Design Tools and Applications at Oncor

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SWEDE Design Committee Workshop
Arlington – May 6, 2010

Overview

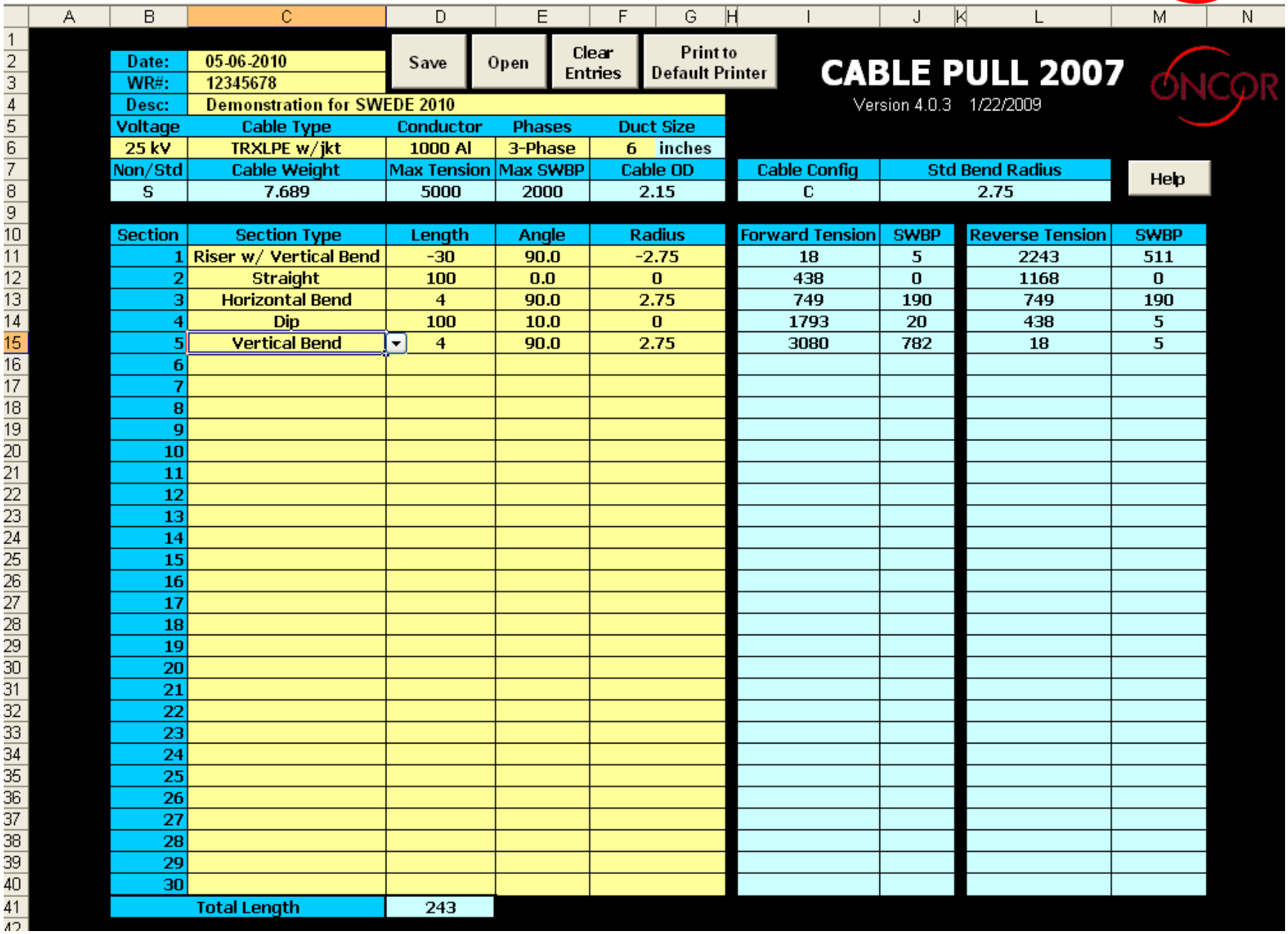
Programs and Applications Used at Oncor

- Cable Pulling Program
- Guying Program
- Voltage Drop Calculation Tools
- Subdivision Layout Tools

Cable Pulling Program

- **Cable Pulling Program 2007**
  - **Single-phase or 3-phase cables**
  - **Forward and reverse tensions**
  - **Several pulling configuration options**
    - **Straight**
    - **Pole riser**
    - **Vertical bends**
    - **Horizontal bends**
    - **Dip**
    - **Pulley (SWBP only)**
  - **Flags for tension, sidewall bearing pressure, clearance, jamming problems, or non-standard cables or ducts**

