


OPGW: 16mm OPGW (To be determined)

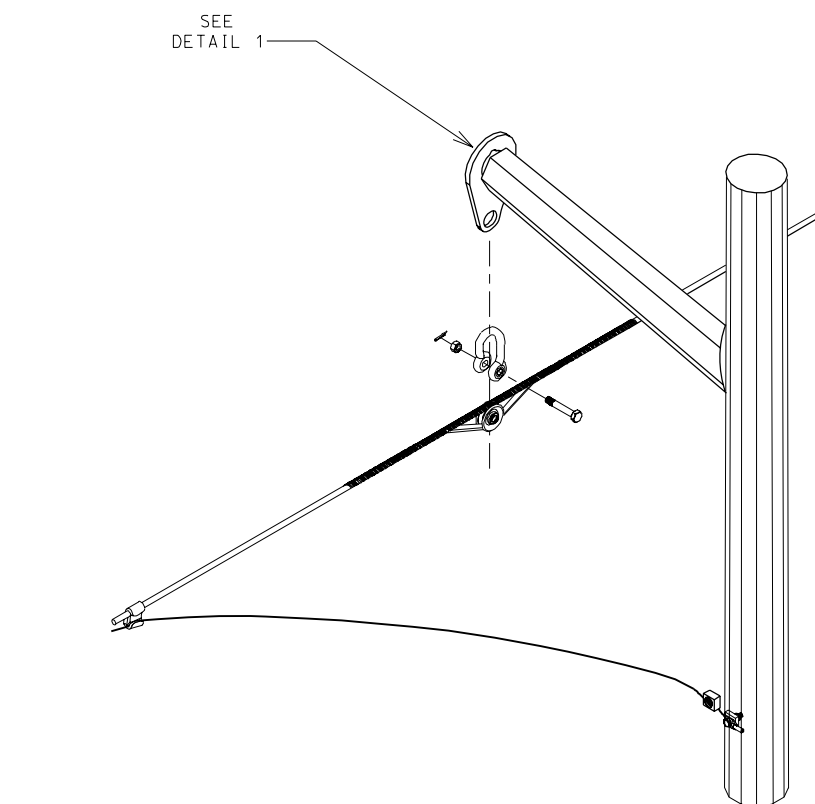
Air Gap Requirements			
Temp.	Wind	Swing	Clearance
(oC)	(Pa)	θ	(a)ft
4	0	10	5.58
4	875	65	2.10
-30	500	50	2.76

Pole Dimensions					
A		B		C	
feet	m	feet	m	feet	m
55	16.76	37.3	11.37	9.5	2.90
60	18.29	41.8	12.74	10	3.05
65	19.81	46.3	14.11	10.5	3.20
70	21.34	50.8	15.48	11	3.35
75	22.86	55.3	16.86	11.5	3.51
80	24.38	59.8	18.23	12	3.66
85	25.91	64.3	19.60	12.5	3.81
90	27.43	68.8	20.97	13	3.96

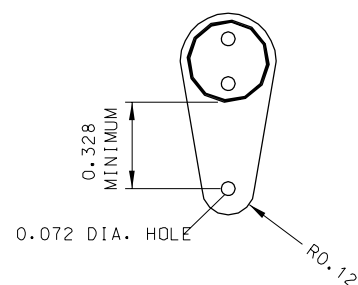
1. Poles are to be designed and fabricated in accordance with ACSE Manuals and reports No. 72 - Design of Steel Transmission Pole Structures, Second Edition.
2. Base plates to be designed for 200 kPa soil.
3. Finish to be galvanized or weathering steel
4. Pole to direct embedded 10% of pole height plus 4 feet.
5. Stainless steel ground tab at pole top & near groundline are required
6. Ladder clips are required
7. Design calculations are to be included with bid for review by SNC-Lavalin ATP Inc.
8. All dimensions to the centre of vang.
9. All dimensions in feet.
10. For assembly drawings see sheet 2.
11. Pole fabrication shall be in accordance with SNC Lavalin ATP Specification #645-04 "Fabrication of Tubular Steel Transmission Structures".
12. Icing on the structure need not be considered in design.

[illegible]

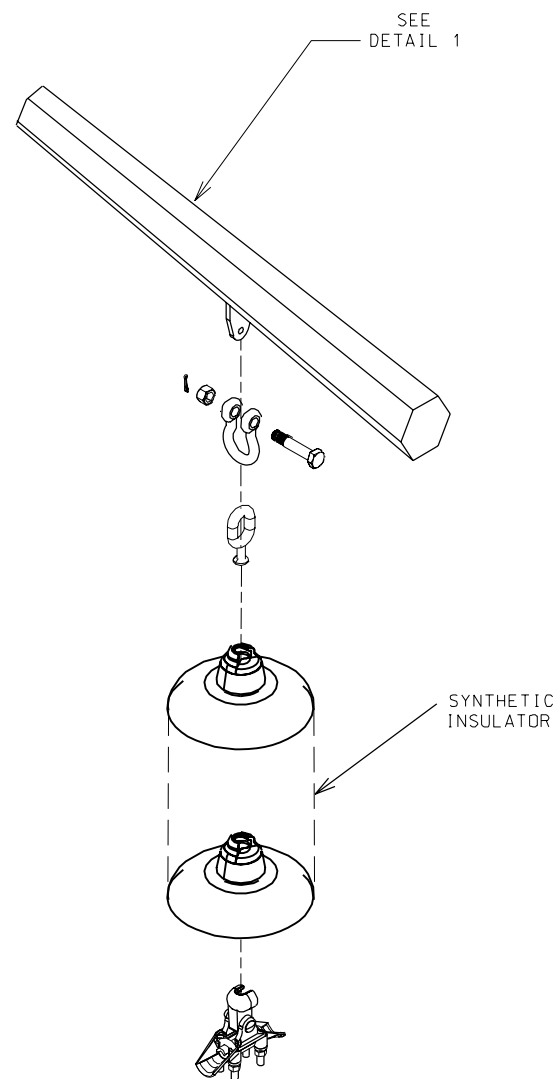
PROFESSIONAL SEAL	 SNC-LAVALIN SNC-Lavalin ATP Inc. 1035 - 7 Ave. S.W. Calgary, Alberta Canada T2P 2N4		CLIENT	MONTANA ALBERTA TIE LTD.	
	DESIGNED	APPROVAL	PROJECT	MONTANA-ALBERTA TIE LINE	
	PAUL DILLON	PROJECT DISCIPLINE ENGINEER			
	DRAWN	PROJECT ENGINEERING MANAGER	TITLE	230KV H-FRAME TANGENT STR. TYPE 1 AND TYPE2	
	J. GORDG				
	CHECKED				
	DATE	CLIENT	DOCUMENT No.	REV	
05-02-15					
SCALE	SHEET	MATLP-43-D1-0003		B	
NTS	1 OF 2				



ASSEMBLY SNC 13
STEEL ARM



DETAIL 1
ATTACHMENT DETAIL



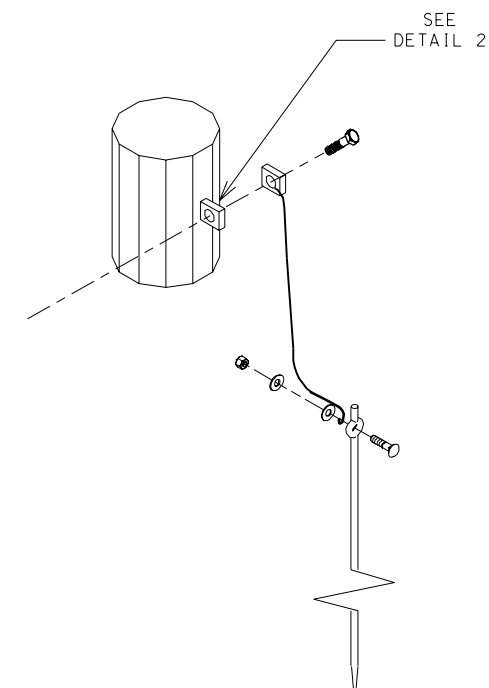
ASSEMBLY SNC 114

NOTE:
1. UNLESS OTHERWISE INDICATED, ALL DIMENSIONS
ARE IN FEET.

