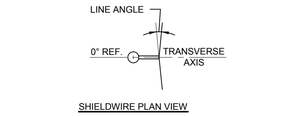
LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.50	1.69	1.34	0.00	3.74	1.96	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.50	1.03	0.00	1.34	2.20	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.50	2.38	0.94	0.00	4.11	1.27	0.00	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.30	39.50	3.23	1.14	0.00	5.16	1.47	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.50	1.13	0.61	0.00	2.49	0.90	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.50	1.13	0.59	0.00	2.49	0.80	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.50	1.13	0.50	5.50	2.49	0.68	6.75	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	30.00	3.68	0.30	0.27	6.14	0.58	0.48	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.50	0.10	0.00	1.34	0.18	0.00	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.80	0.21	0.00	4.49	0.36	0.00	0.00	90.00	2.00

C

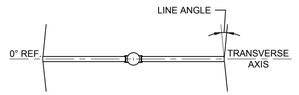




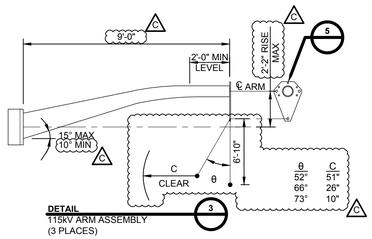


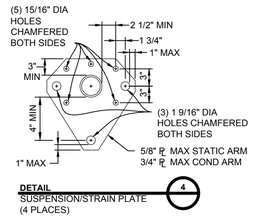


SHIELDWIRE PLAN VIEW



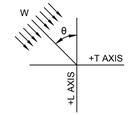
TRANSMISSION PLAN VIEW

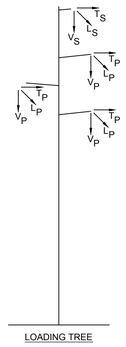




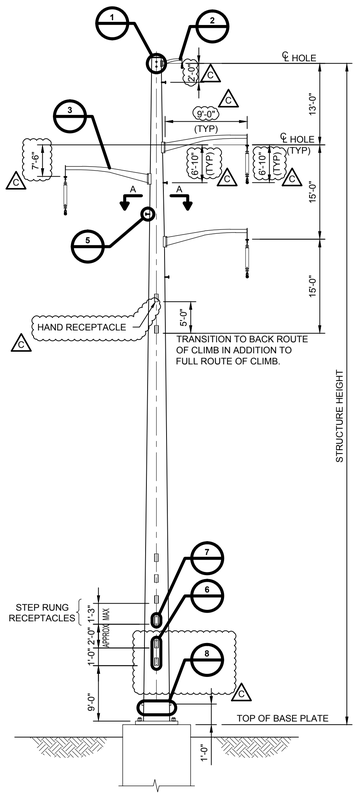
C

REFERENCES:
1. GROUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
7. LIFTING VANG PROVISIONS: SKETCH J + K
8. FALL PROTECTION VANGS: SKETCH N + Q
9. JACKING NUT LOCATIONS: SKETCH I

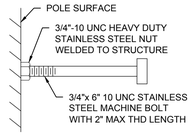


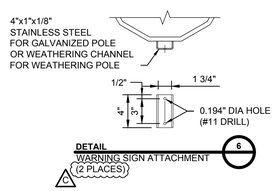


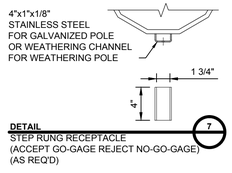
LOADING TREE

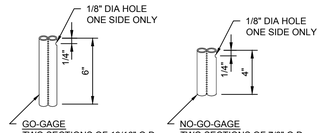


ELEVATION

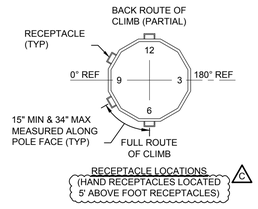


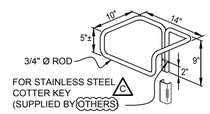




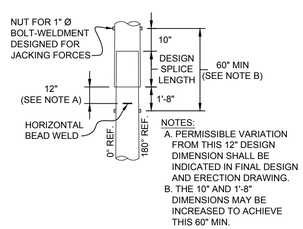


STEP RUNG RECEPTACLE GAGES

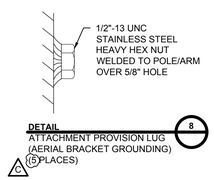




RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



SPLICE DETAILS JACKING NUT LOCATIONS



NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
7. SNUB ANGLES SHALL BE LIMITED TO A 2 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE 180.
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE GROUND LINE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
14. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
15. FALL PROTECTION VANGS FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + O.
16. 3'-2" CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WORKING SPACE. CLIMBING CORRIDOR IS 3 FEET WIDE CENTERED ON CLIMBING ROUTE.

C

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. UPDATES	.	5/29/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

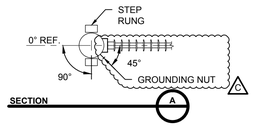
THE NORTHERN PASS

115kV AC TANGENT 0-2°
10-SCDSP-LTW-002
LOAD & DESIGN DRAWING

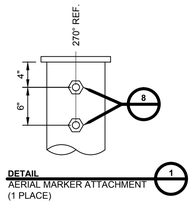
	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-21A.DWG
IMAGE:	
DRAWING NO.	TSP-21A-001

8/19/2015 2:47 PM — mspepich — N:\NUSCO\58479 — NPT\Overhead\Cadd\01-Record Worksheets\TSP-21A.dwg — 001

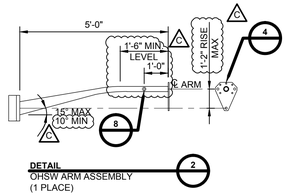
NU VER: 08/2012



SECTION



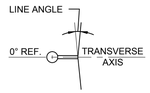
DETAIL 1
AERIAL MARKER ATTACHMENT
(1 PLACE)



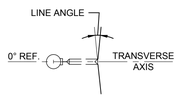
DETAIL 2
OHSW ARM ASSEMBLY
(1 PLACE)

LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.61	1.09	0.00	4.28	1.80	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.48	0.81	0.00	1.61	2.06	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	2.26	0.78	0.00	4.53	1.14	0.00	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	3.07	0.94	0.00	5.59	1.31	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	1.07	0.51	0.00	2.85	0.85	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	1.07	0.49	0.00	2.85	0.68	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	1.07	0.40	5.50	2.85	0.57	6.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.44	0.25	0.24	6.71	0.58	0.51	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.48	0.10	0.00	1.61	0.19	0.00	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.75	0.21	0.00	5.02	0.38	0.00	0.00	90.00	2.00

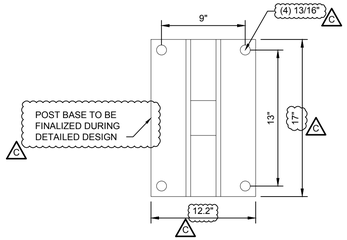
STRUCTURE NAME: 10-SCVSP-LTW-002
115-KV AC CONDUCTOR: 1 - 1272 KCMIL 45/7 "BITTERN" ACSR PER PHASE (10000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 600
WEIGHT SPAN (FT): 950
LINE ANGLE: 0 - 2 DEGREES



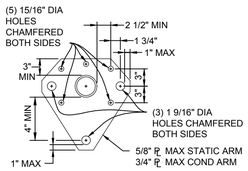
SHIELDWIRE PLAN VIEW



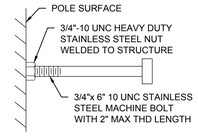
TRANSMISSION PLAN VIEW



DETAIL 3
POST BASE DETAIL
(3 PLACES)

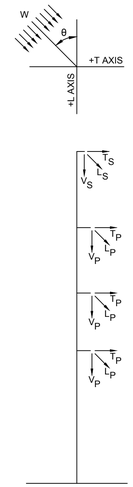


DETAIL 4
SUSPENSION/STRAIN PLATE
(1 PLACE)

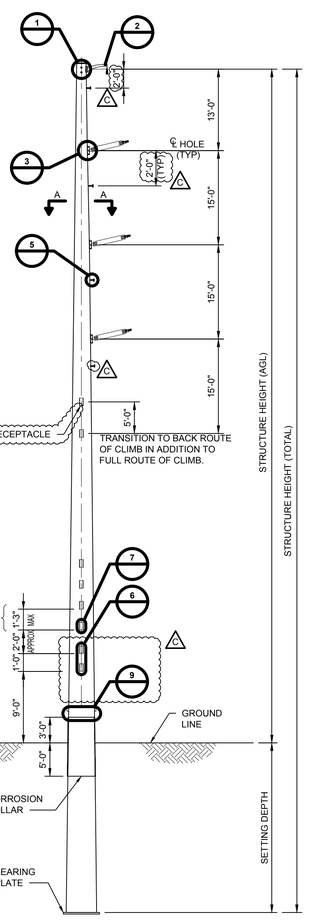


DETAIL 5
REMOVABLE GROUNDING BOLT
(4 PLACES)

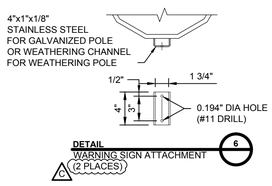
REFERENCES:
1. GROUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
7. LIFTING VANG PROVISIONS: SKETCH J + K
8. FALL PROTECTION VANGS: SKETCH N + Q
9. JACKING NUT LOCATIONS: SKETCH I



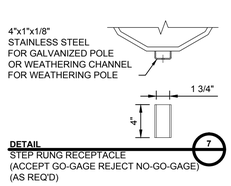
LOADING TREE



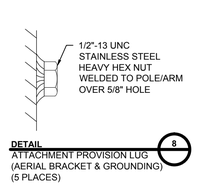
ELEVATION



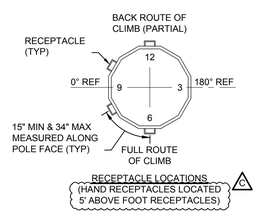
DETAIL 6
WARNING SIGN ATTACHMENT
(2 PLACES)



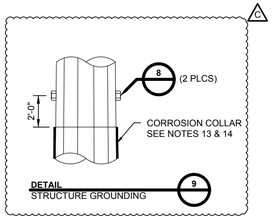
DETAIL 7
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)



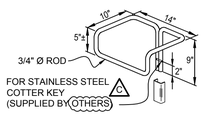
DETAIL 8
ATTACHMENT PROVISION LUG
(AERIAL BRACKET & GROUNDING)
(5 PLACES)



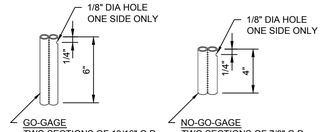
RECEPTACLE LOCATIONS
(HAND RECEPTACLES LOCATED 5' ABOVE FOOT RECEPTACLES)



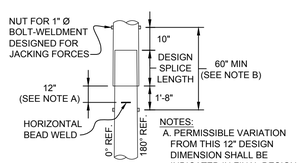
DETAIL 9
STRUCTURE GROUNDING



RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



STEP RUNG RECEPTACLE GAGES



SPLICE DETAILS JACKING NUT LOCATIONS

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED. CONDUCTOR SNUB LOADS SHALL BE APPLIED ON THE POLE SHAFT AT A POINT NEAR THE ATTACHMENT OF THE POST INSULATOR.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
7. SNUB ANGLES SHALL BE LIMITED TO A 2 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE (TBD)
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE GROUND LINE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
   CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. STEEL PLATE, A MINIMUM OF 1/4" THICKNESS GREATER THAN THAT REQUIRED FOR COLUMN STRENGTH SHALL BE IN PLACE IN THE AREA 3'-0" ABOVE AND 5'-0" BELOW THE NOMINAL GROUND LINE.
14. APPLY COAL TAR EPOXY ON INSIDE AND OUTSIDE OF POLE FROM BUTT OF POLE TO 12" ABOVE TOP OF CORROSION COLLAR.
15. BELOW GROUND CORROSION PROTECTION COATING MATERIAL SHALL BE SUPPLIED (ONE QUART PER TWO STRUCTURES) TO "TOUCH UP" SCRATCHES OCCURRING IN SHIPPING AND HANDLING. A COPY OF THE MSDS SHEET SHALL BE SUPPLIED WITH THE "TOUCH UP" MATERIALS.
16. FALL PROTECTION VANGS FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.
17. 3'-2" CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WORKING SPACE. CLIMBING CORRIDOR IS 3 FEET WIDE CENTERED ON CLIMBING ROUTE.
18. 4'-3" CLEARANCE MUST BE CONSIDERED FROM POLE BODY AND ARMS.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. UPDATES	.	5/29/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

115kV AC TANGENT 0-2°
10-SCVSP-LTW-002
LOAD & DESIGN DRAWING

C	
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-22.DWG
IMAGE:	
DRAWING NO.	TSP-22-001

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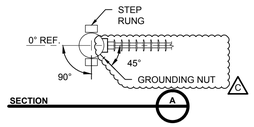
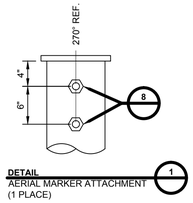
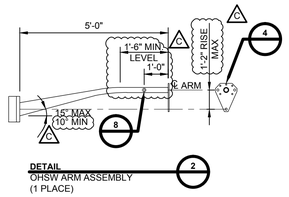
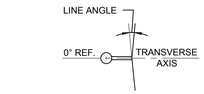
NU VER: 08/2012

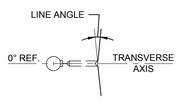




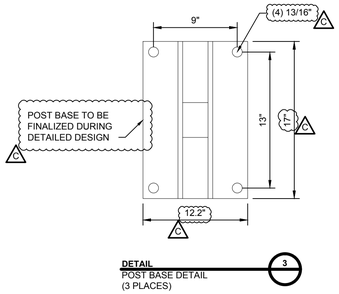


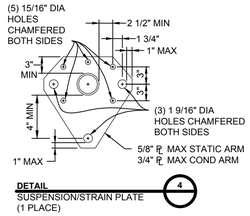


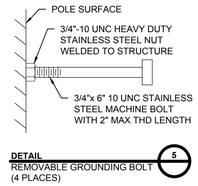
SHIELDWIRE PLAN VIEW

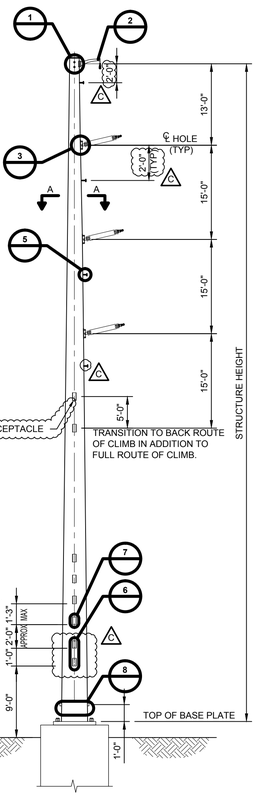


TRANSMISSION PLAN VIEW

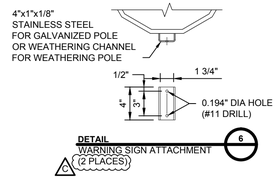


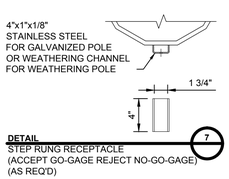


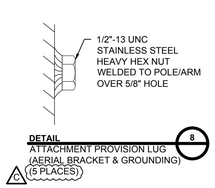


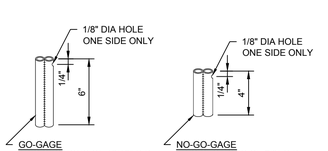


ELEVATION

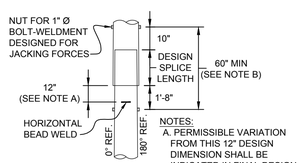




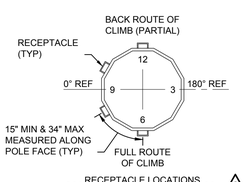


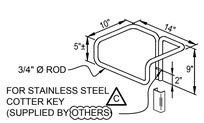


STEP RUNG RECEPTACLE GAGES



SPLICE DETAILS JACKING NUT LOCATIONS



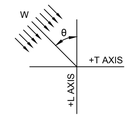


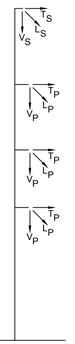
STRUCTURE NAME: 10-SCVSP-LTW-002
115-KV AC CONDUCTOR: 1 - 1272 KCMIL 45/7 "BITTERN" ACSR PER PHASE (10000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 600
WEIGHT SPAN (FT): 950
LINE ANGLE: 0 - 2 DEGREES

LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.61	1.09	0.00	4.28	1.80	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.48	0.81	0.00	1.61	2.06	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	2.26	0.78	0.00	4.53	1.14	0.00	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	3.07	0.94	0.00	5.59	1.31	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	1.07	0.51	0.00	2.85	0.85	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	1.07	0.49	0.00	2.85	0.68	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	1.07	0.40	5.50	2.85	0.57	6.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.44	0.25	0.24	6.71	0.58	0.51	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.48	0.10	0.00	1.61	0.19	0.00	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.75	0.21	0.00	5.02	0.38	0.00	0.00	90.00	2.00

C

REFERENCES:
1. GROUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
7. LIFTING VANG PROVISIONS: SKETCH J + K
8. FALL PROTECTION VANGS: SKETCH N + Q
9. JACKING NUT LOCATIONS: SKETCH I





LOADING TREE

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   - A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   - B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED. CONDUCTOR SNUB LOADS SHALL BE APPLIED ON THE POLE SHAFT AT A POINT NEAR THE ATTACHMENT OF THE POST INSULATOR.
   - C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
7. SNUB ANGLES SHALL BE LIMITED TO A 2 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE (TBD).
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE GROUND LINE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
14. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
15. FALL PROTECTION VANGS FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.
16. 3'-2" CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WORKING SPACE. CLIMBING CORRIDOR IS 3 FEET WIDE CENTERED ON CLIMBING ROUTE.
17. 4'-3" CLEARANCE MUST BE CONSIDERED FROM POLE BODY AND ARMS.

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. UPDATE	.	5/29/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

115kV AC TANGENT 0-2°
10-SCVSP-LTW-002
LOAD & DESIGN DRAWING

	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-22A.DWG
IMAGE:	
DRAWING NO.	TSP-22A-001

PRELIMINARY - NOT FOR CONSTRUCTION

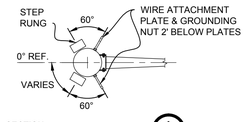
8/19/2015 2:50 PM - mspepich - N:\NUSCO\58479 - NPT\Overhead\Cadd\01-Record Worksheets\TSP-22A.dwg - 001

NU VER: 08/2012

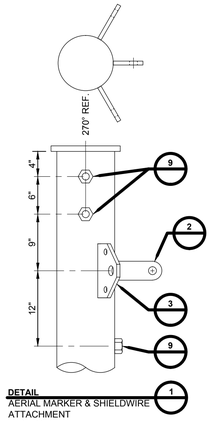
STRUCTURE NAME: 10-SCVSP-LDW-055
115-KV AC CONDUCTOR: 1 - 795 KCMIL 26/7 "DRAKE" ACSR PER PHASE (9000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 475 WIND SPAN BACK (FT): 475
WEIGHT SPAN AHEAD (FT): 625 WEIGHT SPAN BACK (FT): 625
LINE ANGLE: 0 - 55 DEGREES

LOADING CASE					DESIGN LOADS													
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.08	5.04	9.62	1.08	5.04	-9.62	2.64	8.20	15.96	2.64	8.20	-15.96	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.33	2.60	4.51	0.33	2.60	-4.51	0.96	5.25	8.95	0.96	5.25	-8.95	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	1.50	4.02	7.85	1.50	4.02	-7.85	2.77	6.27	12.52	2.77	6.27	-12.52	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	2.04	4.92	9.63	2.04	4.92	-9.63	3.42	7.34	14.66	3.42	7.34	-14.66	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.72	2.93	5.83	0.72	2.93	-5.83	1.76	4.80	9.67	1.76	4.80	-9.67	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.72	2.78	5.50	0.72	2.78	-5.50	1.76	4.49	9.00	1.76	4.49	-9.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.72	2.78	5.50	0.72	0.24	0.00	1.76	4.49	9.00	1.76	0.33	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.48	1.48	0.27	1.85	2.48	-5.23	6.59	2.68	0.48	2.79	4.42	-9.24	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.33	1.37	2.96	0.33	1.37	-2.96	0.96	2.40	5.20	0.96	2.40	-5.20	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.46	2.73	5.92	2.46	2.73	-5.92	3.72	4.80	10.40	3.72	4.80	-10.40	0.00	90.00	2.00
11	UPLIFT	-20.00	0.00	0.00	0.33	2.05	4.43	0.33	2.05	-4.43	0.96	3.69	7.99	0.96	3.69	-7.99	0.00	90.00	1.00

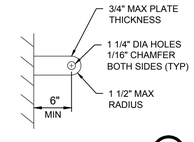
C



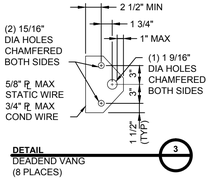
SECTION A



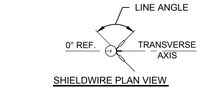
DETAIL
AERIAL MARKER & SHIELDWIRE ATTACHMENT
(1 PLACE)



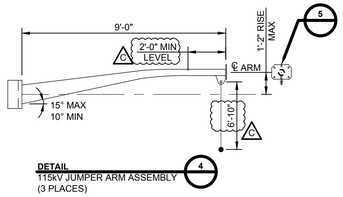
DETAIL
VANG DETAIL
(1 PLACE)



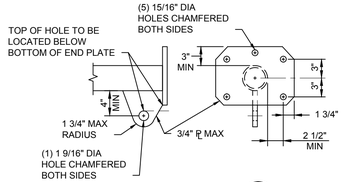
DETAIL
DEADEND VANG
(8 PLACES)



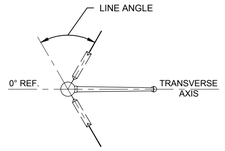
SHIELDWIRE PLAN VIEW



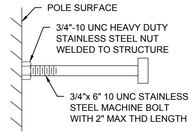
DETAIL
115kV JUMPER ARM ASSEMBLY
(3 PLACES)



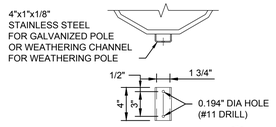
DETAIL
JUMPER ATTACHMENT
(3 PLACES)



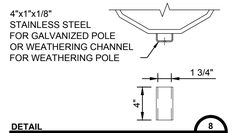
TRANSMISSION PLAN VIEW



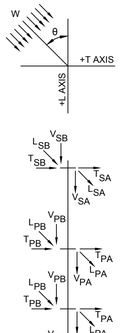
DETAIL
REMOVABLE GROUNDING BOLT
(4 PLACES)



DETAIL
WARNING SIGN ATTACHMENT
(2 PLACES)

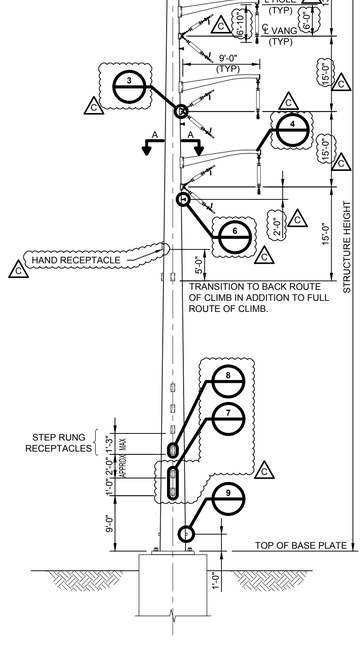


DETAIL
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)

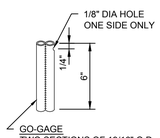


LOADING TREE

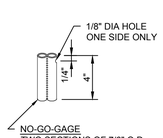
REFERENCES:
1. GROUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
7. LIFTING VANG PROVISIONS: SKETCH J + K
8. FALL PROTECTION VANGS: SKETCH N + Q
9. JACKING NUT LOCATIONS: SKETCH I



ELEVATION

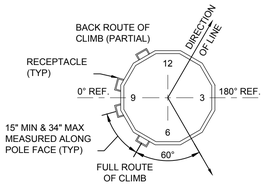


GO-GAGE
TWO SECTIONS OF 13/16" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

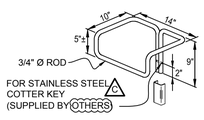


NO-GO-GAGE
TWO SECTIONS OF 7/8" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

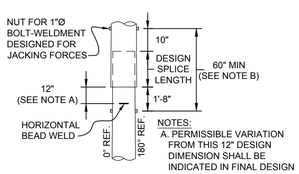
STEP RUNG RECEPTACLE GAGES



RECEPTACLE LOCATIONS
(HAND RECEPTACLES LOCATED 5' ABOVE FOOT RECEPTACLES)

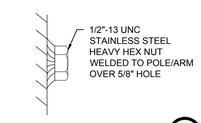


RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



NOTES:
A. PERMISSIBLE VARIATION FROM THIS 12" DESIGN DIMENSION SHALL BE INDICATED IN FINAL DESIGN AND ERECTION DRAWING.
B. THE 10" AND 1'-8" DIMENSIONS MAY BE INCREASED TO ACHIEVE THIS 60" MIN.

SPLICE DETAILS JACKING NUT LOCATIONS



DETAIL
ATTACHMENT PROVISION LUG
(AERIAL BRACKET & GROUNDING)
(6 PLACES)

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
   D. AHEAD OR BACK CONDUCTORS AND GROUND WIRES ONLY INSTALLED.
7. SNUB ANGLES SHALL BE LIMITED TO A 15 DEGREE DEFLECTION ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE TBD.
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
14. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
15. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
16. JUMPER ARMS SHALL BE DESIGNED FOR A VERTICAL LOAD OF 2,000 POUNDS.
17. FALL PROTECTION VANGS FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.
18. 3'-2" CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WORKING SPACE. CLIMBING CORRIDOR IS 3 FEET WIDE CENTERED ON CLIMBING ROUTE.
19. 4'-3" CLEARANCE MUST BE CONSIDERED FROM POLE BODY AND ARMS.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. UPDATES	.	5/29/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.

DWG REV | CONT/PE# | DATE | DRN | CHKD | APPR

THE NORTHERN PASS

115kV AC DEADEND 0-55°
10-SCVSP-LDW-055
LOAD & DESIGN DRAWING

	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-23.DWG
IMAGE:	
DRAWING NO.	TSP-23-001

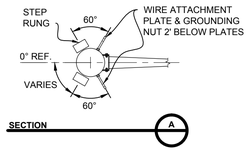
8/19/2015 2:51 PM - mpepich - N:\NUSCO\58479 - NPT\Overhead Cadd\01-Record Worksheets\TSP-23.dwg - 001

NU VER: 08/2012

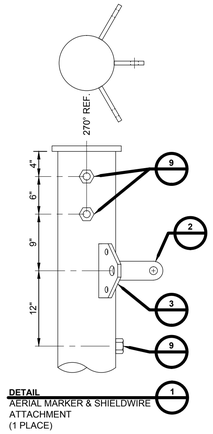
STRUCTURE NAME: 10-SCVSP-HDW-075
115-KV AC CONDUCTOR: 1 - 795 KCMIL 26/7 "DRAKE" ACSR PER PHASE (9000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 375 WIND SPAN BACK (FT): 375
WEIGHT SPAN AHEAD (FT): 725 WEIGHT SPAN BACK (FT): 725
LINE ANGLE: 55 - 75 DEGREES

LOADING CASE					DESIGN LOADS													
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.25	6.33	8.54	1.25	6.33	-8.54	2.95	10.38	14.16	2.95	10.38	-14.16	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.38	3.15	4.00	0.38	3.15	-4.00	1.07	6.33	7.94	1.07	6.33	-7.94	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	1.74	5.09	6.97	1.74	5.09	-6.97	3.14	8.01	11.10	3.14	8.01	-11.10	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	2.36	6.24	8.54	2.36	6.24	-8.54	3.90	9.38	13.01	3.90	9.38	-13.01	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.83	3.74	5.17	0.83	3.74	-5.17	1.97	6.15	8.58	1.97	6.15	-8.58	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.83	3.54	4.88	0.83	3.54	-4.88	1.97	5.74	7.98	1.97	5.74	-7.98	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.83	3.54	4.88	0.83	0.19	0.00	1.97	5.74	7.98	1.97	0.26	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.98	1.40	0.24	1.91	3.24	-4.64	6.92	2.51	0.43	2.95	5.74	-8.19	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.38	1.80	2.62	0.38	1.80	-2.62	1.07	3.17	4.61	1.07	3.17	-4.61	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.55	3.60	5.25	2.55	3.60	-5.25	3.93	6.33	9.23	3.93	6.33	-9.23	0.00	90.00	2.00
11	UPLIFT	-20.00	0.00	0.00	0.38	2.70	3.93	0.38	2.70	-3.93	1.07	4.86	7.08	1.07	4.86	-7.08	0.00	90.00	1.00

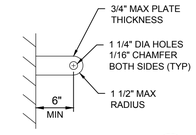
C



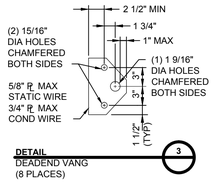
SECTION A



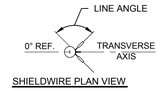
DETAIL
AERIAL MARKER & SHIELDWIRE ATTACHMENT
(1 PLACE)



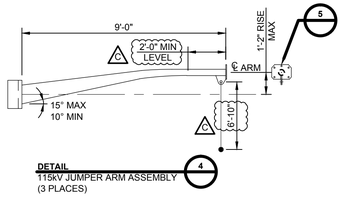
DETAIL
VANG DETAIL
(1 PLACE)



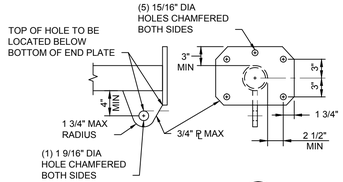
DETAIL
DEADEND VANG
(8 PLACES)



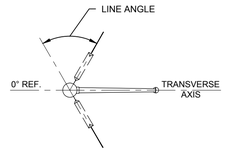
SHIELDWIRE PLAN VIEW



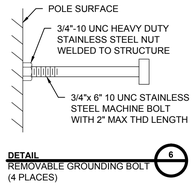
DETAIL
115kV JUMPER ARM ASSEMBLY
(3 PLACES)



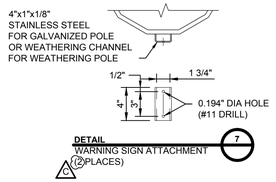
DETAIL
JUMPER ATTACHMENT
(3 PLACES)