Cable Pulling Program



Date:	05-06-2010
WR#:	12345678
Desc:	Demonstration for SWEDE 2010

Save | Open | Clear Entries | Print to Default Printer

CABLE PULL 2007
Version 4.0.3 1/22/2009

Voltage	Cable Type	Conductor	Phases	Duct Size
25 kV	TRXLPE w/jkt	1000 Al	3-Phase	6 inches
Non/Std	Cable Weight	Max Tension	Max SWBP	Cable OD
S	7.689	5000	2000	2.15

Cable Config	Std Bend Radius
C	2.75

Help

Section	Section Type	Length	Angle	Radius	Forward Tension	SWBP	Reverse Tension	SWBP
1	Riser w/ Vertical Bend	-30	90.0	-2.75	18	5	2243	511
2	Straight	100	0.0	0	438	0	1168	0
3	Horizontal Bend	4	90.0	2.75	749	190	749	190
4	Dip	100	10.0	0	1793	20	438	5
5	Vertical Bend	4	90.0	2.75	3080	782	18	5
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
Total Length		243						

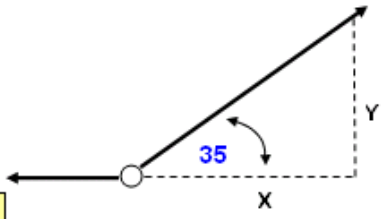
Guying Program

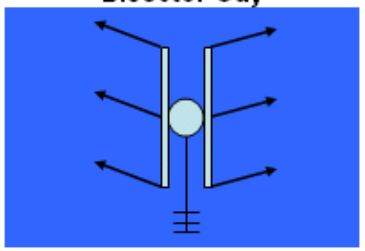
- **Deadend & Double Deadend Guy**
- **90° Corner & Large Angle Guy**
- **Deadend Tap Guy**
- **Angle Pole-Bisector Guy**

Pole Guying Program (Angle Pole Bisector Guy)

April 16, 2010

Case 6: Angle Pole – Bisector Guy





WR# -	12345678
Pole# -	WP3
Guy Case --->	Case 6: Angle Pole – Bisector Guy
Pole Height (ft) -	45
Pole Class -	Class 3
Pole Embedment Depth (ft) -	7
Type of Construction -	Single Phase
Single or Multiple Guys -	Single
Equipment / Facilites --->	

Left Span Length -->	215
Right Span Length -->	180
Enter Degrees --->	35
Enter Minutes --->	
Enter Seconds --->	

OR

Enter "X" -->	
Enter "Y" -->	
Line Angle (Degrees) --->	35
Tension "K" Factor --->	0.601

Clear All Cells

Note: Vertical Loads are not considered in this version. You will need to calculate the vertical loads at this pole until revisions are made.

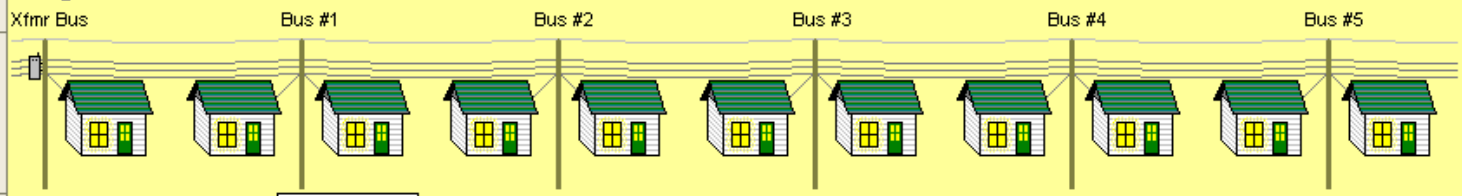
This program is intended to be used as a design tool. The calculations are approximations and do not completely analyze all forces that can impact a structu If questions arise or if it determined more precise calculations are required, contact Distribution Standards.

Subdivision Layout Tools

- **Electric Facility Sizing and Analysis Tool (EFSAT)**
  - **Up to 20 house load types**
  - **Calculates voltage drop and flicker for each meter, secondary bus, and transformer**
- **Underground Loop Loading – Residential**
  - **Summer and winter loop loading**
  - **Calculates minimum fuse size required**

ELECTRIC FACILITY SIZING & ANALYSIS TOOL

Version 1.1
Dated 3/2/2009



Analysis Type	Residential
	CLEAR
Xfmr Type	UG 1 Phase
Xfmr Size	167
Xfmr Voltage	120/240V
Xfmr Imp (%)	2.5%