MATERIAL AND ITEM LIST FOR STRUCTURE SNC13		
QTY	ASSEMBLY	DESCRIPTION
1	SNC13	SUSPEN, PRFD TWIN:GRIP TWRS. 5/16"
1	SNC13	CONNECTOR, WEDGE-TYPE
1	SNC13	CARTRIDGE, COLOR CODE RED
1	SNC13	SHACKLE, TWISTED W/BOLT, 90 kN
1	SNC13	CLAMP, GROUND, BRZ. 1/2 H.H. BOLT LW&NUT
1	SNC13	WIRE, #2ACSR STD OR SB FOR GND DOWNLEAD


MATERIAL AND ITEM LIST FOR STRUCTURE SNC114		
QTY	ASSEMBLY	DESCRIPTION
1	SNC114	BALL-EYE, GLV. 50MM X25 MM OVAL. 111 KN
1	SNC114	CLAMP, SOCKET SUSPENSION
1	SNC114	SHACKLE, CHAIN W. BOLT , 90 kN
1	SNC114	INSULATOR, SYN, SOC-BALL, SIL, 240KV

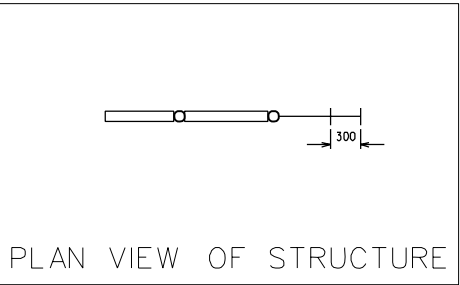
MATERIAL AND ITEM LIST FOR STRUCTURE SNC4		
QTY	ASSEMBLY	DESCRIPTION
1	SNC4	CONNECTOR, #2/0 OR #4/0 TO FLAT SURFACE
3	SNC4	WIRE, CU, SOLID, SD BARE #4
1	SNC4	ROD, GROUND, 5/8" X 8', STEEL



ASSEMBLY SNC 4

[illegible]

PROFESSIONAL SEAL	 SNC-LAVALIN SNC-Lavalin ATP Inc. 1035 - 7 Ave. S.W. Calgary, Alberta Canada T2P 2M4	CLIENT MONTANA ALBERTA TIE LTD.	
	PREPARATION	APPROVAL	PROJECT MONTANA-ALBERTA TIE LINE
	DESIGNED PAUL DILLON	PROJECT DISCIPLINE ENGINEER	
	DRAWN J. GOROG	PROJECT ENGINEERING MANAGER	TITLE 230KV H-FRAME TANGENT STR. ASSEMBLIES TYPE 1 AND TYPE 2
	CHECKED		
	DATE 05-02-15	CLIENT	
	SCALE	SHEET 2 OF 2	
		DOCUMENT NO. MATLP-43-D1-0003	REV B



MATERIAL AND ITEM LIST FOR STRUCTURE MATL-43-D1-0004		
QTY	ASSEMBLY	DESCRIPTION
4	SNC158	GUY STRAIN INSULATOR, 240KV, 100KN UTS
3	SNC114	INSULATOR, SYN, SOC-BALL, SIL, 240KV
3	SNC114	SHACKLE, CHAIN W. BOLT , 90 kN
2	SNC13	SHACKLE, TWISTED W/BOLT, 90 kN
2	SNC13	SUSPEN, PRFD TWIN:GRIP TWRS. 5/16"
2	SNC304	ROD, GROUND, 5/8" X 8', STEEL
3	SNC114	CLAMP, SOCKET SUSPENSION
8	SNC156	GRIP, PRFD 7/16 GUY 40, GREEN
8	SNC158	GRIP, PRFD 7/16 GUY 40, GREEN
2	SNC13	CARTRIDGE, COLOR CODE RED
2	SNC13	CONNECTOR, WEDGE-TYPE
2	SNC304	CONNECTOR, #2/0 OR #4/0 TO FLAT SURFACE
140	SNC156	WIRE, GUY,7 STR. STL, GR.180,7/16"DIA.
2	SNC13	WIRE, #2ACSR STD OR SB FOR GND DOWNLEAD
6	SNC304	WIRE, CU, SOLID, SD BARE #4
2	SNC13	CLAMP, GROUND, BRZ. 1/2 H.H. BOLT LW&NUT
3	SNC114	BALL-EYE, GLV. 50MM X25 MM OVAL. 111 kN
4	SNC156	CLEVIS, THIMBLE, GALV. 20MM SPREAD

Structure: 240kV H-Frame Light Angle Structure
Deflection : 5 Degree Line Angle
Conductor: 1033 kcmil ACSR Curlew
O.H.S.W.: 5/16" Steel Grade 220
OPGW: 16mm OPGW (To be determined)


Air Gap Requirements				
Temp.	Wind	Swing		Clearance
(oC)	(Pa)	(q) - Degrees		(a) - ft
4	0	35	35	5.58
4	875	85	-65	2.10
-30	500	56	-35	2.76

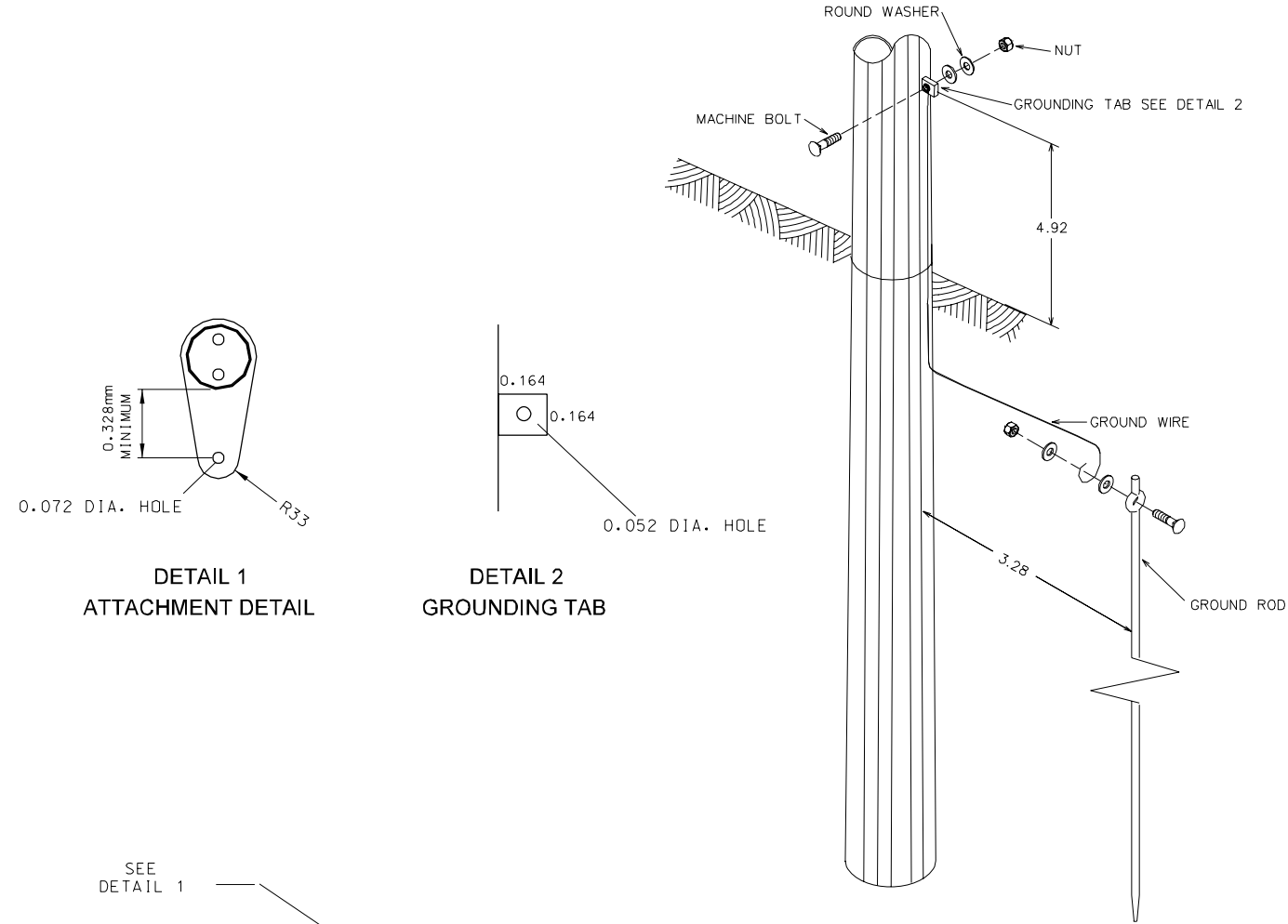
Pole Dimensions					
A		B		C	
feet	m	feet	m	feet	m
55	16.76	37.3	11.37	9.5	2.90
60	18.29	41.8	12.74	10	3.05
65	19.81	46.3	14.11	10.5	3.20
70	21.34	50.8	15.48	11	3.35
75	22.86	55.3	16.86	11.5	3.51
80	24.38	59.8	18.23	12	3.66
85	25.91	64.3	19.60	12.5	3.81
90	27.43	68.8	20.97	13	3.96