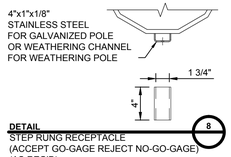
TRANSMISSION PLAN VIEW



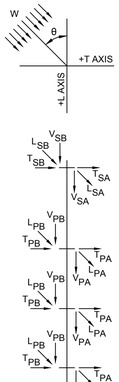
DETAIL
REMOVABLE GROUNDING BOLT
(4 PLACES)



DETAIL
WARNING SIGN ATTACHMENT
(2 PLACES)

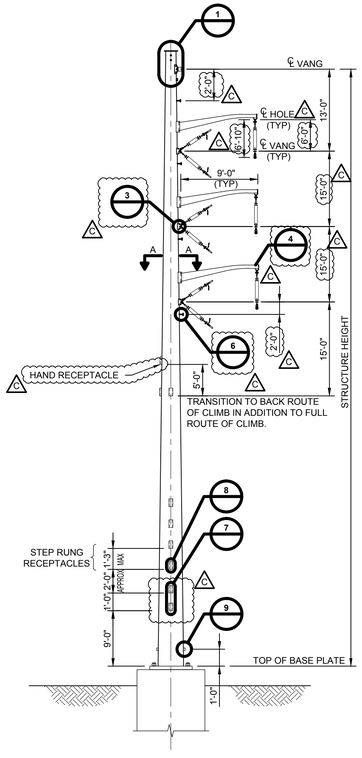


DETAIL
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)

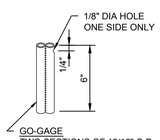


LOADING TREE

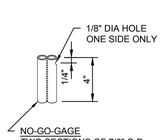
REFERENCES:
1. GROUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ATTACHMENT PROVISIONS FOR GROUNDING AND SIGNS: SKETCH F
7. LIFTING VANG PROVISIONS: SKETCH J + K
8. FALL PROTECTION VANGS: SKETCH N + Q
9. JACKING NUT LOCATIONS: SKETCH I



ELEVATION

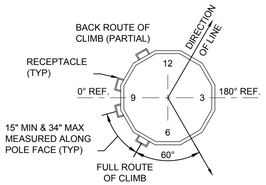


GO-GAGE
TWO SECTIONS OF 13/16" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

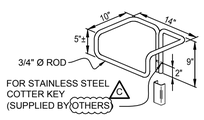


NO-GO-GAGE
TWO SECTIONS OF 7/8" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

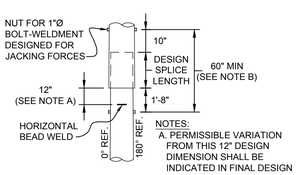
STEP RUNG RECEPTACLE GAGES



RECEPTACLE LOCATIONS
(HAND RECEPTACLES LOCATED 5' ABOVE FOOT RECEPTACLES)

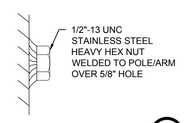


RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



NOTES:
A. PERMISSIBLE VARIATION FROM THIS 12" DESIGN DIMENSION SHALL BE INDICATED IN FINAL DESIGN AND ERECTION DRAWING.
B. THE 10" AND 1'-8" DIMENSIONS MAY BE INCREASED TO ACHIEVE THIS 60" MIN.

SPLICE DETAILS JACKING NUT LOCATIONS



DETAIL
ATTACHMENT PROVISION LUG
(AERIAL BRACKET & GROUNDING)
(16 PLACES)

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
   D. AHEAD OR BACK CONDUCTORS AND GROUND WIRES ONLY INSTALLED.
7. SNUB ANGLES SHALL BE LIMITED TO A 15 DEGREE DEFLECTION ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE(TBD)
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
14. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
15. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
16. JUMPER ARMS SHALL BE DESIGNED FOR A VERTICAL LOAD OF 2,000 POUNDS.
17. FALL PROTECTION VANGS FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.
18. 3'-2" CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WORKING SPACE. CLIMBING CORRIDOR IS 3 FEET WIDE CENTERED ON CLIMBING ROUTE.
19. 4'-3" CLEARANCE MUST BE CONSIDERED FROM POLE BODY AND ARMS.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. UPDATES	.	5/29/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.

DWG REV | EPN/DESCRIPTION | CONT/PE# | DATE | DRN | CHKD | APPR

THE NORTHERN PASS

115kV AC DEADEND 55-75°
10-SCVSP-HDW-075
LOAD & DESIGN DRAWING

	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-24.DWG
IMAGE:	
DRAWING NO.	TSP-24-001

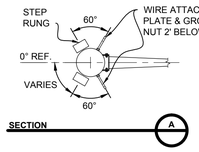
8/19/2015 2:53 PM - mpepich - N:\NUSCO\58479 - NPT\Overhead\Cadd\01-Record Worksheets\TSP-24.dwg - 001

NU VER: 08/2012

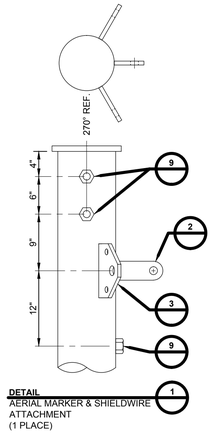
STRUCTURE NAME: 10-SCVSP-LDW-060
115-KV AC CONDUCTOR: 1 - 1590 KCMIL 45/7 "LAPWING" ACSR PER PHASE (11400# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 475 WIND SPAN BACK (FT): 475
WEIGHT SPAN AHEAD (FT): 625 WEIGHT SPAN BACK (FT): 625
LINE ANGLE: 0 - 60 DEGREES

LOADING CASE					DESIGN LOADS													
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.08	5.41	9.62	1.08	5.41	-9.62	3.52	11.30	20.62	3.52	11.30	-20.62	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.33	2.77	4.51	0.33	2.77	-4.51	1.39	7.30	11.56	1.39	7.30	-11.56	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	1.50	4.32	7.85	1.50	4.32	-7.85	3.51	8.44	15.76	3.51	8.44	-15.76	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	2.04	5.29	9.63	2.04	5.29	-9.63	4.24	9.88	18.49	4.24	9.88	-18.49	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.72	3.16	5.83	0.72	3.16	-5.83	2.35	6.64	12.50	2.35	6.64	-12.50	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.72	2.99	5.50	0.72	2.99	-5.50	2.35	6.10	11.40	2.35	6.10	-11.40	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.72	2.99	5.50	0.72	0.24	0.00	2.35	6.10	11.40	2.35	0.40	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.85	1.47	0.27	1.85	2.68	-5.22	8.69	3.40	0.61	3.44	6.08	-11.74	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.33	1.48	2.96	0.33	1.48	-2.96	1.39	3.33	6.67	1.39	3.33	-6.67	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.46	2.96	5.92	2.46	2.96	-5.92	4.59	6.67	13.34	4.59	6.67	-13.34	0.00	90.00	2.00
11	UPLIFT	-20.00	0.00	0.00	0.33	2.22	4.43	0.33	2.22	-4.43	1.39	5.17	10.34	1.39	5.17	-10.34	0.00	90.00	1.00

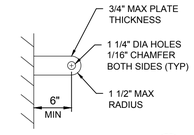
C



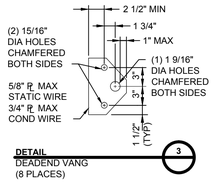
SECTION A



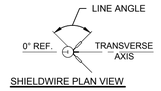
DETAIL
AERIAL MARKER & SHIELDWIRE ATTACHMENT
(1 PLACE)



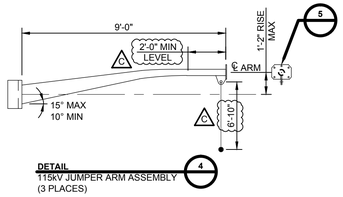
DETAIL
VANG DETAIL
(1 PLACE)



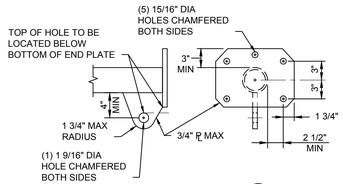
DETAIL
DEADEND VANG
(8 PLACES)



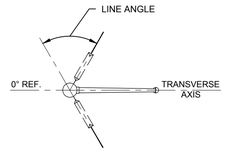
SHIELDWIRE PLAN VIEW



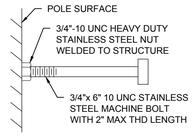
DETAIL
115kV JUMPER ARM ASSEMBLY
(3 PLACES)



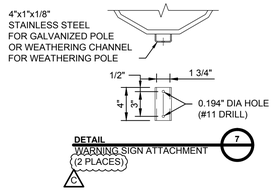
DETAIL
JUMPER ATTACHMENT
(3 PLACES)



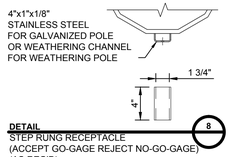
TRANSMISSION PLAN VIEW



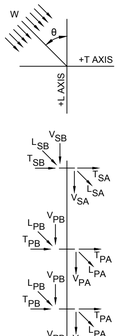
DETAIL
REMOVABLE GROUNDING BOLT
(4 PLACES)



DETAIL
WARNING SIGN ATTACHMENT
(2 PLACES)
C



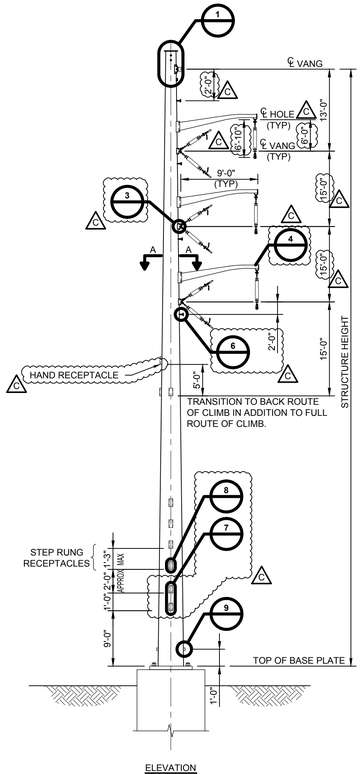
DETAIL
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)



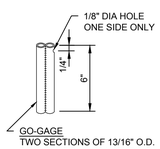
LOADING TREE

C

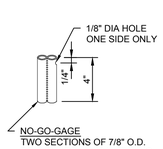
REFERENCES:
1. GROUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
7. LIFTING VANG PROVISIONS: SKETCH J + K
8. FALL PROTECTION VANGS: SKETCH N + Q
9. JACKING NUT LOCATIONS: SKETCH I



ELEVATION

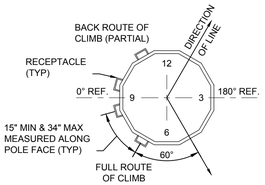


GO-GAGE
TWO SECTIONS OF 13/16" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

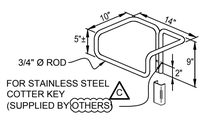


NO-GO-GAGE
TWO SECTIONS OF 7/8" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

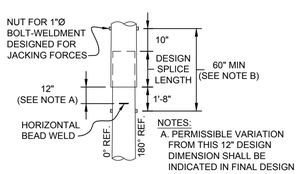
STEP RUNG RECEPTACLE GAGES



RECEPTACLE LOCATIONS
(HAND RECEPTACLES LOCATED 5' ABOVE FOOT RECEPTACLES)
C

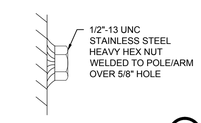


RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



NOTES:
A. PERMISSIBLE VARIATION FROM THIS 12" DESIGN DIMENSION SHALL BE INDICATED IN FINAL DESIGN AND ERECTION DRAWING.
B. THE 10" AND 1'-8" DIMENSIONS MAY BE INCREASED TO ACHIEVE THIS 60" MIN.

SPLICE DETAILS JACKING NUT LOCATIONS



DETAIL
ATTACHMENT PROVISION LUG
(AERIAL BRACKET & GROUNDING)
(6 PLACES)
9

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
   D. AHEAD OR BACK CONDUCTORS AND GROUND WIRES ONLY INSTALLED.
7. SNUB ANGLES SHALL BE LIMITED TO A 15 DEGREE DEFLECTION ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE (TBD)
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
14. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
15. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
16. JUMPER ARMS SHALL BE DESIGNED FOR A VERTICAL LOAD OF 2,000 POUNDS.
17. FALL PROTECTION VANGS FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.
18. 3'-2" CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WORKING SPACE. CLIMBING CORRIDOR IS 3 FEET WIDE CENTERED ON CLIMBING ROUTE.
19. 4'-3" CLEARANCE MUST BE CONSIDERED FROM POLE BODY AND ARMS.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. UPDATES	.	5/29/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.

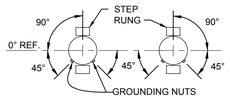
THE NORTHERN PASS

115kV AC DEADEND 0-60°
10-SCVSP-LDW-060
LOAD & DESIGN DRAWING

C	
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-25.DWG
IMAGE:	
DRAWING NO.	TSP-25-001

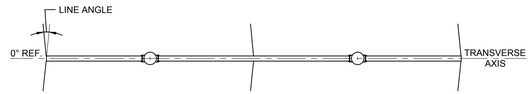
8/19/2015 2:54 PM - mpepich - N:\NUSCO\58479 - NPT\Overhead\Cadd\01-Record Worksheets\TSP-25.dwg - 001

NU VER: 05/2012

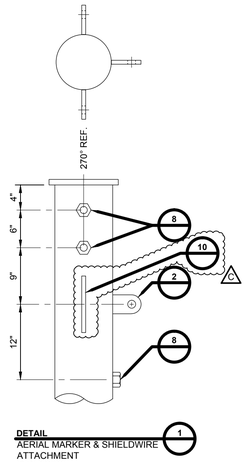


SECTION A

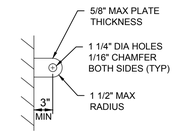
SHIELDWIRE PLAN VIEW



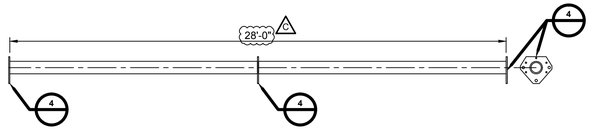
TRANSMISSION PLAN VIEW



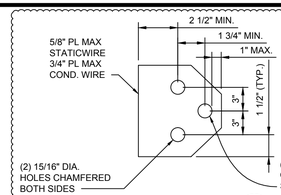
DETAIL 1
AERIAL MARKER & SHIELDWIRE ATTACHMENT
(2 PLACES)



DETAIL 2
VANG DETAIL
(2 PLACES)



DETAIL 3
115kV ARM ASSEMBLY
(1 PLACE)



DETAIL 10
DEADEND VANG
(4 PLACES)

C

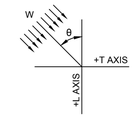
STRUCTURE NAME: 10-SCHSP-LTW-002
115-KV AC CONDUCTOR: 1 - 795 KCMIL 26/7 "DRAKE" ACSR PER PHASE (9000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 300
WEIGHT SPAN (FT): 300
LINE ANGLE: 0 - 2 DEGREES

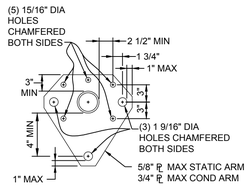
LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	0.56	0.71	0.00	1.54	1.08	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.18	0.48	0.00	0.58	1.02	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	0.75	0.53	0.00	1.51	0.75	0.00	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	1.00	0.64	0.00	1.83	0.87	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.37	0.35	0.00	1.03	0.55	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.37	0.34	0.00	1.03	0.45	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.37	0.25	5.50	1.03	0.33	6.75	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.21	0.23	0.27	4.99	0.42	0.48	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.18	0.10	0.00	0.58	0.18	0.00	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.17	0.21	0.00	2.96	0.36	0.00	0.00	90.00	2.00