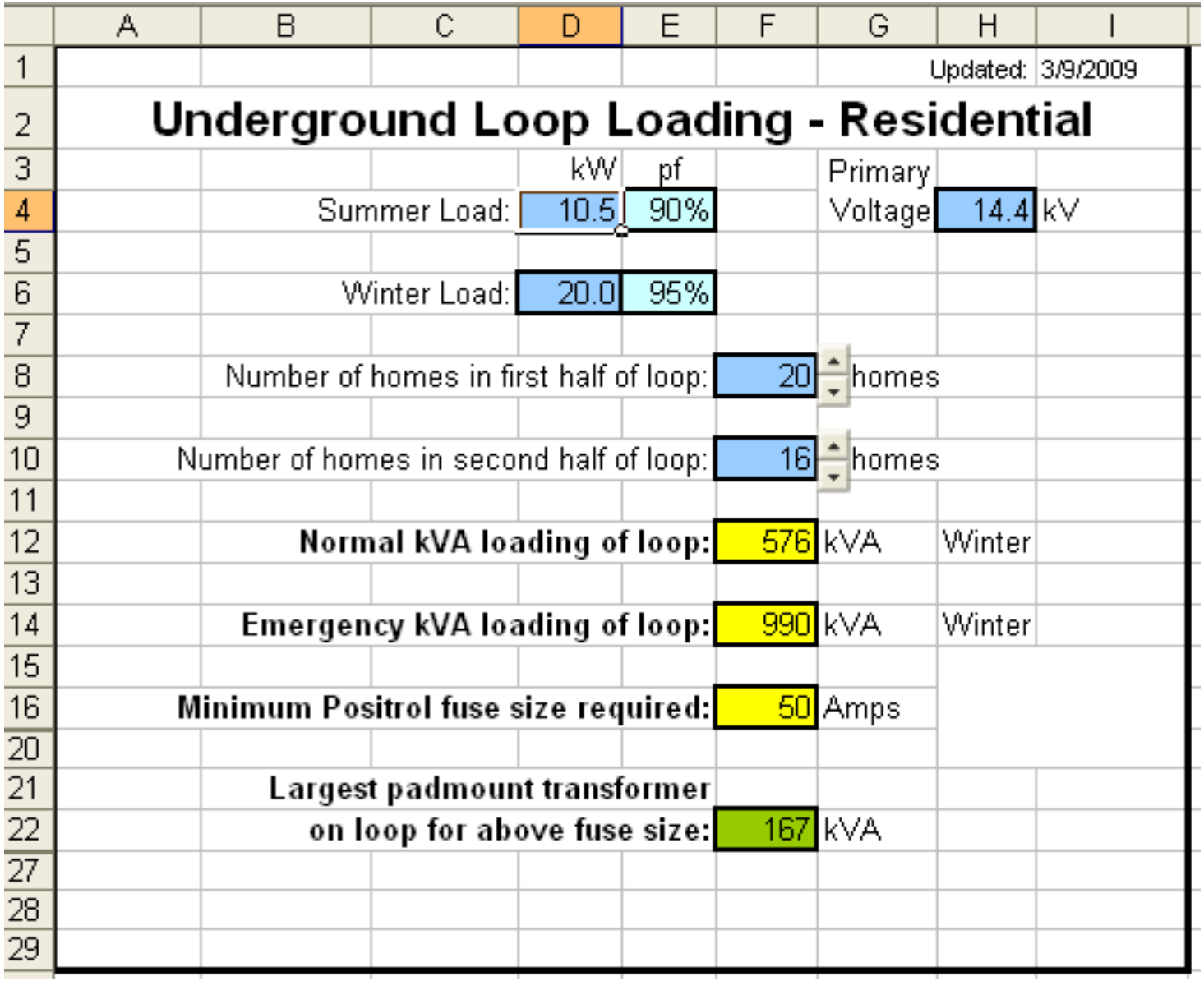
	Summer	Winter
Power Factor	90%	95%

Neutral V-Drop	Yes

	Type	Length (ft)	Bus at End of Span	Voltage Drop	Voltage Flicker
Transformer	167 kVA UG 1 Phase		Xfmr	1.33%	0.36%
1st Secondary Span	350 kcmil Al XLPE TPX UG	100	#1	3.11%	0.98%
2nd Secondary Span	350 kcmil Al XLPE TPX UG	100	#2	4.44%	1.59%
3rd Secondary Span	350 kcmil Al XLPE TPX UG	100	#3	5.34%	2.20%
4th Secondary Span	350 kcmil Al XLPE TPX UG	95	#4	5.80%	2.78%
5th Secondary Span			#5		
6th Secondary Span			#6		
7th Secondary Span			#7		
8th Secondary Span			#8		
9th Secondary Span			#9		
10th Secondary Span			#10		