General Notes:

1. Poles are to be designed and fabricated in accordance with ACSE Manuals and reports No. 72 - Design of Steel Transmission Pole Structures, Second Edition.
2. Base plates to be designed for 200kPa soil.
3. Finish to be galvanized or weathering steel
4. Pole to direct embedded 10% of pole height plus 4 feet.
5. Stainless steel ground tab at pole top & near groundline are required
6. Ladder clips are required
7. Design calculations are to be included with bid for review by SNC-Lavalin ATP Inc.
8. All dimensions to the centre of vang.
9. All dimensions in feet.
10. For assembly drawings see sheet 2 and 3.
11. Pole fabrication shall be in accordance with SNC Lavalin ATP Specification #645-04 "Fabrication of Tubular Steel Transmission Structures".
12. Icing on the structure need not be considered in design.

[illegible]

PROFESSIONAL SEAL  SNC-LAVALIN SNC-Lavalin ATP Inc. 1035 - 7 Ave. S.W. Calgary, Alberta Canada T2P 2M4	PREPARATION		APPROVAL		CLIENT	MONTANA ALBERTA TIE LINE LTD	
	DESIGNED PAUL DILLON		PROJECT DISCIPLINE ENGINEER		PROJECT	MONTANA-ALBERTA TIE LINE	
	DRAWN J. GOROG		PROJECT ENGINEERING MANAGER		TITLE	230kV H-FRAME TANGENT STR.	
	CHECKED						
	DATE 05-02-15		CLIENT				
	SCALE NTS		SHEET 1 OF 3		DOCUMENT No.	REV	
					MATLP-43-D1-0004		B



DETAIL 1
ATTACHMENT DETAIL

DETAIL 2
GROUNDING TAB

ASSEMBLY SNC 4

ASSEMBLY SNC 13
STEEL ARM

NOTE:
1. UNLESS OTHERWISE INDICATED, ALL DIMENSIONS
ARE IN FEET.

MATERIAL AND ITEM LIST FOR STRUCTURE SNC13		
QTY	ASSEMBLY	DESCRIPTION
1	SNC13	SUSPEN, PRFD TWIN:GRIP TWRS. 5/16"
1	SNC13	CONNECTOR, WEDGE-TYPE
1	SNC13	CARTRIDGE, COLOR CODE RED
1	SNC13	SHACKLE, TWISTED W/BOLT, 90 kN
1	SNC13	CLAMP, GROUND, BRZ. 1/2 H.H. BOLT LW&NUT
1	SNC13	WIRE, #2ACSR STD OR SB FOR GND DOWNLEAD

MATERIAL AND ITEM LIST FOR STRUCTURE SNC4		
QTY	ASSEMBLY	DESCRIPTION
1	SNC4	CONNECTOR, #2/0 OR #4/0 TO FLAT SURFACE
3	SNC4	WIRE, CU, SOLID, SD BARE #4
1	SNC4	ROD, GROUND, 5/8" X 8', STEEL

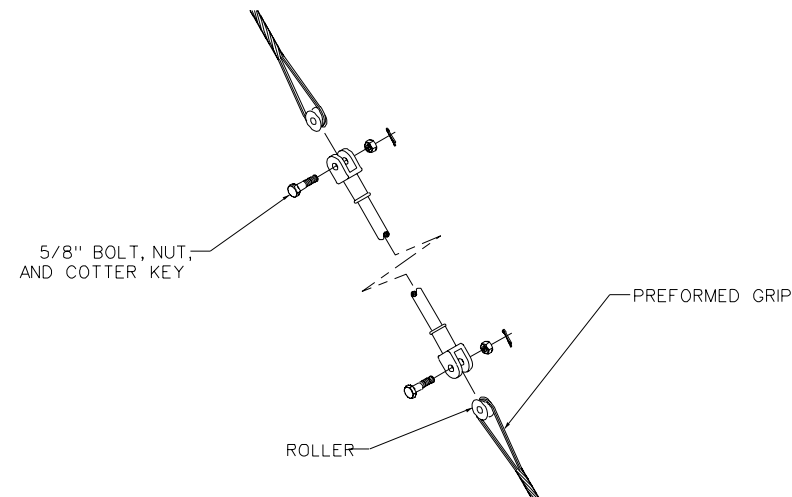
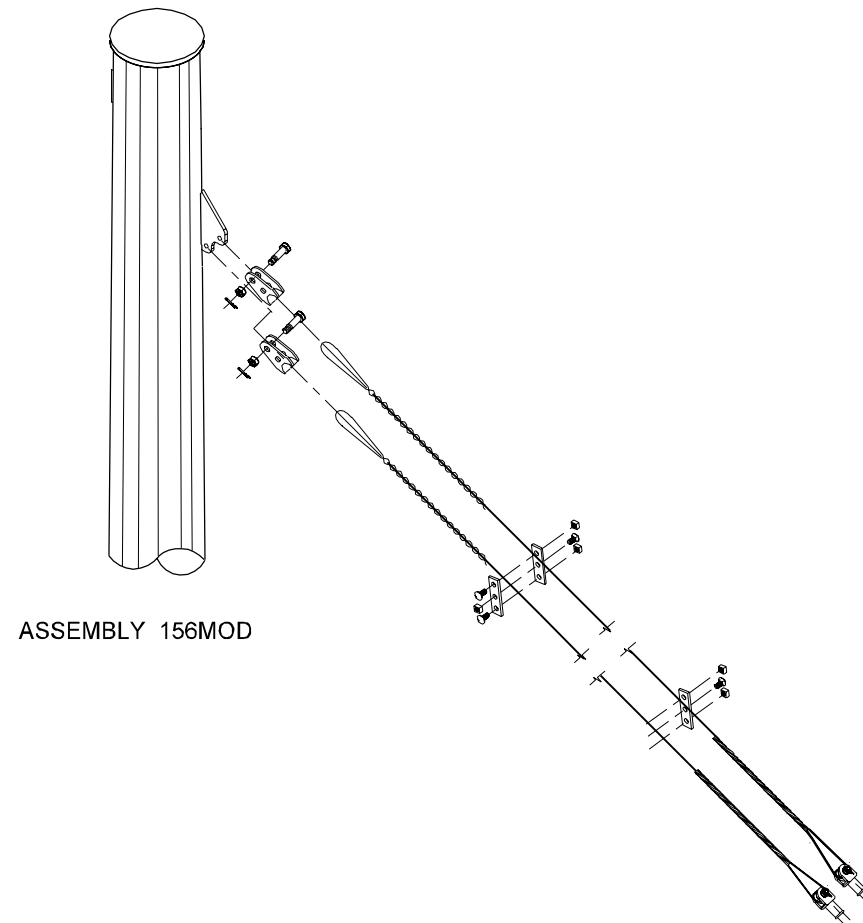
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ISSUE No	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No	No	REVISION DESCRIPTION	DATE (Y/M/D)
1	A	05/02/18	ISSUED FOR BID		A	ISSUED FOR BID	05/02/15
						INITIALS: * DESIGNED ** APPROVED	

PROFESSIONAL SEAL		SNC-Lavalin ATP Inc. 1035 - 7 Ave. S.W. Calgary, Alberta Canada T2P 2M4		CLIENT MONTANA ALBERTA TIE LTD.	
DESIGNED PAUL DILLON		APPROVAL PROJECT DISCIPLINE ENGINEER		PROJECT MONTANA-ALBERTA TIE LINE	
DRAWN J. GOROG		PROJECT ENGINEERING MANAGER		TITLE 230kV H-FRAME LIGHT ANGLE ASSEMBLIES	
CHECKED				DOCUMENT No. MATLP-43-D1-0004	
DATE 05-02-15		CLIENT		REV B	
SCALE		SHEET 2 OF 3			

MATERIAL AND ITEM LIST FOR STRUCTURE SNC158		
QTY	ASSEMBLY	DESCRIPTION
4	SNC158	GRIP, PRFD 7/16 GUY 40, GREEN
2	SNC158	GUY STRAIN INSULATOR, 240KV, 100KN UTS

MATERIAL AND ITEM LIST FOR STRUCTURESNC156		
QTY	ASSEMBLY	DESCRIPTION
2	SNC156	CLEVIS, THIMBLE, GALV, 20MM SPREAD
4	SNC156	GRIP, PRFD 7/16 GUY 40, GREEN
70	SNC156	WIRE, GUY, 7 STR, STL, GR.180, 7/16"DIA.