C

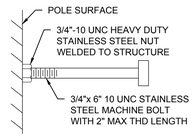
C

REFERENCES:
1. GROUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
7. LIFTING VANG PROVISIONS: SKETCH J + K
8. FALL PROTECTION VANGS: SKETCH N + Q
9. JACKING NUT LOCATIONS: SKETCH I

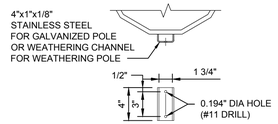




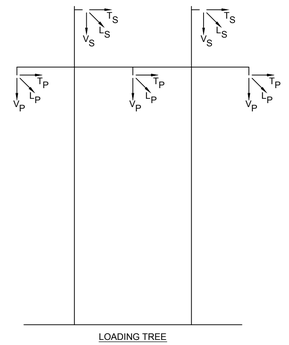
DETAIL 4
SUSPENSION/STRAIN PLATE
(3 PLACES)



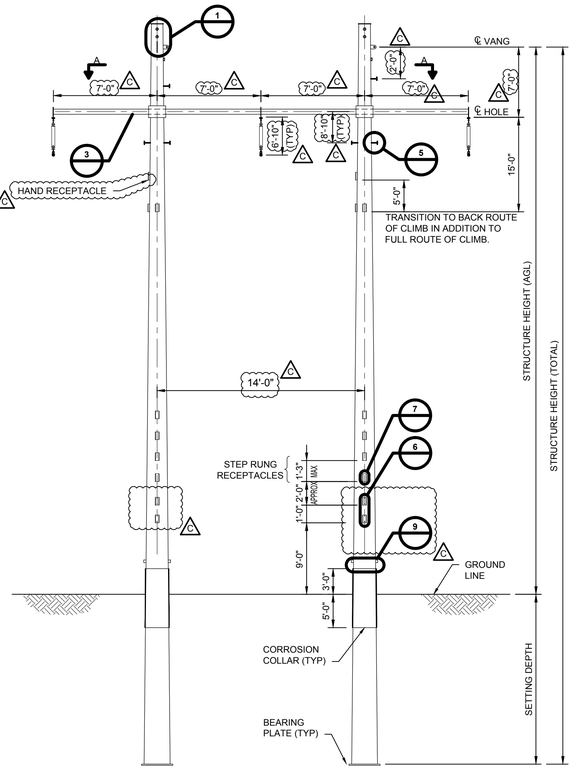
DETAIL 5
REMOVABLE GROUNDING BOLT
(6 PLACES)



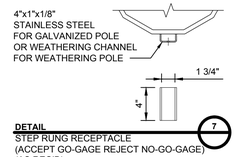
DETAIL 6
WARNING SIGN ATTACHMENT
(10 PLACES)



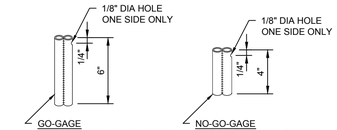
LOADING TREE



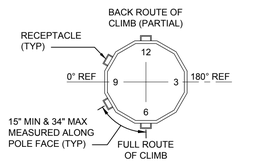
ELEVATION



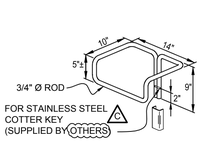
DETAIL 7
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)



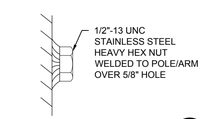
STEP RUNG RECEPTACLE GAGES



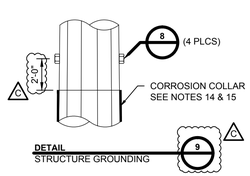
RECEPTACLE LOCATIONS
(HAND RECEPTACLES LOCATED 5' ABOVE FOOT RECEPTACLES)



RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



DETAIL 8
ATTACHMENT PROVISION LUG
(AERIAL BRACKET & GROUNDING)
(10 PLACES)



DETAIL 9
STRUCTURE GROUNDING

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   - A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   - B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   - C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
7. SNUB ANGLES SHALL BE LIMITED TO A 2 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE TBD
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE GROUND LINE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. POLE SPLICES SHALL USE FLANGED DESIGN..
14. STEEL PLATE, A MINIMUM OF 1/4" THICKNESS GREATER THAN THAT REQUIRED FOR COLUMN STRENGTH SHALL BE IN PLACE IN THE AREA 3'-0" ABOVE AND 5'-0" BELOW THE NOMINAL GROUND LINE.
15. APPLY COAL TAR EPOXY ON INSIDE AND OUTSIDE OF POLE FROM BUTT OF POLE TO 12" ABOVE TOP OF CORROSION COLLAR.
16. BELOW GROUND CORROSION PROTECTION COATING MATERIAL SHALL BE SUPPLIED (ONE QUART PER TWO STRUCTURES) TO "TOUCH UP" SCRATCHES OCCURRING IN SHIPPING AND HANDLING. A COPY OF THE MSDS SHEET SHALL BE SUPPLIED WITH THE "TOUCH UP" MATERIALS.
17. ARM AND X-BRACE SIZE, SHAPE AND MOUNTING HARDWARE REQUIRED SHALL BE DETERMINED AND FURNISHED BY POLE SUPPLIER.
18. BRACING USE, CONFIGURATION AND LOCATIONS TO BE DETERMINED BY MANUFACTURER.
19. FALL PROTECTION VANGS FOR CLIMBING AND WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND IN REFERENCE SKETCHES N + Q.
20. 3'-2" CLEARANCE SHALL BE CONSIDERED FROM CLIMBING AND WORKING SPACE. CLIMBING CORRIDOR IS 3 FEET WIDE CENTERED ON CLIMBING ROUTE.

C

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. UPDATES	.	5/29/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

115kV AC TANGENT 0-2°
10-SCHSP-LTW-002
LOAD & DESIGN DRAWING

	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-26.DWG
IMAGE:	
DRAWING NO.	TSP-26-001

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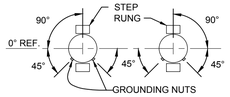
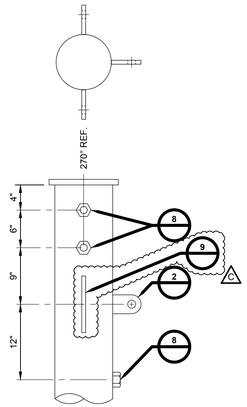
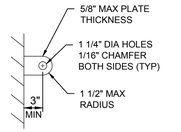
NU VER: 05/2012



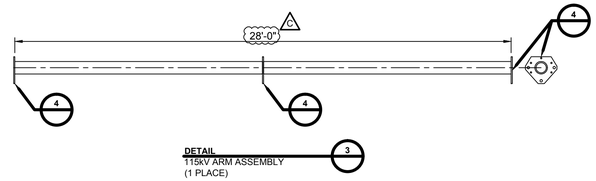
SECTION A



DETAIL 1
AERIAL MARKER & SHIELDWIRE ATTACHMENT
(2 PLACES)

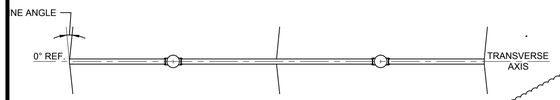


DETAIL 2
VANG DETAIL
(2 PLACES)

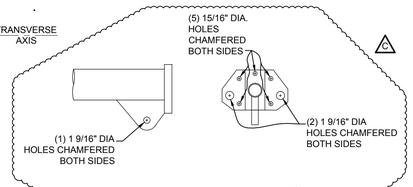


DETAIL 3
115kV ARM ASSEMBLY
(1 PLACE)

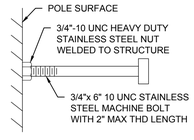
SHIELDWIRE PLAN VIEW



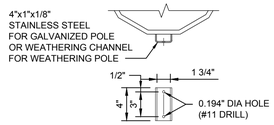
TRANSMISSION PLAN VIEW



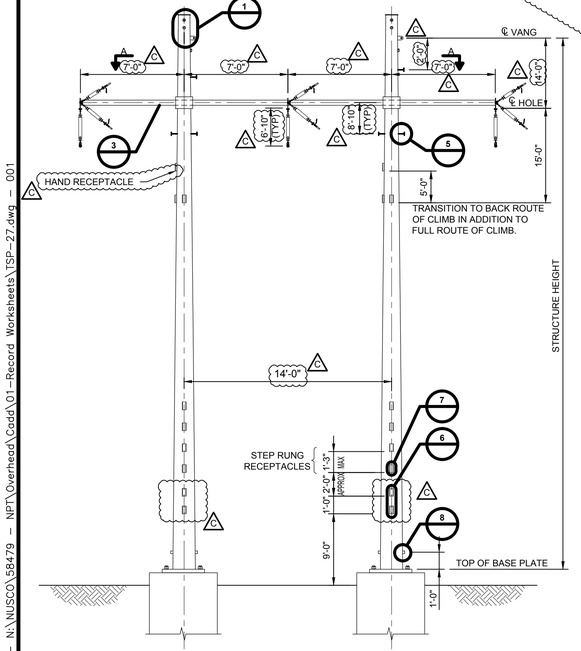
DETAIL 4
SUSPENSION/STRAIN PLATE
(3 PLACES)



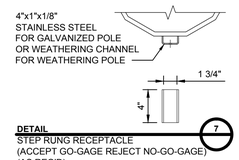
DETAIL 5
REMOVABLE GROUNDING BOLT
(6 PLACES)



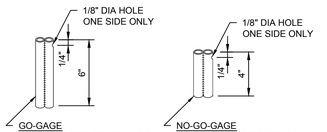
DETAIL 6
WARNING SIGN ATTACHMENT
(4 PLACES)



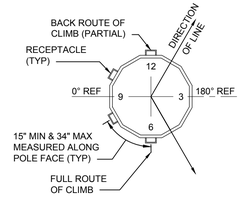
ELEVATION



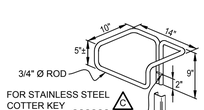
DETAIL 7
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)



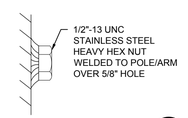
STEP RUNG RECEPTACLE GAGES



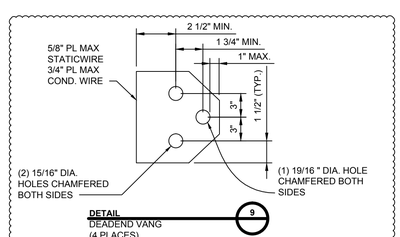
RECEPTACLE LOCATIONS
(HAND RECEPTACLES LOCATED 5' ABOVE FOOT RECEPTACLES)



RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



DETAIL 8
ATTACHMENT PROVISION LUG
(AERIAL BRACKET & GROUNDING)
(10 PLACES)



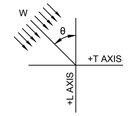
DETAIL 9
DEADEND VANG
(4 PLACES)

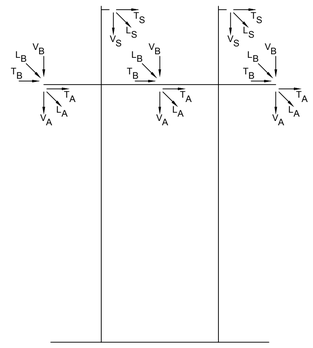
STRUCTURE NAME: 10-SCHSP-LDW-015
115-KV AC CONDUCTOR: 1 - 795 KCMIL 26/7 "DRAKE" ACSR PER PHASE (9000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 350 WIND SPAN BACK (FT): 350
WEIGHT SPAN AHEAD (FT): 475 WEIGHT SPAN BACK (FT): 475
LINE ANGLE: 0 - 15 DEGREES

LOADING CASE					DESIGN LOADS													
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	0.84	1.70	9.62	0.84	1.70	-9.62	2.17	2.70	15.96	2.17	2.70	-15.96	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.26	0.97	4.51	0.26	0.97	-4.51	0.79	1.99	8.95	0.79	1.99	-8.95	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	1.15	1.32	7.85	1.15	1.32	-7.85	2.21	2.00	12.52	2.21	2.00	-12.52	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	1.56	1.61	9.63	1.56	1.61	-9.63	2.71	2.33	14.66	2.71	2.33	-14.66	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.56	0.94	5.83	0.56	0.94	-5.83	1.44	1.51	9.67	1.44	1.51	-9.67	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.56	0.89	5.50	0.56	0.89	-5.50	1.44	1.42	9.00	1.44	1.42	-9.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.56	0.89	5.50	0.56	0.18	0.00	1.44	1.42	9.00	1.44	0.25	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.65	1.44	0.27	1.74	0.73	-5.23	6.10	2.58	0.48	2.54	1.32	-9.24	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.26	0.39	2.96	0.26	0.39	-2.96	0.79	0.68	5.20	0.79	0.68	-5.20	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.33	0.77	5.92	2.33	0.77	-5.92	3.39	1.36	10.40	3.39	1.36	-10.40	0.00	90.00	2.00
11	UPLIFT	-20.00	0.00	0.00	0.26	0.58	4.43	0.26	0.58	-4.43	0.79	1.04	7.99	0.79	1.04	-7.99	0.00	90.00	1.00

C

REFERENCES:
1. GROUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
7. LIFTING VANG PROVISIONS: SKETCH J + K
8. FALL PROTECTION VANGS: SKETCH N + Q
9. JACKING NUT LOCATIONS: SKETCH I





LOADING TREE

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   - A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   - B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   - C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
   - D AHEAD OR BACK CONDUCTORS AND GROUND WIRES ONLY INSTALLED.
7. SNUB ANGLES SHALL BE LIMITED TO A 15 DEGREE DEFLECTION ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE (TBD).
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE GROUND LINE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
14. POLE SPLICES SHALL USE FLANGED DESIGN.
15. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
16. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
17. ARM AND X-BRACE SIZE, SHAPE AND MOUNTING HARDWARE REQUIRED SHALL BE DETERMINED AND FURNISHED BY POLE SUPPLIER.
18. BRACING USE, CONFIGURATION AND LOCATIONS TO BE DETERMINED BY MANUFACTURER.
19. FALL PROTECTION VANGS FOR CLIMBING AND WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND IN REFERENCE SKETCHES N + Q.
20. 3'-2" CLEARANCE SHALL BE CONSIDERED FROM CLIMBING AND WORKING SPACE. CLIMBING CORRIDOR IS 3 FEET WIDE CENTERED ON CLIMBING ROUTE.
21. 4'-3" CLEARANCE MUST BE CONSIDERED FROM POLE BODY AND ARMS.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. UPDATES	.	5/29/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

115kV AC DEADEND 0°–15°
10–SCHSP–LDW–015
LOAD & DESIGN DRAWING

	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP–27.DWG
IMAGE:	
DRAWING NO.	TSP–27–001

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NU VER: 08/2012

STRUCTURE NAME: 10-SCHSP-LDW-055
115-KV AC CONDUCTOR: 1 - 795 KCMIL 26/7 "DRAKE" ACSR PER PHASE (9000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 350 WIND SPAN BACK (FT): 350
WEIGHT SPAN AHEAD (FT): 475 WEIGHT SPAN BACK (FT): 475
LINE ANGLE: 0 - 55 DEGREES

LOADING CASE					DESIGN LOADS												
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	0.84	4.88	9.62	0.84	4.88	-9.62	2.17	7.99	15.96	2.17	7.99	-15.96	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.26	2.46	4.51	0.26	2.46	-4.51	0.79	4.96	8.95	0.79	4.96	-8.95	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	1.15	3.92	7.85	1.15	3.92	-7.85	2.21	6.14	12.52	2.21	6.14	-12.52	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	1.56	4.80	9.63	1.56	4.80	-9.63	2.71	7.19	14.66	2.71	7.19	-14.66	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.56	2.87	5.83	0.56	2.87	-5.83	1.44	4.71	9.67	1.44	4.71	-9.67	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.56	2.72	5.50	0.56	2.72	-5.50	1.44	4.40	9.00	1.44	4.40	-9.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.56	2.72	5.50	0.56	0.18	0.00	1.44	4.40	9.00	1.44	0.25	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.65	1.45	0.27	1.74	2.46	-5.23	6.10	2.60	0.48	2.54	4.38	-9.24	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.26	1.37	2.96	0.26	1.37	-2.96	0.79	2.40	5.20	0.79	2.40	-5.20	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.33	2.73	5.92	2.33	2.73	-5.92	3.39	4.80	10.40	3.39	4.80	-10.40	0.00	90.00	2.00
11	UPLIFT	-20.00	0.00	0.00	0.26	2.05	4.43	0.26	2.05	-4.43	0.79	3.69	7.99	0.79	3.69	-7.99	0.00	90.00	1.00

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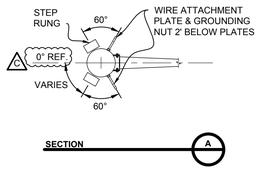
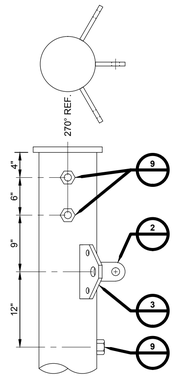
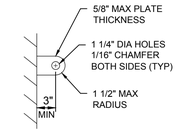


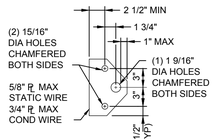
SECTION A



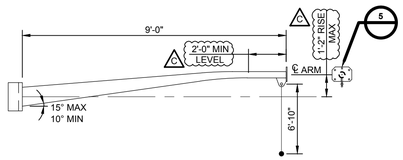
DETAIL 1
AERIAL MARKER & SHIELDWIRE ATTACHMENT
(2 PLACES)



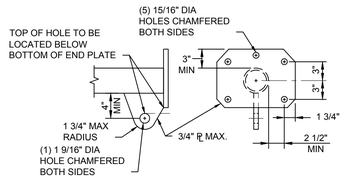
DETAIL 2
VANG DETAIL
(2 PLACES)



DETAIL 3
DEADEND VANG
(10 PLACES)



DETAIL 4
115kV JUMPER ARM ASSEMBLY
(3 PLACES)

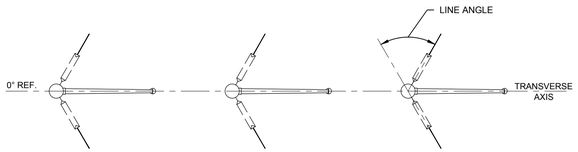


DETAIL 5
JUMPER ATTACHMENT
(3 PLACES)

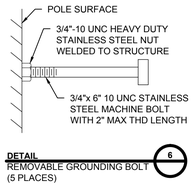
C

REFERENCES:
1. GROUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
7. LIFTING VANG PROVISIONS: SKETCH J + K
8. FALL PROTECTION VANGS: SKETCH N + Q
9. JACKING NUT LOCATIONS: SKETCH I

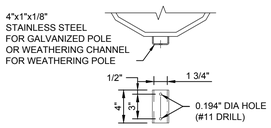
SHIELDWIRE PLAN VIEW



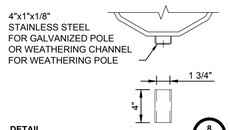
TRANSMISSION PLAN VIEW



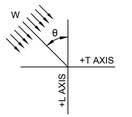
DETAIL 6
REMOVABLE GROUNDING BOLT
(5 PLACES)

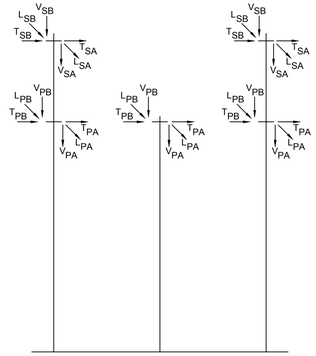


DETAIL 7
WARNING SIGN ATTACHMENT
(6 PLACES)

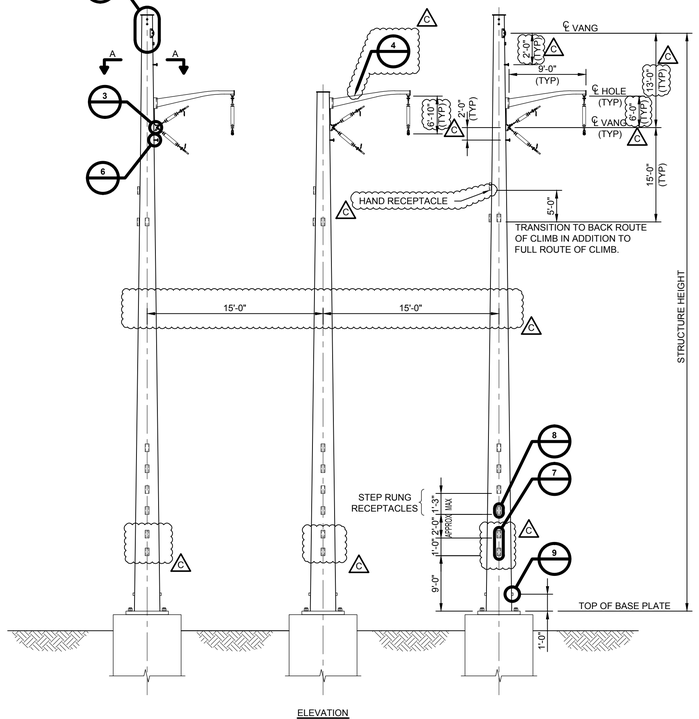


DETAIL 8
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)

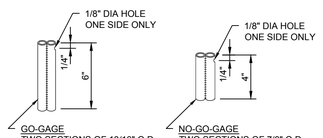




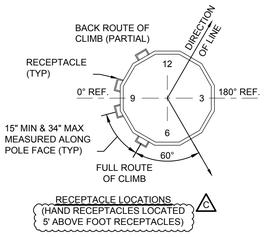
LOADING TREE



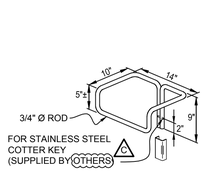
ELEVATION



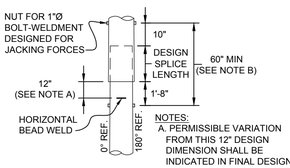
STEP RUNG RECEPTACLE GAGES



RECEPTACLE LOCATIONS
(HAND RECEPTACLES LOCATED 5' ABOVE FOOT RECEPTACLES)

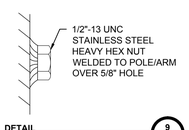


RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



NOTES:
A. PERMISSIBLE VARIATION FROM THIS 12" DESIGN DIMENSION SHALL BE INDICATED IN FINAL DESIGN AND ERECTION DRAWING.
B. THE 10" AND 1'-8" DIMENSIONS MAY BE INCREASED TO ACHIEVE THIS 60° MIN.

SPLICE DETAILS JACKING NUT LOCATIONS



DETAIL 9
ATTACHMENT PROVISION LUG
(AERIAL BRACKET & GROUNDING)
(12 PLACES)

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
   D. AHEAD OR BACK CONDUCTORS AND GROUND WIRES ONLY INSTALLED.
7. SNUB ANGLES SHALL BE LIMITED TO A 15 DEGREE DEFLECTION ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE (TBD)
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
14. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
15. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
16. JUMPER ARMS SHALL BE DESIGNED FOR A VERTICAL LOAD OF 2,000 POUNDS.
17. FALL PROTECTION VANGS FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.
18. 3'-2" CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WORKING SPACE. CLIMBING CORRIDOR IS 3 FEET WIDE CENTERED ON CLIMBING ROUTE.
19. 4'-3" CLEARANCE MUST BE CONSIDERED FROM POLE BODY AND ARMS.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE #	DATE	DRN	CHKD	APPR
C	MISC. UPDATES	.	5/29/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE #	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

115kV AC DEADEND 0-55°
10-SCHSP-LDW-055
LOAD & DESIGN DRAWING

	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-28.DWG
IMAGE:	
DRAWING NO.	TSP-28-001

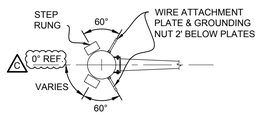
8/19/2015 2:58 PM - mspepich - N:\NUSCO\58479 - NPT\Overhead\Cadd\01-Record Worksheets\TSP-28.dwg - 001

NU VER: 08/2012

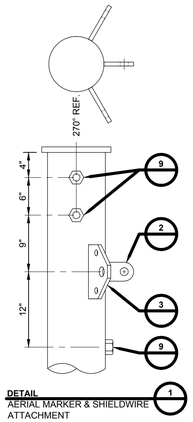
STRUCTURE NAME: 10-SCHSP-HDW-090
115-KV AC CONDUCTOR: 1 - 795 KCMIL 26/7 "DRAKE" ACSR PER PHASE (9000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 175 WIND SPAN BACK (FT): 175
WEIGHT SPAN AHEAD (FT): 300 WEIGHT SPAN BACK (FT): 300
LINE ANGLE: 55 - 90 DEGREES

LOADING CASE					DESIGN LOADS													
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	0.56	7.03	8.54	0.56	7.03	-8.54	1.62	11.59	14.16	1.62	11.59	-14.16	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.18	3.38	4.00	0.18	3.38	-4.00	0.60	6.74	7.94	0.60	6.74	-7.94	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	0.75	5.70	6.97	0.75	5.70	-6.97	1.56	9.03	11.10	1.56	9.03	-11.10	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	1.00	6.98	8.54	1.00	6.98	-8.54	1.88	10.58	13.01	1.88	10.58	-13.01	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.37	4.21	5.17	0.37	4.21	-5.17	1.08	6.96	8.58	1.08	6.96	-8.58	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.37	3.98	4.88	0.37	3.98	-4.88	1.08	6.49	7.98	1.08	6.49	-7.98	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.37	3.98	4.88	0.37	0.09	0.00	1.08	6.49	7.98	1.08	0.12	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.41	1.27	0.24	1.63	3.72	-4.64	5.52	2.27	0.43	2.25	6.59	-8.19	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.18	2.09	2.62	0.18	2.09	-2.62	0.60	3.68	4.61	0.60	3.68	-4.61	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.17	4.18	5.25	2.17	4.18	-5.25	3.01	7.36	9.23	3.01	7.36	-9.23	0.00	90.00	2.00
11	UPLIFT	-20.00	0.00	0.00	0.18	3.13	3.93	0.18	3.13	-3.93	0.60	5.65	7.08	0.60	5.65	-7.08	0.00	90.00	1.00

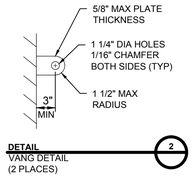
C



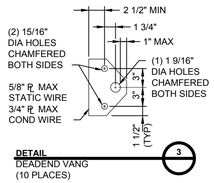
SECTION A



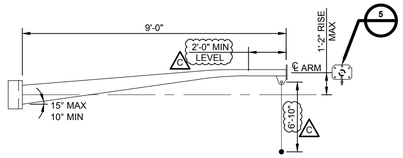
DETAIL 1
AERIAL MARKER & SHIELDWIRE ATTACHMENT
(2 PLACES)



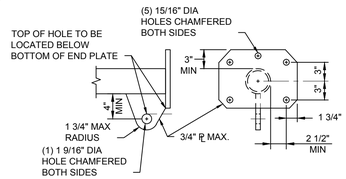
DETAIL 2
VANG DETAIL
(2 PLACES)



DETAIL 3
DEADEND VANG
(10 PLACES)



DETAIL 4
115kV JUMPER ARM ASSEMBLY
(3 PLACES)



DETAIL 5
JUMPER ATTACHMENT
(3 PLACES)

C

REFERENCES:
1. GROUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
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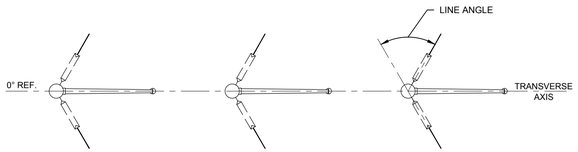
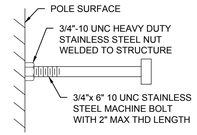
8. FALL PROTECTION VANGS: SKETCH N + Q
9. JACKING NUT LOCATIONS: SKETCH I

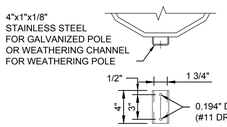
SHIELDWIRE PLAN VIEW



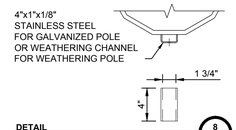
TRANSMISSION PLAN VIEW



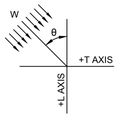
DETAIL 6
REMOVABLE GROUNDING BOLT
(5 PLACES)

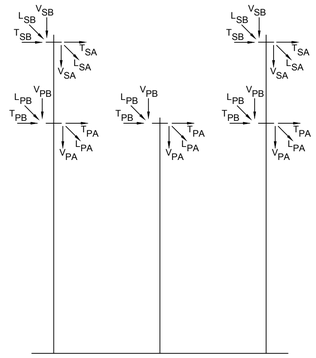


DETAIL 7
WARNING SIGN ATTACHMENT
C (6) PLACES)

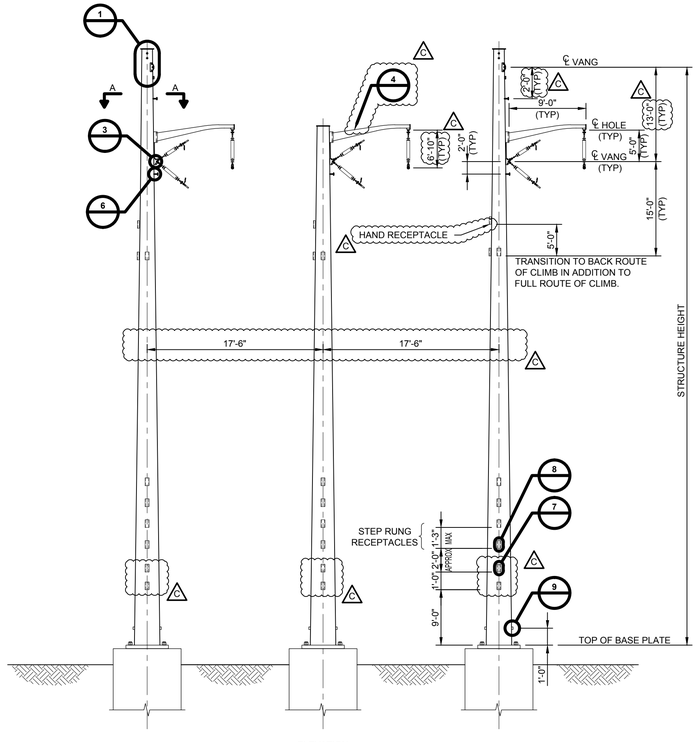


DETAIL 8
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)

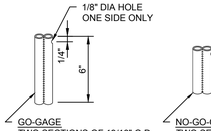




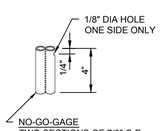
LOADING TREE



ELEVATION

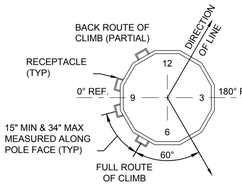


GO-GAGE
TWO SECTIONS OF 13/16" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

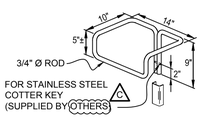


NO-GO-GAGE
TWO SECTIONS OF 7/8" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

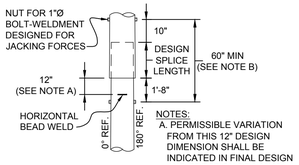
STEP RUNG RECEPTACLE GAGES



RECEPTACLE LOCATIONS
(HAND RECEPTACLES LOCATED 5' ABOVE FOOT RECEPTACLES)

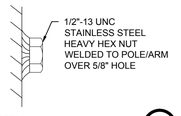


RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



NOTES:
A. PERMISSIBLE VARIATION FROM THIS 12" DESIGN DIMENSION SHALL BE INDICATED IN FINAL DESIGN AND ERECTION DRAWING.
B. THE 10" AND 1'-8" DIMENSIONS MAY BE INCREASED TO ACHIEVE THIS 60" MIN.