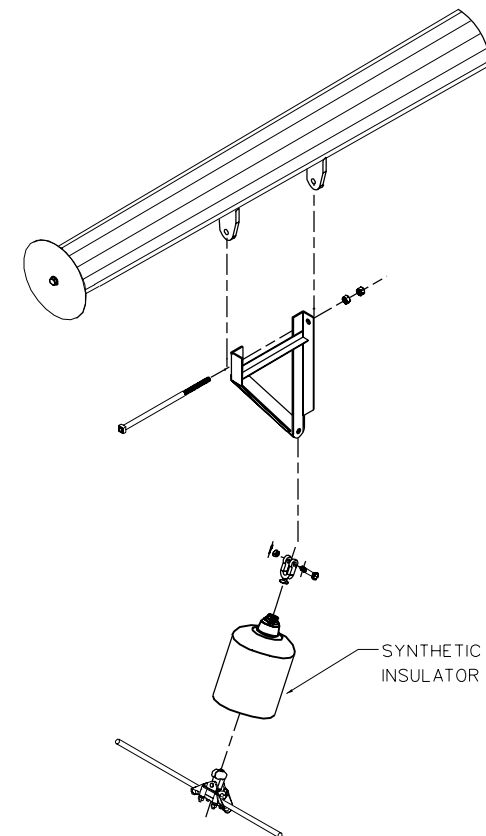
MATERIAL AND ITEM LIST FOR STRUCTURE SNC106		
QTY	ASSEMBLY	DESCRIPTION
1	SNC106	BALL-CLEVIS, GLV, 60MM D, 22MM S, M16 B
1	SNC106	INSULATOR, SYN, SOC-BALL, SIL, 240KV
1	SNC106	ROD, ARMOUR, PRFD AL, CURLEW(2.54)BLK 12
1	SNC106	CLAMP, ANGLE SUSP, SOCK, 1,40-2.18



-PREFORMED GRIP

ROLLER-

ASSEMBLY 158



ASSEMBLY 106

[illegible]

B	PRELIMINARY DESIGN	05/03/29	PO
A	ISSUED FOR BID	05/02/15	PO
No	REVISION DESCRIPTION	DATE (Y/M/D)	•
INITIALS: * DESIGNED ** APPROVED			

PROFESSIONAL SEAL



SNC-Lavalin ATP Inc.
1035 - 7 Ave. S.W.
Calgary, Alberta
Canada T2P 2M4

PREPARATION	APPROVAL
DESIGNED PAUL DILLON	PROJECT DISCIPLINE ENGINEER
DRAWN J. GOROG	PROJECT ENGINEERING MANAGER
CHECKED	
DATE 05-02-15	CLIENT
SCALE	SHEET 3 OF 3

	APPROVAL
	PROJECT DISCIPLINE ENGINEER
	PROJECT ENGINEERING MANAGER

DESIGNED BY J. GOROG	PROJECT ENGINEERING NUMBER
CHECKED BY	
DATE 05-02-15	CLIENT
SCALE	SHEET 3 OF 3

CLIENT	MONTANA ALBERTA TIE LTD.	
PROJECT	MONTANA-ALBERTA TIE LINE	
TITLE	230kV H-FRAME LIGHT ANGLE ASSEMBLIES	
DOCUMENT No.	MATLP-43-D1-0004	REV B

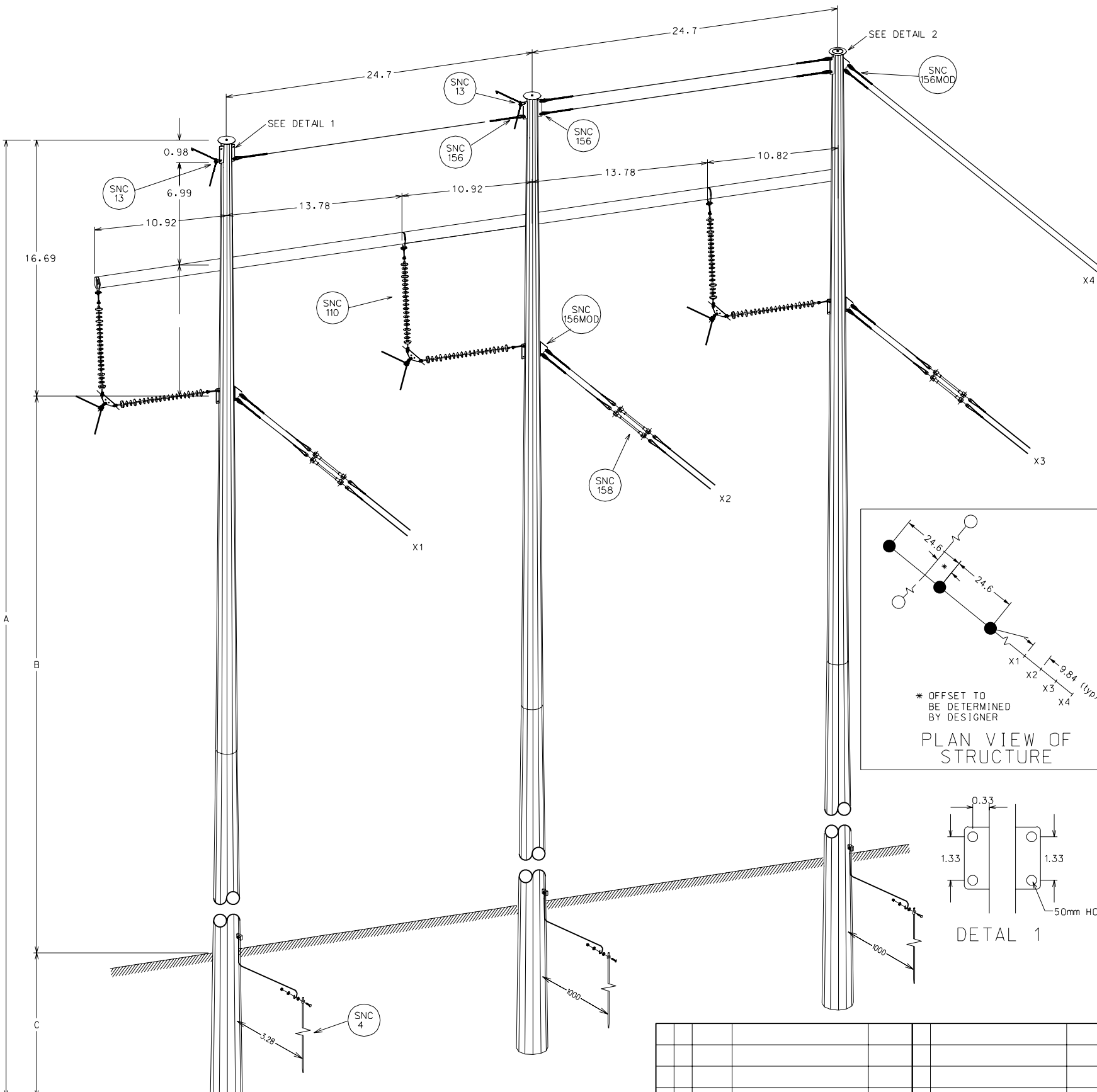
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C