SPLICE DETAILS JACKING NUT LOCATIONS



DETAIL 9
ATTACHMENT PROVISION LUG
(AERIAL BRACKET & GROUNDING)
C (12) PLACES)

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
   D. AHEAD OR BACK CONDUCTORS AND GROUND WIRES ONLY INSTALLED.
7. SNUB ANGLES SHALL BE LIMITED TO A 15 DEGREE DEFLECTION ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE (TBD)
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
14. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
15. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
16. JUMPER ARMS SHALL BE DESIGNED FOR A VERTICAL LOAD OF 2,000 POUNDS.
17. FALL PROTECTION VANGs FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.
18. 3'-2" CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WORKING SPACE. CLIMBING CORRIDOR IS 3 FEET WIDE CENTERED ON CLIMBING ROUTE.
19. 4'-3" CLEARANCE MUST BE CONSIDERED FROM POLE BODY AND ARMS.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. UPDATES	.	5/29/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BHL	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

115kV AC DEADEND 55-90°
10-SCHSP-HDW-090
LOAD & DESIGN DRAWING

	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-29.DWG
IMAGE:	
DRAWING NO.	TSP-29-001

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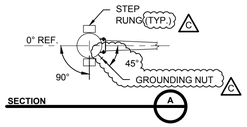
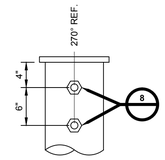
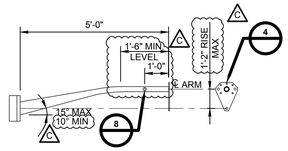
NU VER: 08/2012

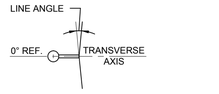




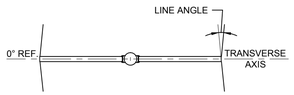
DETAIL
AERIAL MARKER ATTACHMENT
(1 PLACE)
1



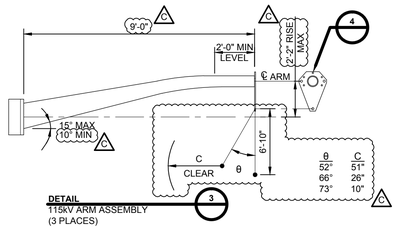
DETAIL
OHSW ARM ASSEMBLY
(1 PLACE)
2



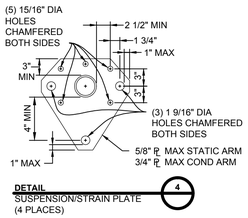
SHIELDWIRE PLAN VIEW



TRANSMISSION PLAN VIEW



DETAIL
115kV ARM ASSEMBLY
(3 PLACES)
3

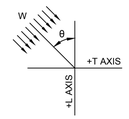


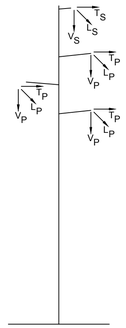
DETAIL
SUSPENSION/STRAIN PLATE
(4 PLACES)
4

REFERENCES:
1. GROUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
7. LIFTING VANG PROVISIONS: SKETCH J + K
8. FALL PROTECTION VANGS: SKETCH N + Q
9. JACKING NUT LOCATIONS: SKETCH I

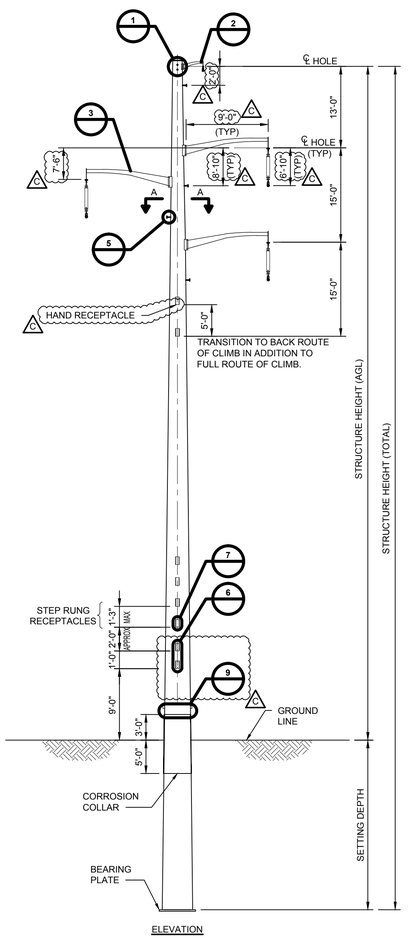
STRUCTURE NAME: 10-SCDSP-LTW-002
115-KV AC CONDUCTOR: 1 - 1590 KCMIL 45/7 "LAPWING" ACSR PER PHASE (11400# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN (FT): 800
WEIGHT SPAN (FT): 1000
LINE ANGLE: 0 - 2 DEGREES

LOADING CASE					DESIGN LOADS								
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VS (k)	TS (k)	LS (k)	VP (k)	TP (k)	LP (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.69	1.34	0.00	5.15	2.39	0.00	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.50	1.03	0.00	2.04	2.97	0.00	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	2.38	0.94	0.00	5.30	1.48	0.00	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	3.23	1.14	0.00	6.47	1.71	0.00	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	1.13	0.61	0.00	3.44	1.10	0.00	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	1.13	0.59	0.00	3.44	0.97	0.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	1.13	0.50	5.50	3.44	0.82	8.55	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.68	0.30	0.27	7.98	0.76	0.61	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.50	0.10	0.00	2.04	0.23	0.00	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.80	0.31	0.00	5.88	0.47	0.00	0.00	90.00	2.00

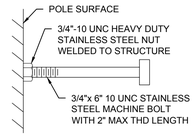




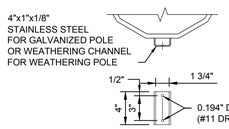
LOADING TREE



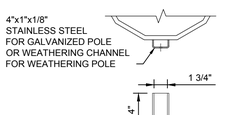
ELEVATION



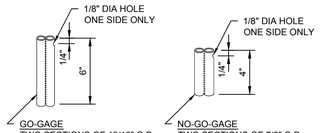
DETAIL
REMOVABLE GROUNDING BOLT
(4 PLACES)
5



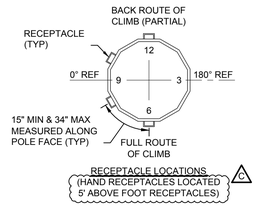
DETAIL
WARNING SIGN ATTACHMENT
(2 PLACES)
6

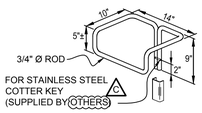


DETAIL
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)
7

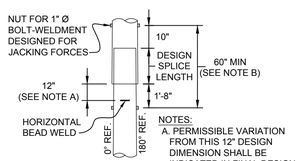


STEP RUNG RECEPTACLE GAGES



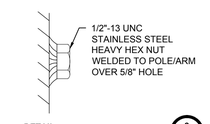


RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)

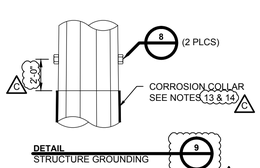


NOTES:
A. PERMISSIBLE VARIATION FROM THIS 12" DESIGN DIMENSION SHALL BE INDICATED IN FINAL DESIGN AND ERECTION DRAWING.
B. THE 10" AND 1'-8" DIMENSIONS MAY BE INCREASED TO ACHIEVE THIS 60" MIN.

SPLICE DETAILS JACKING NUT LOCATIONS



DETAIL
ATTACHMENT PROVISION LUG
(AERIAL BRACKET & GROUNDING)
(15 PLACES)
8



DETAIL
STRUCTURE GROUNDING
9

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
7. SNUB ANGLES SHALL BE LIMITED TO A 2 DEGREE LINE ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE (TBD).
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE GROUND LINE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. STEEL PLATE, A MINIMUM OF 1/4" THICKNESS GREATER THAN THAT REQUIRED FOR COLUMN STRENGTH SHALL BE IN PLACE IN THE AREA 3'-0" ABOVE AND 5'-0" BELOW THE NOMINAL GROUND LINE.
14. APPLY COAL TAR EPOXY ON INSIDE AND OUTSIDE OF POLE FROM BUTT OF POLE TO 12" ABOVE TOP OF CORROSION COLLAR.
15. BELOW GROUND CORROSION PROTECTION COATING MATERIAL SHALL BE SUPPLIED (ONE QUART PER TWO STRUCTURES) TO "TOUCH UP" SCRATCHES OCCURRING IN SHIPPING AND HANDLING. A COPY OF THE MSDS SHEET SHALL BE SUPPLIED WITH THE "TOUCH UP" MATERIALS.
16. FALL PROTECTION VANGS FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.
17. 3'-2" CLEARANCE SHALL BE CONSIDED FROM CLIMBING AND WORKING SPACE. CLIMBING CORRIDOR IS 3 FEET WIDE CENTERED ON CLIMBING ROUTE.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. UPDATES	.	5/29/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.

THE NORTHERN PASS

115kV AC TANGENT 0-2°
10-SCDSP-LTW-002
LOAD & DESIGN DRAWING

C	
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-30.DWG
IMAGE:	
DRAWING NO.	TSP-30-001

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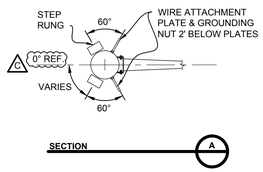
NU VER: 08/2012

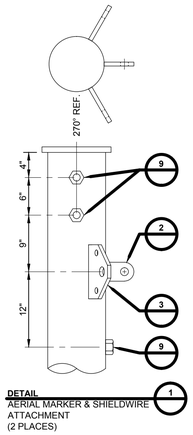
STRUCTURE NAME: 10-SCHSP-LDW-055
115-KV AC CONDUCTOR: 1 - 1590 KCMIL 45/7 "LAPWING" ACSR PER PHASE (11400# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 350 WIND SPAN BACK (FT): 350
WEIGHT SPAN AHEAD (FT): 475 WEIGHT SPAN BACK (FT): 475
LINE ANGLE: 0 - 55 DEGREES

LOADING CASE					DESIGN LOADS													
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	0.84	4.88	9.62	0.84	4.88	-9.62	2.84	10.25	20.62	2.84	10.25	-20.62	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.26	2.46	4.51	0.26	2.46	-4.51	1.13	6.46	11.56	1.13	6.46	-11.56	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	1.15	3.92	7.85	1.15	3.92	-7.85	2.78	7.69	15.76	2.78	7.69	-15.76	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	1.56	4.80	9.63	1.56	4.80	-9.63	3.33	9.00	18.49	3.33	9.00	-18.49	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.56	2.87	5.83	0.56	2.87	-5.83	1.89	6.06	12.50	1.89	6.06	-12.50	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.56	2.72	5.50	0.56	2.72	-5.50	1.89	5.56	11.40	1.89	5.56	-11.40	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.56	2.72	5.50	0.56	0.18	0.00	1.89	5.56	11.40	1.89	0.29	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.65	1.45	0.27	1.74	2.46	-5.22	7.88	3.32	0.61	3.04	5.57	-11.74	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.26	1.37	2.96	0.26	1.37	-2.96	1.13	3.08	6.67	1.13	3.08	-6.67	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.33	2.73	5.92	2.33	2.73	-5.92	4.05	6.16	13.34	4.05	6.16	-13.34	0.00	90.00	2.00
11	UPLIFT	-20.00	0.00	0.00	0.26	2.05	4.43	0.26	2.05	-4.43	1.13	4.78	10.34	1.13	4.78	-10.34	0.00	90.00	1.00

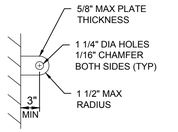
C



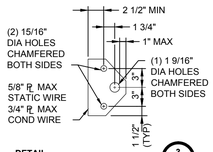
SECTION A



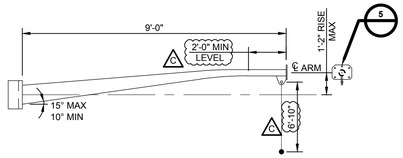
DETAIL 1
AERIAL MARKER & SHIELDWIRE ATTACHMENT
(2 PLACES)



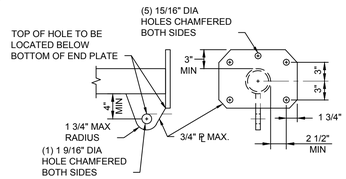
DETAIL 2
VANG DETAIL
(2 PLACES)



DETAIL 3
DEADEND VANG
(10 PLACES)



DETAIL 4
115kV JUMPER ARM ASSEMBLY
(3 PLACES)

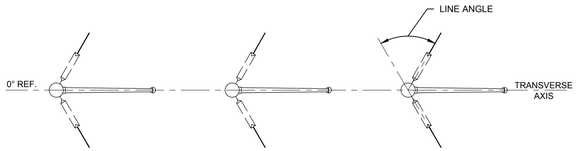


DETAIL 5
JUMPER ATTACHMENT
(3 PLACES)

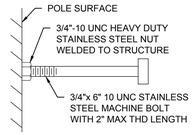
C

REFERENCES:
1. GROUNDING NUT: SKETCH B
2. STEP RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTACLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ATTACHMENT PROVISIONS FOR GOUNDING AND SIGNS: SKETCH F
7. LIFTING VANG PROVISIONS: SKETCH J + K
8. FALL PROTECTION VANGS: SKETCH N + Q
9. JACKING NUT LOCATIONS: SKETCH I

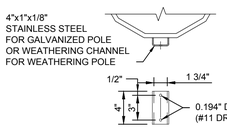
SHIELDWIRE PLAN VIEW



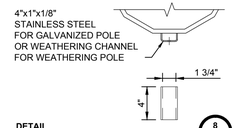
TRANSMISSION PLAN VIEW



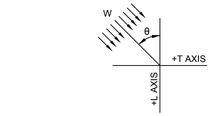
DETAIL 6
REMOVABLE GROUNDING BOLT
(5 PLACES)