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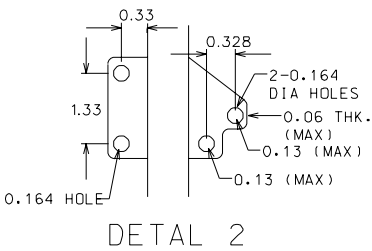
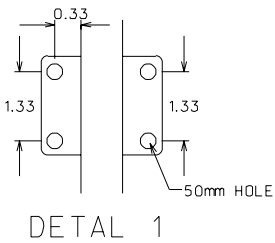
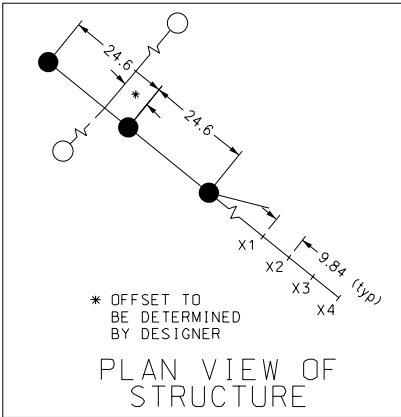


MATERIAL AND ITEM LIST FOR STRUCTURE MATL-43-D1-005		
QTY	ASSEMBLY	DESCRIPTION
0	SNC110	SOCKET-CLEVIS, GLV. 38MM D, 22MM S, M16
0	SNC110	BALL-CLEVIS, GLV. 38MM D, 22MM S, M16 B
0	SNC156, MOD	CLEVIS, THIMBLE, GALV. 20MM SPREAD
0	SNC110	BALL-EYE, GLV. 50MM X25 MM OVAL, 111 KN
0	SNC110	PLATE, YOKE, 16 SPACING
0	SNC110	BALL-Y-CLEVIS, GLV. H/L 680MM L, M20 BLT
0	SNC13	CLAMP, GROUND, BRZ. 1/2 H.H. BOLT LW&NUT
0	SNC304	WIRE, CU, SOLID, SD BARE #4
0	SNC13	WIRE, #2ACSR STD OR SB FOR GND DOWNLEAD
0	SNC156, MOD	WIRE, GUY, 7 STR. STL, GR.180, 7/16"DIA.
0	SNC304	CONNECTOR, #2/0 OR #4/0 TO FLAT SURFACE
0	SNC13	CONNECTOR, WEDGE-TYPE
0	SNC13	CARTRIDGE, COLOR CODE RED
0	SNC156, MOD	GRIP, PRFD 7/16 GUY 40, GREEN
0	SNC110	ROD, ARMOUR, PRFD AL, CURLEW(2.54)BLK 12
0	SNC110	CLAMP, ANGLE SUSP, SOCK, 1.40-2.18
0	SNC304	ROD, GROUND, 5/8" X 8', STEEL
0	SNC13	SUSPEN, PRFD TWIN:GRIP TWRS. 5/16"
0	SNC13	SHACKLE, TWISTED W/BOLT, 90 kN
0	SNC110	SHACKLE, CHAIN W. BOLT, 90 kN
0	SNC110	INSULATOR, SYN, SOC-BALL, SIL, 240kV

Structure: 240kV Three Pole Medium Angle Structure
Deflection : 5 to 20 Degree Line Angle
Conductor: 1033 kcmil ACSR Curlew
O.H.S.W.: 5/16" Steel Grade 220
OPGW: 16mm OPGW (To be determined)

Pole Dimensions					
A		B		C	
feet	m	feet	m	feet	m
75	22.86	46.78	14.26	11.5	3.51
80	24.38	51.28	15.63	12	3.66
85	25.91	55.81	17.01	12.5	3.81
90	27.43	60.30	18.38	13	3.96

- General Notes:
- Poles are to be designed and fabricated in accordance with ACSE Manuals and reports No. 72 - Design of Steel Transmission Pole Structures, Second Edition.
 - Base plates to be designed for 200kPa soil.
 - Finish to be galvanized or weathering steel
 - Pole to direct embedded 10% of pole height plus 4 feet.
 - All dimensions are to the centre of the vang.
 - Stainless steel ground tab at pole top & near groundline are required
 - Ladder clips are required
 - Design calculations are to be included with bid for review by SNC-Lavalin ATP Inc.
 - Unless otherwise indicated, all dimensions are in feet.
 - For assembly drawings see sheets 2 and 3.
 - Pole fabrication shall be in accordance with SNC Lavalin ATP Specification #645-04 "Fabrication of Tubular Steel Transmission Structures".
 - Icing on the structure need not be considered in design.



- NOTES:
- OLF = 1.67
 - ULTIMATE STRENGTH OF GUY VANG = 30000 LBS. PER CONNECTION POINT.

ISSUE REGISTER				REVISION REGISTER			
ISSUE NO	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER NO	No	REVISION DESCRIPTION	DATE (Y/M/D)
1	A	05/02/18	ISSUED FOR BID		B	PRELIMINARY DESIGN	05/03/29
					A	PRELIMINARY DESIGN	05/02/16
						INITIALS: * DESIGNED ** APPROVED	

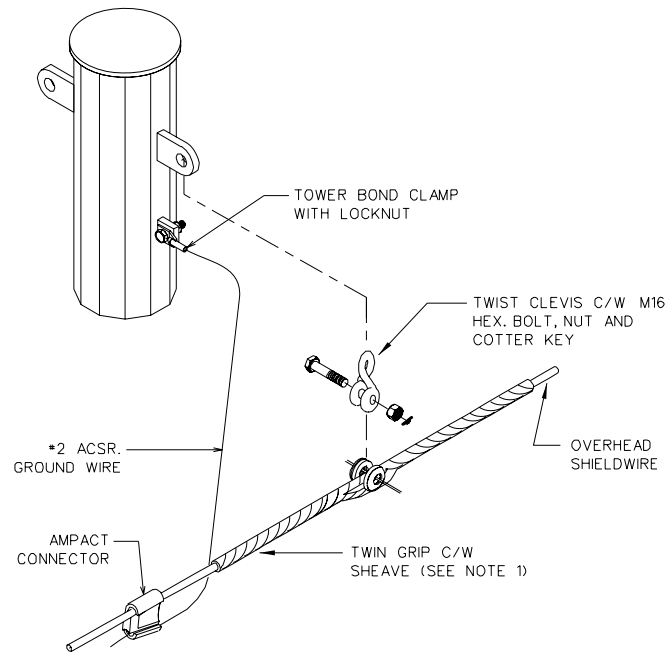
PROFESSIONAL SEAL



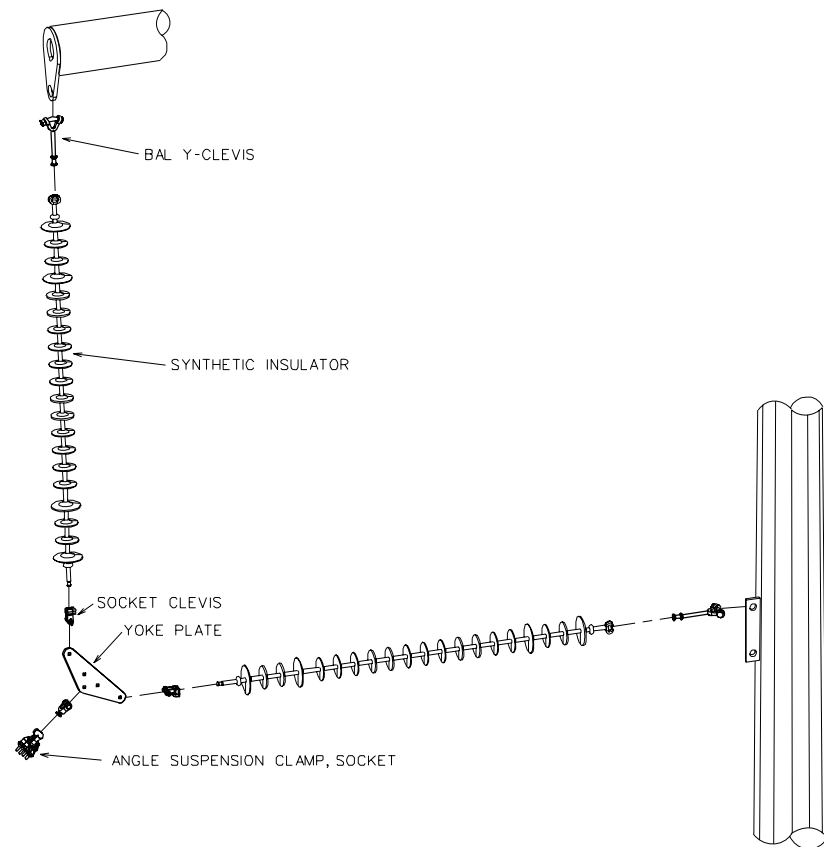
SNC-Lavalin ATP Inc.
1035 - 7 Ave. S.W.
Calgary, Alberta
Canada T2P 2M4