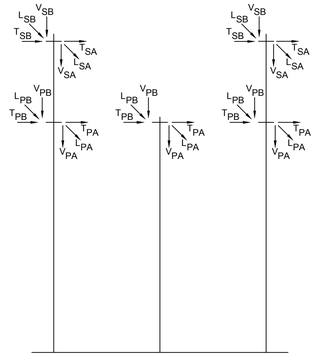


DETAIL 7
WARNING SIGN ATTACHMENT
(10 PLACES)
C



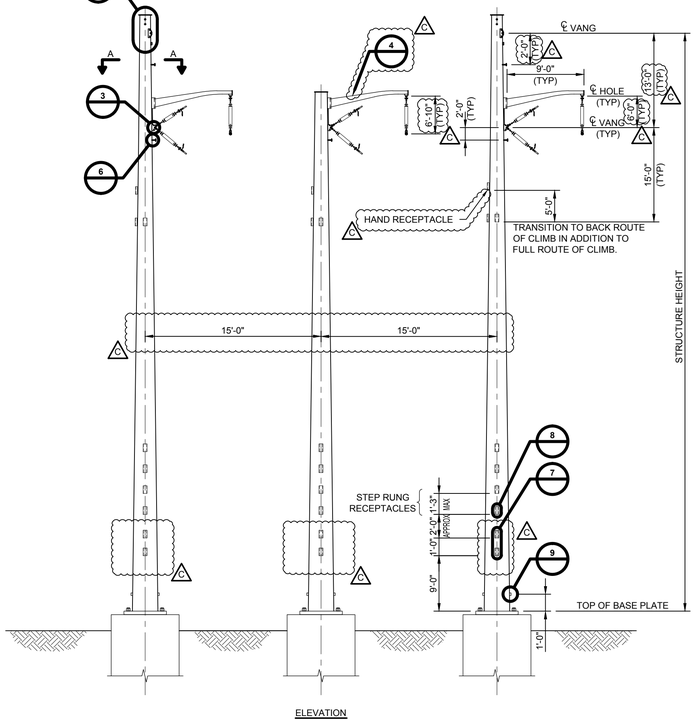
DETAIL 8
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)





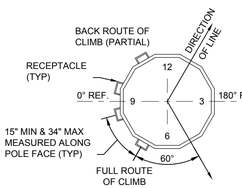
LOADING TREE

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
   D. AHEAD OR BACK CONDUCTORS AND GROUND WIRES ONLY INSTALLED.
7. SNUB ANGLES SHALL BE LIMITED TO A 15 DEGREE DEFLECTION ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE (TBD)
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°.
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
14. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
15. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
16. JUMPER ARMS SHALL BE DESIGNED FOR A VERTICAL LOAD OF 2,000 POUNDS.
17. FALL PROTECTION VANGS FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.
18. 3'-2" CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WORKING SPACE. CLIMBING CORRIDOR IS 3 FEET WIDE CENTERED ON CLIMBING ROUTE.
19. 4'-3" CLEARANCE MUST BE CONSIDERED FROM POLE BODY AND ARMS.

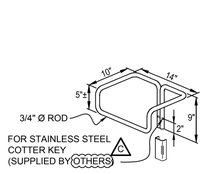


ELEVATION

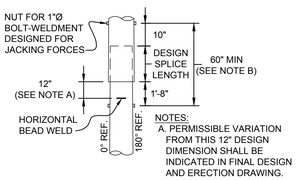
STEP RUNG RECEPTACLE GAGES



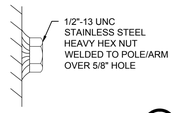
RECEPTACLE LOCATIONS
(HAND RECEPTACLES LOCATED 5' ABOVE FOOT RECEPTACLES)



RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



SPLICE DETAILS JACKING NUT LOCATIONS



DETAIL 9
ATTACHMENT PROVISION LUG
(AERIAL BRACKET & GROUNDING)
(12 PLACES)
C

PRELIMINARY - NOT FOR CONSTRUCTION

REV	DESCRIPTION	ENG/PE #	DATE	DRN	CHKD	APPR
C	MISC. UPDATES	.	5/29/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.
DWG REV	EPN/DESCRIPTION	CONT/PE #	DATE	DRN	CHKD	APPR

CONTRACT SERVICES

THE NORTHERN PASS

115kV AC DEADEND 0-55°
10-SCHSP-LDW-055
LOAD & DESIGN DRAWING

	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP-31.DWG
IMAGE:	
DRAWING NO.	TSP-31-001

8/19/2015 3:01 PM - mspepich - N:\NUSCO\58479 - NPT\Overhead\Cadd\01-Record Worksheets\TSP-31.dwg - 001

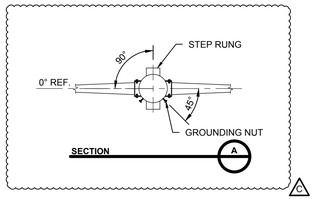
NU VER: 08/2012

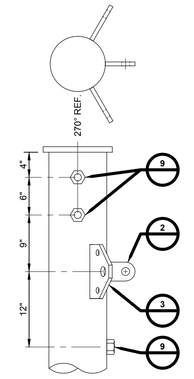
STRUCTURE NAME: 10-SCVSP-LDW-015
115-KV AC CONDUCTOR: 1 - 795 KCMIL 26/7 "DRAKE" ACSR PER PHASE (9000# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 125 WIND SPAN BACK (FT): 125
WEIGHT SPAN AHEAD (FT): 175 WEIGHT SPAN BACK (FT): 175
LINE ANGLE: 0 - 15 DEGREES

LOADING CASE					DESIGN LOADS													
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	0.36	1.41	9.62	0.36	1.41	-9.62	1.22	2.30	15.96	1.22	2.30	-15.96	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.13	0.72	4.51	0.13	0.72	-4.51	0.47	1.46	8.95	0.47	1.46	-8.95	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	0.46	1.13	7.85	0.46	1.13	-7.85	1.10	1.76	12.52	1.10	1.76	-12.52	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	0.61	1.38	9.63	0.61	1.38	-9.63	1.28	2.06	14.66	1.28	2.06	-14.66	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.24	0.82	5.83	0.24	0.82	-5.83	0.82	1.35	9.67	0.82	1.35	-9.67	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.24	0.78	5.50	0.24	0.78	-5.50	0.82	1.26	9.00	0.82	1.26	-9.00	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.24	0.78	5.50	0.24	0.06	0.00	0.82	1.26	9.00	0.82	0.09	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.24	1.37	0.27	1.54	0.70	-5.23	5.11	2.43	0.48	2.05	1.25	-9.24	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.13	0.39	2.96	0.13	0.39	-2.96	0.47	0.68	5.20	0.47	0.68	-5.20	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.06	0.77	5.92	2.06	0.77	-5.92	2.73	1.36	10.40	2.73	1.36	-10.40	0.00	90.00	2.00
11	UPLIFT	-20.00	0.00	0.00	0.13	0.58	4.43	0.13	0.58	-4.43	0.47	1.04	7.99	0.47	1.04	-7.99	0.00	90.00	1.00

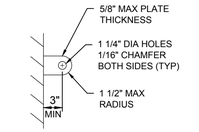
C

REFERENCES:
1. CLIMBING FACILITIES: SKETCH B
2. GROUNDING NUTS: SKETCH B
3. HAND + FOOT RECEPTACLE LOCATIONS: SKETCH C
4. STEP RUNG: SKETCH E
5. ATTACHMENT PROVISIONS FOR SIGNS + GROUNDING: SKETCH F
6. JACKING NUT LOCATIONS: SKETCH I
7. LIFTING VANGS: SKETCH J + K
8. STEP RUNG RECEPTACLE GAGES: SKETCH J
9. FALL PROTECTION VANGS: SKETCH N + Q

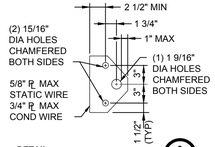




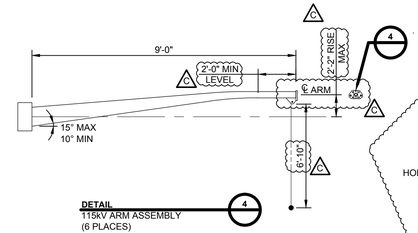
DETAIL
AERIAL MARKER & SHIELDWIRE ATTACHMENT
(1 PLACE)
1



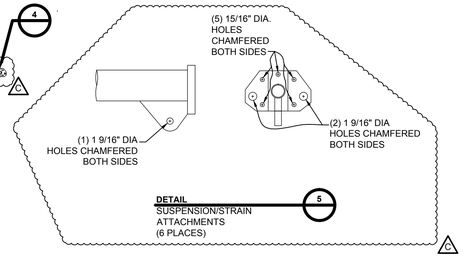
DETAIL
VANG DETAIL
(1 PLACES)
C
2



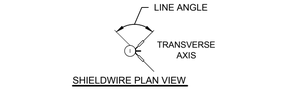
DETAIL
DEADEND VANG
(2 PLACES)
3



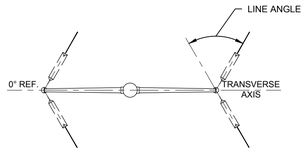
DETAIL
115kV ARM ASSEMBLY
(6 PLACES)
4



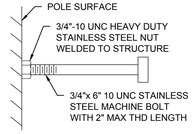
DETAIL
SUSPENSION/STRAIN ATTACHMENTS
(6 PLACES)
5



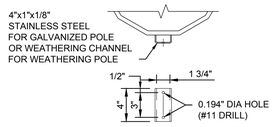
SHIELDWIRE PLAN VIEW



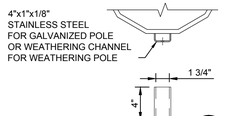
TRANSMISSION PLAN VIEW



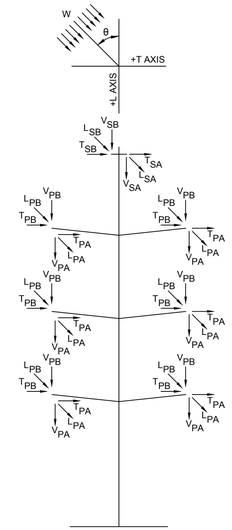
DETAIL
REMOVABLE GROUNDING BOLT
(8 PLACES)
6



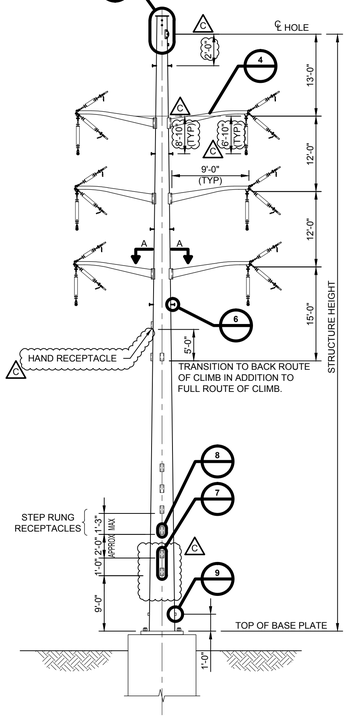
DETAIL
WARNING SIGN ATTACHMENT
(2 PLACES)
C
7



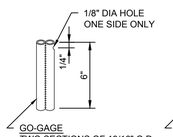
DETAIL
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D)
8



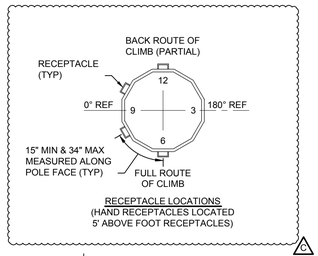
LOADING TREE



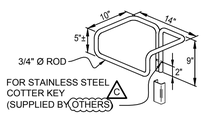
ELEVATION



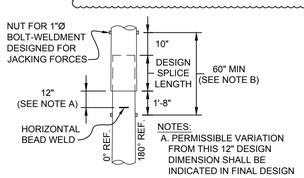
STEP RUNG RECEPTACLE GAGES



RECEPTACLE LOCATIONS
(HAND RECEPTACLES LOCATED 5' ABOVE FOOT RECEPTACLES)
C

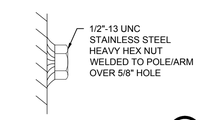


RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)



NOTES:
A. PERMISSIBLE VARIATION FROM THIS 12" DESIGN DIMENSION SHALL BE INDICATED IN FINAL DESIGN AND ERECTION DRAWING.
B. THE 10" AND 1'-8" DIMENSIONS MAY BE INCREASED TO ACHIEVE THIS 60" MIN.

SPLICE DETAILS JACKING NUT LOCATIONS



DETAIL
ATTACHMENT PROVISION LUG
(AERIAL BRACKET & GROUNDING)
C (6 PLACES)
9

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0.
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K.
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE OR GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE.
   D. AHEAD OR BACK CONDUCTORS AND GROUND WIRES ONLY INSTALLED.
7. SNUB ANGLES SHALL BE LIMITED TO A 15 DEGREE DEFLECTION ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE (TBD)
8. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°.
9. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
10. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
11. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
12. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
13. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT.
14. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE.
15. FALL PROTECTION VANGS FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.
16. 3'-2" CLEARANCE MUST BE CONSIDERED FROM CLIMBING AND WORKING SPACE. CLIMBING CORRIDOR IS 3 FEET WIDE CENTERED ON CLIMBING ROUTE.
17. 4'-3" CLEARANCE MUST BE CONSIDERED FROM POLE BODY AND ARMS.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. UPDATES	.	5/29/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/4/15	BLH	.	.

DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

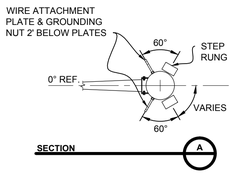
THE NORTHERN PASS

115kV AC DEADEND 0–15°
11–DCVSP–LDW–015
LOAD & DESIGN DRAWING

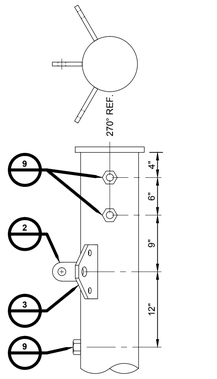
	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	
SCALE	NTS
FILE:	TSP–32.DWG
IMAGE:	
DRAWING NO.	TSP–32–001

8/19/2015 3:03 PM – mspepich – N:\NUSCO\58479 – NPT\Overhead\Cad\01-Record Worksheets\TSP-32.dwg – 001

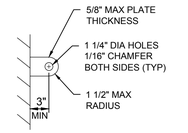
NU VER: 05/2012



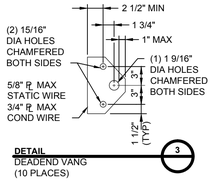
SECTION A



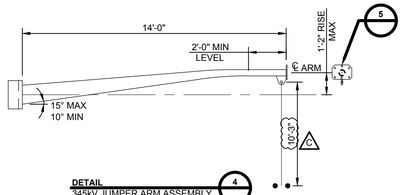
DETAIL
AERIAL MARKER & SHIELDWIRE ATTACHMENT
(2 PLACES) 1



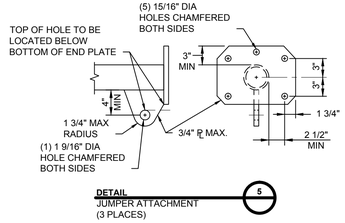
DETAIL
VANG DETAIL
(2 PLACES) 2



DETAIL
DEADEND VANG
(10 PLACES) 3



DETAIL
345kV JUMPER ARM ASSEMBLY
(3 PLACES) 4



DETAIL
JUMPER ATTACHMENT
(3 PLACES) 5

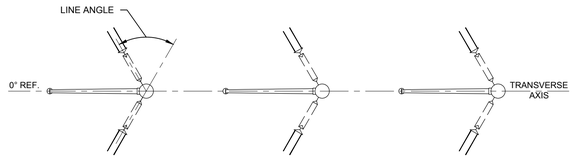
C **REFERENCES:**
1. GOUNDING NUT: SKETCH B
2. STED RUNG + RECEPTACLE : SKETCH E
3. GAGES FOR RECEPTAKLE: SKETCH L
4. CLIMBING FACILITIES: SKETCH B
5. RECEPTACLE LOCATIONS: SKETCH C
6. ADDITIONAL RECEPTACLE LOCATION: SKETCH D
7. ATTACHMENT PROVISIONS FOR GROUNDING AND SIGNS: SKETCH F
8. LIFTING VANG PROVISIONS: SKETCH J + K
9. FALL PROTECTION VANGS: SKETCH N + Q
10. JACKING NUT LOCATIONS: SKETCH I

STRUCTURE NAME: 30-SCHSP-LSW-045
345-KV AC CONDUCTOR: 2 - 1590 KCMIL 45/7 "LAPWING" ACSR PER PHASE (11400# @ NESC HEAVY)
OHGW: 1 - 19 NO.10 ALUMOWELD PER PHASE (5500# @ NESC HEAVY)
WIND SPAN AHEAD (FT): 475 WIND SPAN BACK (FT): 475
WEIGHT SPAN AHEAD (FT): 625 WEIGHT SPAN BACK (FT): 625
LINE ANGLE: 0 - 45 DEGREES

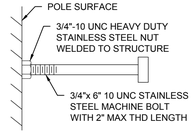
LOADING CASE					DESIGN LOADS													
NO.	DESCRIPTION	TEMP (°F)	ICE (in)	WIND (mph)	VSA (k)	TSA (k)	LSA (k)	VSB (k)	TSB (k)	LSB (k)	VPA (k)	TPA (k)	LPA (k)	VPB (k)	TPB (k)	LPB (k)	W (psf)	θ	K
1	NESC 250B	0.00	0.50	39.53	1.08	4.28	9.62	1.08	4.28	-9.62	7.87	17.76	41.24	7.87	17.76	-41.24	10.00	90.00	1.50
2	NESC 250C	60.00	0.00	100.00	0.33	2.24	4.51	0.33	2.24	-4.51	3.01	11.89	23.11	3.01	11.89	-23.11	29.00	90.00	1.00
3	NESC 250D	15.00	1.00	39.53	1.50	3.46	8.01	1.50	3.46	-8.01	7.58	13.17	31.53	7.58	13.17	-31.53	4.00	90.00	1.00
4	NU EXTREME ICE	15.00	1.25	39.53	2.04	4.27	9.92	2.04	4.27	-9.92	9.04	15.42	36.98	9.04	15.42	-36.98	4.00	90.00	1.00
5	NESC 250B w/o OLF	0.00	0.50	39.53	0.72	2.47	5.83	0.72	2.47	-5.83	5.25	10.36	24.99	5.25	10.36	-24.99	4.00	90.00	1.00
6	BROKEN WIRE (INTACT)	0.00	0.50	39.53	0.72	2.34	5.50	0.72	2.34	-5.50	5.25	9.52	22.80	5.25	9.52	-22.80	4.00	90.00	1.00
7	BROKEN WIRE (BROKEN)	0.00	0.50	39.53	0.72	2.34	5.50	0.72	0.24	0.00	5.25	9.52	22.80	5.25	0.79	0.00	4.00	90.00	1.00
8	CONSTRUCTION	30.00	0.00	29.97	3.85	1.50	0.27	1.85	2.07	-5.23	16.51	6.91	1.21	5.87	9.40	-23.49	3.45	90.00	1.50
9	DEFLECTION	60.00	0.00	0.00	0.33	1.13	2.96	0.33	1.13	-2.96	3.01	5.10	13.34	3.01	5.10	-13.34	0.00	90.00	1.00
10	MAINTENANCE	60.00	0.00	0.00	2.46	2.26	5.92	2.46	2.26	-5.92	7.83	10.21	26.68	7.83	10.21	-26.68	0.00	90.00	2.00
11	UPLIFT	-20.00	0.00	0.00	0.33	1.70	4.43	0.33	1.70	-4.43	3.01	7.92	20.69	3.01	7.92	-20.69	0.00	90.00	1.00

C

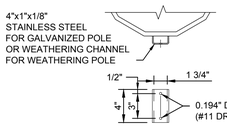
SHIELDWIRE PLAN VIEW



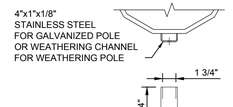
TRANSMISSION PLAN VIEW



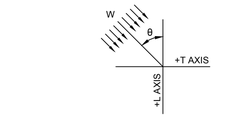
DETAIL
REMOVABLE GROUNDING BOLT
(5 PLACES) 6

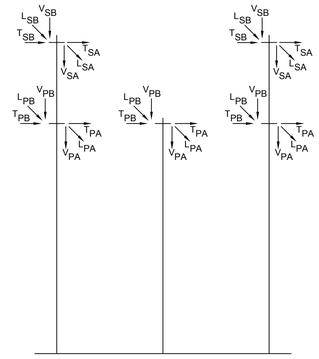


DETAIL
WARNING SIGN ATTACHMENT
(3 PLACES) 7

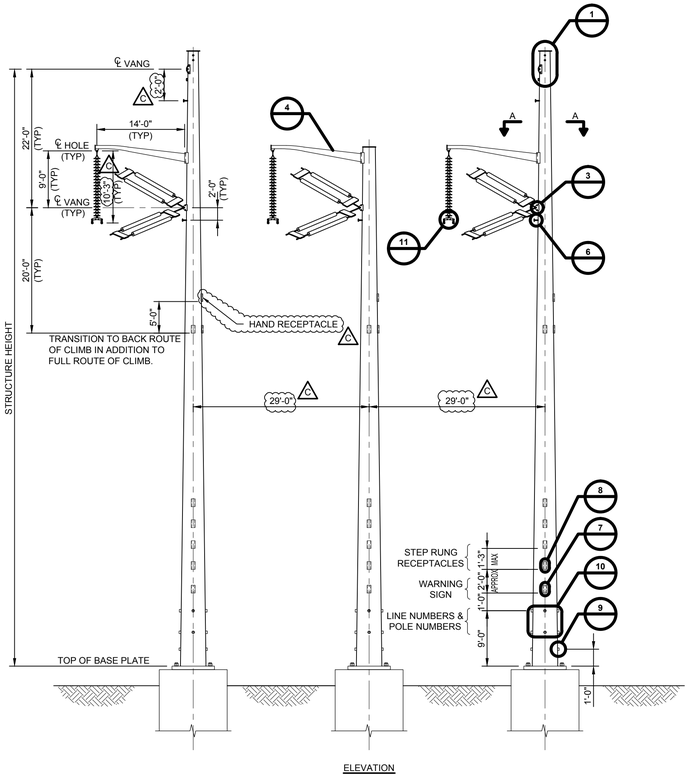


DETAIL
STEP RUNG RECEPTACLE
(ACCEPT GO-GAGE REJECT NO-GO-GAGE)
(AS REQ'D) 8

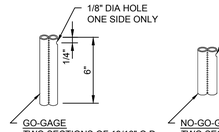




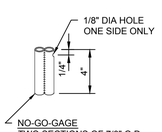
LOADING TREE



ELEVATION

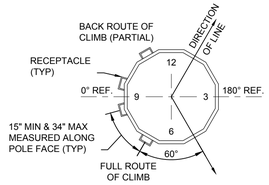


GO-GAGE
TWO SECTIONS OF 13/16" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

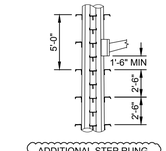


NO-GO-GAGE
TWO SECTIONS OF 7/8" O.D. ROUND MECHANICAL TUBING CARBON STEEL-WELDED OR BRAZED TOGETHER. THICKNESS OF TUBING SUFFICIENT FOR WELDING OR BRAZING.

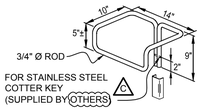
STEP RUNG RECEPTACLE GAGES



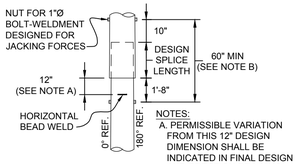
RECEPTACLE LOCATIONS
(HAND RECEPTACLES LOCATED 5' ABOVE FOOT RECEPTACLES) C



ADDITIONAL STEP RUNG RECEPTACLE LOCATIONS C

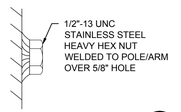


RECEPTACLE & STEP RUNG
(STEP RUNG SUPPLIED BY OTHERS)

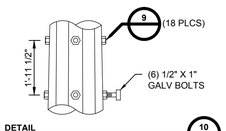


NOTES:
A. PERMISSIBLE VARIATION FROM THIS 12" DESIGN DIMENSION SHALL BE INDICATED IN FINAL DESIGN AND ERECTION DRAWING.
B. THE 10" AND 1'-8" DIMENSIONS MAY BE INCREASED TO ACHIEVE THIS 60" MIN.

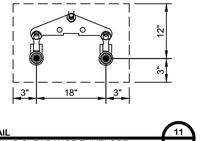
SPLICE DETAILS JACKING NUT LOCATIONS



DETAIL
ATTACHMENT PROVISION LUG
(AERIAL BRACKET, LINE NUMBER, POLE NUMBER & GROUNDING)
(30 PLACES) C 9



DETAIL
LINE & POLE NUMBER ATTACHMENT
(3 PLACES) 10



DETAIL
I-STRING CLEARANCE ENVELOPE
(3 PLACES) 11

NOTES:
1. ALL INDICATED LOADS ARE ULTIMATE AND INCLUDE ALL OVERLOAD FACTORS AS INDICATED IN THE LOAD TABLE. STRUCTURES SHALL BE DESIGNED WITH A MATERIAL STRENGTH FACTOR OF 1.0. C
2. V, T, & L ARE IN KIPS AND ARE THE LOADS IN THE DIRECTION OF THE STRUCTURES VERTICAL, TRANSVERSE AND LONGITUDINAL AXIS RESPECTIVELY.
3. W IS THE WIND LOAD (INCLUSIVE OF OVERLOAD FACTORS) APPLIED TO THE STRUCTURE IN PSF. A SHAPE FACTOR OF 1.0 SHALL BE APPLIED TO THE WIND LOAD.
4. THETA (θ) IS THE ANGLE IN DEGREES BETWEEN THE L-AXIS AND THE WIND DIRECTION AS SHOWN ON THE LOADING TREE DIAGRAM.
5. THE DEAD LOAD OF THE STRUCTURE SHALL BE MULTIPLIED BY K. B
6. THE STRUCTURE SHALL BE DESIGNED FOR THE FOLLOWING CRITERIA OPTIONS:
   A. ALL CONDUCTORS AND GROUND WIRES INSTALLED.
   B. ANY ONE OR MORE PHASES (UP TO ALL PHASES SIMULTANEOUSLY) AND GROUND WIRES SNUBBED. LOAD APPLIED SHALL BE THE CONSTRUCTION LOAD CASE. UNSNUBBED SUPPORTS SHALL BE UNLOADED.
   C. ANY ONE PHASE AND GROUND WIRE BROKEN. LOAD APPLIED AT BROKEN SUPPORT SHALL BE THE BROKEN WIRE LOAD CASE. LOAD APPLIED AT REMAINING SUPPORTS SHALL BE THE BROKEN WIRE (INTACT) LOAD CASE. C
7. SNUB ANGLES SHALL BE LIMITED TO A 15° DEFLECTION ANGLE AND TO A 3 HORIZONTAL TO 1 VERTICAL SNUB.
8. MAX SHIELD ANGLE AT THE STRUCTURE SHALL BE 15°.
9. ALL CLEARANCE CHECKS TO CONDUCTOR SHALL ALLOW FOR A BREAKOVER ANGLE OF 0-20°. CLEARANCES MUST BE CHECKED TO SUBCONDUCTOR ENVELOPE SHOWN IN DETAIL 11. C
10. STRUCTURES SHALL BE DESIGNED AND DETAILED WITH LIFTING POINTS FOR CRANE ERECTION. ALL LIFTING POINTS AND ALL COMPONENTS SHALL BE DESIGNED TO WITHSTAND AT LEAST TWICE THE STATIC LOADS PRODUCED BY THE PROPOSED ERECTION METHOD.
11. TEMPORARY LIFT OR TENSION POINTS, CLOSE TO THE NORMAL ATTACHMENT POINTS OF CONDUCTORS AND USED FOR MAINTENANCE OR LIVE LINE OPERATIONS SHALL BE DESIGNED TO WITHSTAND THE CONDUCTOR LOADS UNDER THE MAINTENANCE LOAD CASE.
12. PROVIDE STEP RUNG RECEPTACLES FOR CLIMBING, STARTING AT A MINIMUM OF 12'-0" ABOVE TOP OF BASE PLATE TO THE TOP OF THE STRUCTURE. SEE RECEPTACLE LOCATIONS DETAIL FOR RECEPTACLE LOCATIONS FOR FULL AND TRANSITION TO BACK ROUTE OF CLIMB. PROVIDE ADDITIONAL RECEPTACLES ON FLATS WHERE NECESSARY, SO THAT ALL PARTS OF THE STRUCTURE, INSULATORS, AND HARDWARE ASSEMBLIES CAN BE REACHED FOR MAINTENANCE.
    CAUTION: "CLIMBING SPACE" HAS BEEN PROVIDED FOR CLIMBING CLEARANCE TO ENERGIZED CONDUCTORS. ADDITIONAL STEP RUNG LOCATIONS MAY NOT PROVIDE ELECTRICAL CLEARANCES TO ENERGIZED CONDUCTORS.
13. VANG AND VANG CONNECTION TO POLE SHALL BE DESIGNED TO WITHSTAND THE RESULTANT LOAD 10 DEGREES EITHER SIDE OF INDICATED LINE ANGLES.
14. MINIMUM ANCHOR BOLT PROJECTION SHALL BE 12 INCHES WITH THE ANCHOR BOLT THREADED LENGTH BEING SUFFICIENT TO ACCOMMODATE STRUCTURE RAKING. PROVIDE ONE (1) BOLT DIAMETER OF THREAD PROJECTING ABOVE THE TOP NUT. C
15. ANCHOR BOLTS SHALL PROJECT ABOVE THE CONCRETE BY THE FULL THREADED LENGTH PLUS 1 INCH OF UNTHREADED ROD WITH NOT MORE THAN 2 TIMES THE DIAMETER OF THE ANCHOR BOLTS BETWEEN CONCRETE AND BOTTOM OF THE BASE PLATE. C
16. JUMPER ARMS SHALL BE DESIGNED FOR A VERTICAL LOAD OF 2,000 POUNDS.
17. FALL PROTECTION VANG FOR CLIMBING & WORKING SHALL BE PROVIDED AS INDICATED IN THE SPECIFICATION AND ON REFERENCE SKETCHES N + Q.

PRELIMINARY - NOT FOR CONSTRUCTION

CONTRACT SERVICES

REV	DESCRIPTION	ENG/PE#	DATE	DRN	CHKD	APPR
C	MISC. UPDATES	.	5/27/15	MSP	.	.
B	MISC. REVISIONS	.	5/8/15	BLH	.	.
A	RELEASE FOR RFP BID	.	5/1/15	BLH	.	.

DWG REV	EPN/DESCRIPTION	CONT/PE#	DATE	DRN	CHKD	APPR

THE NORTHERN PASS

345kV AC LIGHT STRAIN 0–45°
30–SCHSP–LSW–045
LOAD & DESIGN DRAWING

	C
DRAWN	BLH
ENGINEER	CET
CHECKED	TAB
APPROVED	
DATE	5/1/15
SCALE	NTS
FILE:	TSP–33.DWG
IMAGE:	
DRAWING NO.	TSP–33–001

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