PREPARATION		APPROVAL	
DESIGNED	P. DILLON	PROJECT DISCIPLINE ENGINEER	
DRAWN	A. MAY	PROJECT ENGINEERING MANAGER	
CHECKED			
DATE	05-02-16	CLIENT	
SCALE	NTS	SHEET	1 OF 3

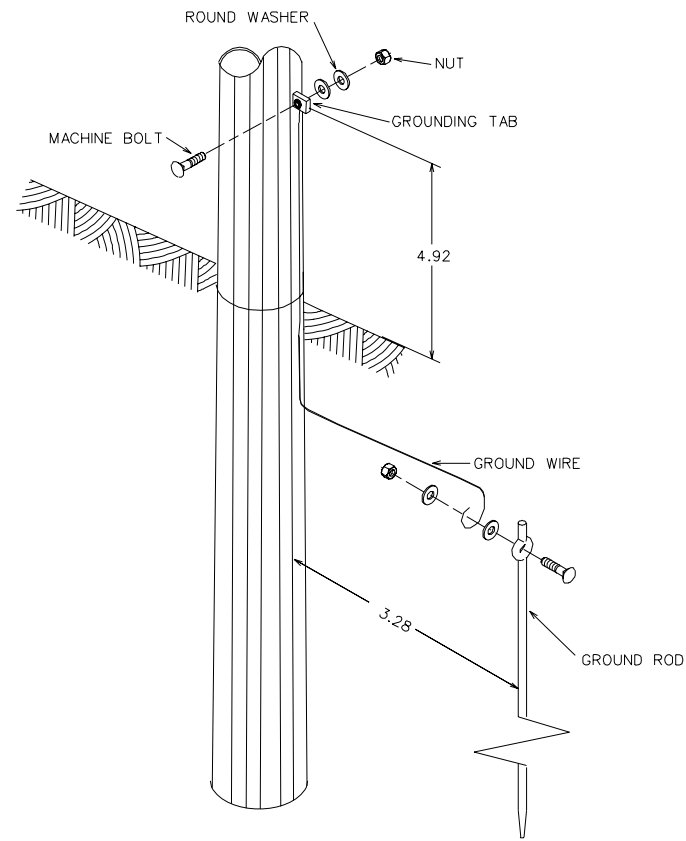
PERMIT TO PRACTICE STAMP	
CLIENT	MONTANA ALBERTA TIE LTD.
PROJECT	MONTANA-ALBERTA TIE LINE
TITLE	THREE POLE 230KV MEDIUM ANGLE STRUCTURE WITH TWO OVERHEAD SHIELD WIRES
DOCUMENT No.	MATLP-43-D1-0005
REV	B



ASSEMBLY SNC 13



ASSEMBLY SNC 110



ASSEMBLY SNC 4

MATERIAL AND ITEM LIST FOR STRUCTURE SNC13		
QTY	ASSEMBLY	DESCRIPTION
1	SNC13	SUSPEN, PRFD TWIN:GRIP TWRS. 5/16"
1	SNC13	CONNECTOR, WEDGE-TYPE
1	SNC13	CARTRIDGE, COLOR CODE RED
1	SNC13	SHACKLE, TWISTED W/BOLT, 90 kN
1	SNC13	CLAMP, GROUND, BRZ. 1/2 H.H. BOLT LW&NUT
1	SNC13	WIRE, #2ACSR STD OR SB FOR GND DOWNLEAD

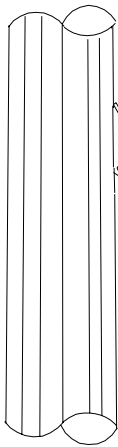
MATERIAL AND ITEM LIST FOR STRUCTURE SNC4		
QTY	ASSEMBLY	DESCRIPTION
1	SNC4	CONNECTOR, #2/0 OR #4/0 TO FLAT SURFACE
3	SNC4	WIRE, CU, SOLID, SD BARE #4
1	SNC4	ROD, GROUND, 5/8" X 8', STEEL

MATERIAL AND ITEM LIST FOR STRUCTURE SNC110		
QTY	ASSEMBLY	DESCRIPTION
2	SNC110	SOCKET-CLEVIS, GLV. 38MM D, 22MM S, M16
1	SNC110	BALL-CLEVIS, GLV. 38MM D, 22MM S, M16 B
1	SNC110	PLATE, YOKE, 16 SPACING
2	SNC110	BALL-Y-CLEVIS, GLV. H/L 680MM L, M20 BLT
1	SNC110	ROD, ARMOUR, PRFD AL, CURLEW(2.54)BLK 12
1	SNC110	CLAMP, ANGLE SUSP, SOCK, 1.40-2.18
2	SNC110	INSULATOR, SYN, SOC-BALL, SIL, 240kV

NOTE:
1. UNLESS OTHERWISE INDICATED ALL DIMENSIONS
ARE IN FEET.

ISSUE REGISTER				REVISION REGISTER			
ISSUE NO	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER NO	No	REVISION DESCRIPTION	DATE (Y/M/D)
1	A	05/02/18	ISSUED FOR BID		A	ISSUED FOR BID	05/02/16
						INITIALS: * DESIGNED ** APPROVED	

PROFESSIONAL SEAL		SNC-Lavalin ATP Inc. 1035 - 7 Ave. S.W. Calgary, Alberta Canada T2P 2M4		CLIENT	MONTANA ALBERTA TIE LTD.	
DESIGNED PAUL DILLON		APPROVAL PROJECT DISCIPLINE ENGINEER		PROJECT	MONTANA-ALBERTA TIE LINE	
DRAWN R. BROUILLETTE		PROJECT ENGINEERING MANAGER		TITLE	THREE POLE 230KV MEDIUM ANGLE STRUCTURE WITH 2 OHSW ASSEMBLY DRAWINGS	
CHECKED				DATE	05-02-16	
SCALE NTS		SHEET 2 OF 3		DOCUMENT No.	MATLP-43-D1-0005	
				REV	B	



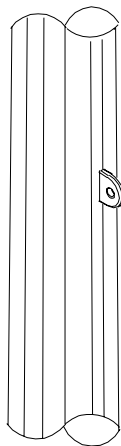
DEAD-END CLEVIS

PREFORMED GRIP

GUY WIRE

3-BOLT CLAMP

ASSEMBLY SNC 156 MOD



DEAD-END CLEVIS

PREFORMED GRIP

ASSEMBLY SNC 156

BOLT, NUT,
AND COTTER KEY

PREFORMED GRIP

ROLLER

ASSEMBLY SNC 158

MATERIAL AND ITEM LIST FOR STRUCTURE SNC156		
QTY	ASSEMBLY	DESCRIPTION
1	SNC156MOD	CLEVIS, THIMBLE, GALV. 20MM SPREAD
2	SNC156MOD	GRIP, PRFD 7/16 GUY 40, GREEN
20	SNC156MOD	WIRE, GUY,7 STR. STL, GR.180,7/16"DIA.

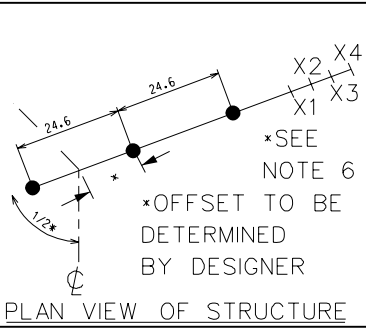
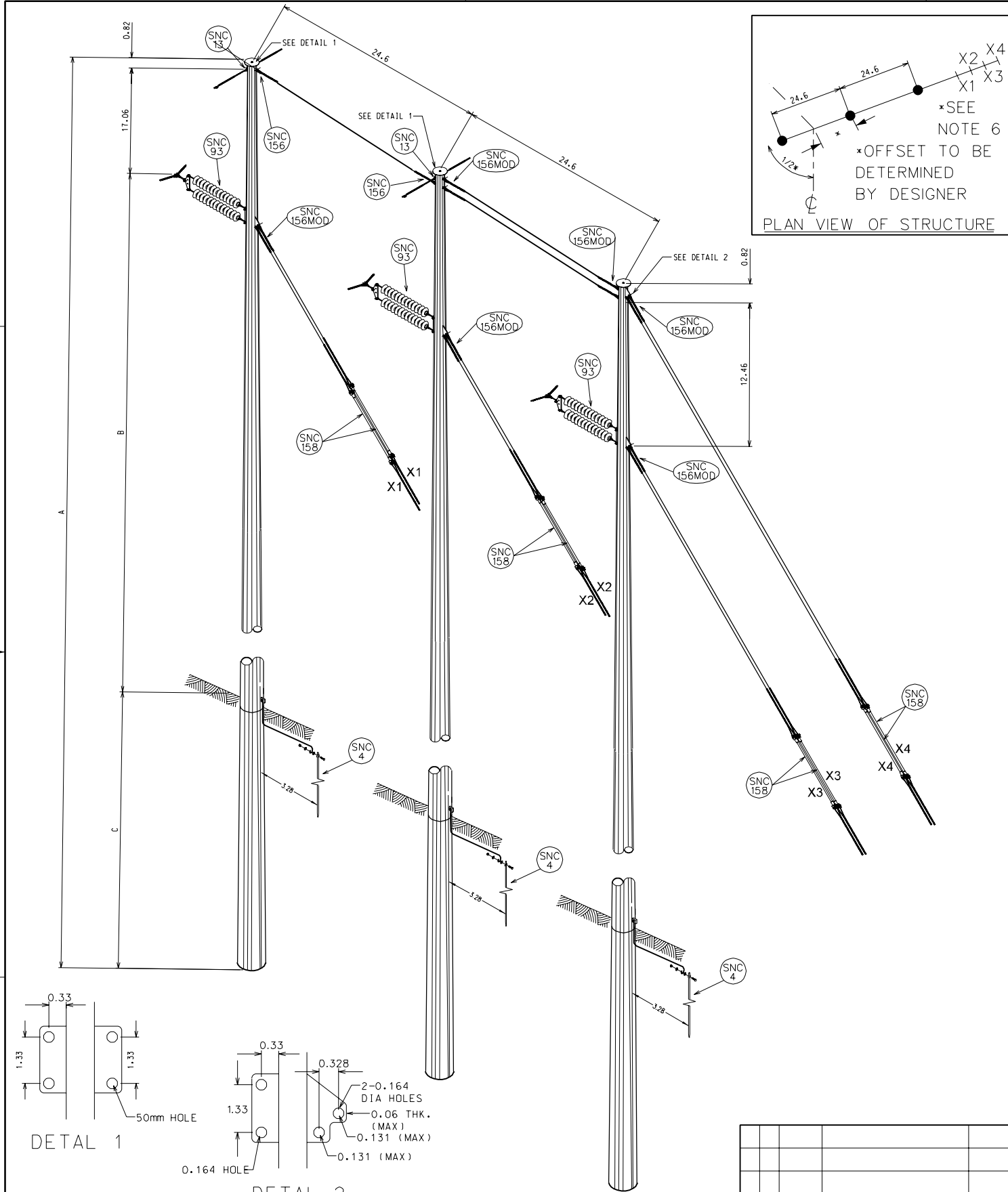
MATERIAL AND ITEM LIST FOR STRUCTURE SNC158		
QTY	ASSEMBLY	DESCRIPTION
2	SNC158	GRIP, PRFD 7/16 GUY 40, GREEN
1	SNC158	GUY STRAIN INSULATOR, 240KV, 100KN UTS

MATERIAL AND ITEM LIST FOR STRUCTURE SNC156MOD		
QTY	ASSEMBLY	DESCRIPTION
2	SNC156MOD	CLEVIS, THIMBLE, GALV. 20MM SPREAD
4	SNC156MOD	GRIP, PRFD 7/16 GUY 40, GREEN
50	SNC156MOD	WIRE, GUY,7 STR. STL, GR.180,7/16"DIA.
2	SNC156MOD	CLAMP,GUY,GALV.5/8"BOLT,3 BOLT STRAIGHT

NOTE:
1. UNLESS OTHERWISE INDICATED ALL DIMENSIONS
ARE IN FEET.

ISSUE REGISTER				REVISION REGISTER			
ISSUE NO	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER NO	No	REVISION DESCRIPTION	DATE (Y/M/D)
1	A	05/02/18	ISSUED FOR BID		A	ISSUED FOR BID	05/02/16
						INITIALS: * DESIGNED ** APPROVED	

PROFESSIONAL SEAL		SNC-Lavalin ATP Inc. 1035 - 7 Ave. S.W. Calgary, Alberta Canada T2P 2M4		CLIENT MONTANA ALBERTA TIE LTD.	
		DESIGNED PAUL DILLON	APPROVAL PROJECT DISCIPLINE ENGINEER	PROJECT MONTANA-ALBERTA TIE LINE	
		DRAWN R. BROUILLETTE	PROJECT ENGINEERING MANAGER	TITLE THREE POLE 230KV MEDIUM ANGLE STRUCTURE WITH 2 OHSW ASSEMBLY DRAWINGS	
		CHECKED		DOCUMENT No. MATLP-43-D1-0005	
		DATE 05-02-16	CLIENT	REV	B
SCALE NTS		SHEET 3 OF 3			



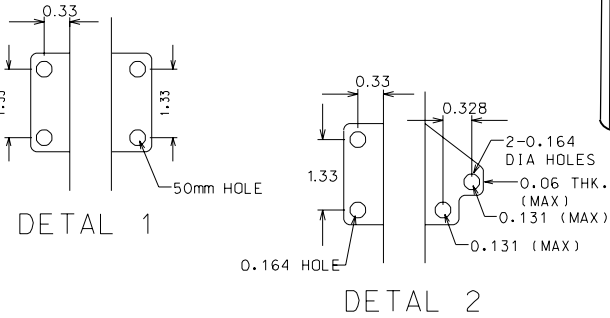
MATERIAL AND ITEM LIST FOR STRUCTURE MATL-43-D1-006		
QTY	ASSEMBLY	DESCRIPTION
2	SNC93	SOCKET-CLEVIS, GLV. 38MM D, 22MM S, M16
1	SNC93	BALL-CLEVIS, GLV. 38MM D, 22MM S, M16 B
14	SNC156, 156MOD	CLEVIS, THIMBLE, GALV. 20MM SPREAD
1	SNC93	PLATE, YOKE, 16 SPACING
2	SNC93	BALL-Y-CLEVIS, GLV. H/L 680MM L, M20 BLT
12	SNC156MOD	CLAMP, GUY, GALV. 5/8" BOLT, 3 BOLT STRAIGHT
2	SNC13	CLAMP, GROUND, BRZ. 1/2 H.H. BOLT LW&NUT
9	SNC4	WIRE, CU. SOLID, SD BARE #4
2	SNC13	WIRE, #2ACSR STD OR SB FOR GND DOWNLEAD
300	SNC156, 156MOD	WIRE, GUY, 7 STR. STL, GR. 180, 7/16" DIA.
3	SNC4	CONNECTOR, #2/0 OR #4/0 TO FLAT SURFACE
2	SNC13	CONNECTOR, WEDGE-TYPE
2	SNC13	CARTRIDGE, COLOR CODE RED
44	SNC156, 156MOD, SNC158	GRIP, PRFD 7/16 GUY 40, GREEN
1	SNC93	ROD, ARMOUR, PRFD AL, CURLEW(2.54)BLK 12
1	SNC93	CLAMP, ANGLE SUSP, SOCK, 1.40-2.18
3	SNC4	ROD, GROUND, 5/8" X 8', STEEL
2	SNC13	SUSPEN, PRFD TWIN:GRIP TWRS. 5/16"
2	SNC13	SHACKLE, TWISTED W/BOLT, 90 kN
2	SNC93	INSULATOR, SYN, SOC-BALL, SIL, 240KV
8	SNC158	GUY STRAIN INSULATOR, 240KV, 100KN UTS

Structure: 240kV 3 Pole Heavy Angle Structure
Deflection : 20 to 45 Degree Line Angle
Conductor: 1033 kcmil ACSR Curlew
O.H.S.W.: 5/16" Steel Grade 220
OPGW: 16mm OPGW (To be determined)

Air Gap Requirements				
Temp.	Wind	Swing		Clearance
(oC)	(Pa)	θ - Degrees		(a) - mm
4	0	79	67	5.58
4	875	81	40	2.1
-30	500	82	64	2.76

Pole Dimensions					
A		B		C	
feet	m	feet	m	feet	m
65	19.81	36.62	11.16	10.5	3.20
70	21.34	41.12	12.53	11	3.35
75	22.86	45.62	13.91	11.5	3.51
80	24.38	50.12	15.28	12	3.66
85	25.91	54.62	16.65	12.5	3.81

- General Notes:
1. Poles are to be designed and fabricated in accordance with ACSE Manuals and reports No. 72 - Design of Steel Transmission Pole Structures, Second Edition.
 2. Base plates to be designed for 200kPa soil.
 3. Finish to be galvanized or weathering steel
 4. Pole to direct embedded 10% of pole height plus 4 feet.
 5. All dimensions are to the centre of the vang.
 6. Stainless steel ground tab at pole top & near groundline are required
 7. Ladder clips are required
 8. Design calculations are to be included with bid for review by SNC-Lavalin ATP Inc.
 9. All dimensions are in feet.
 10. For assemblies see sheet 2 and 3.
 11. Outside pole is 5 feet shorter.
 12. Pole fabrication shall be in accordance with SNC Lavalin ATP Specification #645-04 "Fabrication of Tubular Steel Transmission Structures".
 13. Icing on the structure need not be considered in design.



- NOTES:
1. OLF = 1.67
 2. ULTIMATE STRENGTH OF GUY VANG = 30000 LBS. PER CONNECTION POINT.

ISSUE REGISTER				REVISION REGISTER			
ISSUE NO	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER NO	No	REVISION DESCRIPTION	DATE (Y/M/D)
1	A	05/02/18	ISSUED FOR BID		A	PRELIMINARY DESIGN	05-02-16
						INITIALS: * DESIGNED ** APPROVED	

PROFESSIONAL SEAL		SNC-Lavalin ATP Inc. 1035 - 7 Ave. S.W. Calgary, Alberta Canada T2P 2M4		CLIENT	
DESIGNED P. DILLON		APPROVAL PROJECT DISCIPLINE ENGINEER		PROJECT	
DRAWN A. MAY		PROJECT ENGINEERING MANAGER		TITLE THREE POLE 230KV HEAVY ANGLE STRUCTURE WITH TWO OVERHEAD SHIELD WIRES	
CHECKED				DOCUMENT No. MATLP-43-31-0006	
DATE 05-02-16		CLIENT		REV	
SCALE NTS		SHEET 1 OF 3		B	



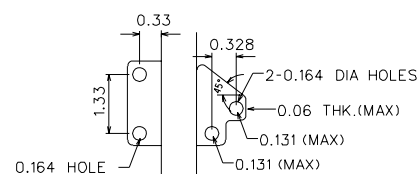
MATERIAL AND ITEM LIST FOR STRUCTURE MATL-43-D1-006		
QTY	ASSEMBLY	DESCRIPTION
12	SNC96	SOCKET-CLEVIS, GLV, 38MM D, 22MM S, M16
30	SNC33, SNC95, SNC156MOD	CLEVIS, THIMBLE, GALV, 20MM SPREAD
3	SNC95	BALL-EYE, GLV, 50MM X25 MM OVAL, 111 KN
3	SNC95	SHACKLE, ANCHOR, STRENGTH 90 kN
12	SNC96	SHACKLE, ANCHOR, STRENGTH 222 kN
6	SNC96	PLATE, YOKE, 16 SPACING
12	SNC96	BALL-Y-CLEVIS, GLV, H/L 680MM L, M20 BLT
20	SNC156MOD	CLAMP, GUY, GALV, 5/8" BOLT, 3 BOLT STRAIGHT
2	SNC33	CLAMP, GROUND, BRZ, 1/2 H.H. BOLT LW&NUT
9	SNC4	WIRE, CU, SOLID, SD BARE #4
2	SNC33	WIRE, #2ACSR STD OR SB FOR GND DOWNLEAD
550	SNC95, SNC156MOD	WIRE, GUY, 7 STR, STL, GR, 180, 7/16" DIA.
3	SNC4	CONNECTOR, #2/0 OR #4/0 TO FLAT SURFACE
2	SNC33	CONNECTOR, WEDGE-TYPE
3	SNC96	CONNECTOR, WEDGE-TYPE [AMP #602180]
2	SNC33	CARTRIDGE, COLOR CODE RED
3	SNC96	CARTRIDGE, COLOR CODE YELLOW
6	SNC96	DEADEND, 2 COMP. CONN, 1033.5 ACSR CURL
40	SNC156MOD	GRIP, PRFD 7/16 GUY 40, GREEN
40	SNC158	GRIP, PRFD 7/16 GUY 40, GREEN
4	SNC33	GRIP, GUY, PRFD, GALV STEEL, 5/16
6	SNC95	GRIP, GUY, PRFD, GALV STEEL, 5/16
3	SNC95	CLAMP, SOCKET SUSPENSION
3	SNC4	ROD, GROUND, 5/8" X 8", STEEL
42	SNC95	INSULATOR, SUSP, BOS, 15000# PORC
12	SNC96	INSULATOR, SYN, SOC-BALL, SIL, 240KV
20	SNC158	GUY STRAIN INSULATOR, 240KV, 100KN UTS

Structure: 240kV Three Pole Dead-End Structure
Deflection : 45 to 90 Degree Line Angle
Conductor: 1033 kcmil ACSR Curlew
OPGW: 16mm OPGW (To be determined)

Pole Dimensions					
A		B		C	
feet	m	feet	m	feet	m
60	18.29	30.32	9.24	10	3.05
65	19.81	34.82	10.61	10.5	3.20
70	21.34	39.32	11.98	11	3.35
75	22.86	43.82	13.36	11.5	3.51
80	24.38	48.32	14.73	12	3.66


General Notes:

1. Poles are to be designed and fabricated in accordance with ACSE Manuals and reports No. 72 - Design of Steel Transmission Pole Structures, Second Edition.
2. Base plates to be designed for 200kPa soil.
3. Finish to be galvanized or weathering steel
4. Pole to direct embedded 10% of pole height plus 4 feet.
5. All dimensions are to the centre of the vang.
6. All Dimensions in feet.
7. For Assemblies refer to sheets 2 and 3.
8. Design calculations are to be included with bid for review by SNC-Lavalin ATP Inc.
9. Stainless steel ground tab at pole top & near groundline are required
10. Ladder clips are required
11. Middle pole is 5 feet shorter.
12. Pole fabrication shall be in accordance with SNC Lavalin ATP Specification #645-04 "Fabrication of Tubular Steel Transmission Structures".
13. Icing on the structure need not be considered in design.



DETAIL 1

[illegible]

PROFESSIONAL SEAL	 SNC-LAVALIN SNC-Lavalin ATP Inc. 1035 - 7 Ave. S.W. Calgary, Alberta Canada T2P 2M4		CLIENT	MONTANA ALBERTA TIE LTD.	
	PREPARATION DESIGNED P. DILLON DRAWN A. MAY CHECKED DATE 05-02-17 SCALE NTS		APPROVAL PROJECT DISCIPLINE ENGINEER PROJECT ENGINEERING MANAGER TITLE THREE POLE 230kV DEADEND STRUCTURE WITH TWO OVERHEAD SHIELD WIRES		
	SHEET		DOCUMENT No.	REV	
	1 OF 3		MATLP-43-D1-0007		