	Individual Consumer Information					Service Information		Secondary	Voltage	
#	Description/Address	kWh or kW	Summer	Winter	AC Tons	Type	Length (ft)	Bus	Drop	Flicker
A	301 Main St	kW	3.5	5.5	3.0	#4/0 Al XLPE TPX UG	100	Xfmr	1.51%	1.33%
B	302 Main St	kW	3.5	5.5	3.0	#4/0 Al XLPE TPX UG	100	Xfmr	1.51%	1.33%
C	303 Main St	kW	3.5	5.5	3.0	#4/0 Al XLPE TPX UG	100	Xfmr	1.51%	1.33%
D	304 Main St	kW	3.5	5.5	3.0	#4/0 Al XLPE TPX UG	100	Xfmr	1.51%	1.33%
E	305 Main St	kW	3.5	5.5	3.0	#4/0 Al XLPE TPX UG	100	#1	3.30%	1.95%
F	306 Main St	kW	3.5	5.5	3.0	#4/0 Al XLPE TPX UG	100	#1	3.30%	1.95%
G	307 Main St	kW	3.5	5.5	3.0	#4/0 Al XLPE TPX UG	100	#1	3.30%	1.95%
H	308 Main St	kW	3.5	5.5	3.0	#4/0 Al XLPE TPX UG	100	#1	3.30%	1.95%
I	309 Main St	kW	3.5	5.5	3.0	#4/0 Al XLPE TPX UG	100	#2	4.64%	2.56%
J	310 Main St	kW	3.5	5.5	3.0	#4/0 Al XLPE TPX UG	100	#2	4.64%	2.56%
K	311 Main St	kW	3.5	5.5	3.0	#4/0 Al XLPE TPX UG	100	#2	4.64%	2.56%
L	312 Main St	kW	3.5	5.5	3.0	#4/0 Al XLPE TPX UG	100	#2	4.64%	2.56%
M	313 Main St	kW	3.5	5.5	3.0	#4/0 Al XLPE TPX UG	100	#3	5.54%	3.17%
N	314 Main St	kW	3.5	5.5	3.0	#4/0 Al XLPE TPX UG	100	#3	5.54%	3.17%
O	315 Main St	kW	3.5	5.5	3.0	#4/0 Al XLPE TPX UG	100	#3	5.54%	3.17%
P	316 Main St	kW	3.5	5.5	3.0	#4/0 Al XLPE TPX UG	100	#3	5.54%	3.17%
Q	317 Main St	kW	3.5	5.5	3.0	#4/0 Al XLPE TPX UG	100	#4	6.00%	3.74%
R	318 Main St	kW	3.5	5.5	3.0	#4/0 Al XLPE TPX UG	100	#4	6.00%	3.74%
S	319 Main St	kW	3.5	5.5	3.0	#4/0 Al XLPE TPX UG	100	#4	6.00%	3.74%
T	320 Main St	kW	3.5	5.5	3.0	#4/0 Al XLPE TPX UG	100	#4	6.00%	3.74%

Underground Loop Loading - Residential



	A	B	C	D	E	F	G	H	I
1								Updated:	3/9/2009
2	**Underground Loop Loading - Residential**								
3				kW	pf		Primary		
4			Summer Load:	10.5	90%		Voltage	14.4	kV
5									
6			Winter Load:	20.0	95%				
7									
8			Number of homes in first half of loop:			20	homes		
9									
10			Number of homes in second half of loop:			16	homes		
11									
12			**Normal kVA loading of loop:**			576	kVA	Winter	
13									
14			**Emergency kVA loading of loop:**			990	kVA	Winter	
15									
16			**Minimum Positrol fuse size required:**			50	Amps		
20									
21			**Largest padmount transformer**						
22			**on loop for above fuse size:**			167	kVA		
27									
28									
29									

Voltage Drop Calculation Tools

- **Residential Flicker (Also in EFSAT)**
  - **Flicker at meter or on secondary bus due to A/C compressor**
- **Residential Voltage Drop (Also in EFSAT)**
  - **Voltage drop**
- **Commercial Voltage Drop**
  - **Single or parallel cables**
  - **Single phase or 3-phase loads**
- **Street Light Voltage Drop**

Commercial Voltage Drop

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1		VdropComm(Web).xls								RLH						
2		Voltage Drop for Commercial Secondary Cables								12/17/07						
3																
4			**System Voltages (See 207-040)**							**Load Type**	**kW**	**pf**	**kVA**	**rf**	**θ**	**I**
5			126	Substation Bus Voltage (120 V Base)						3-phase	494.0	95%	520.0	31%	0.318	1444.4
6		Vs	124	Primary at Transformer (120 V Base)							-	95%	0.0	31%	0.318	0.0
7																
8																
9			UG	OH/UG Transformer												
10			120/208Y 4W	**Nominal Load Voltage**					Zxfmr	X/R	Ra	Xa				
11			750	3-ph Transformer kVA					5.7%	6.0	0.0002	0.0011				
12			225								-	-				
13																
14		f	1	2=neutral or 2nd phase voltage drop, 1=no neutral or 2nd phase drop												
15		v	1	Voltage multiplier based on Nominal Load Voltage												
16		ph	3	Number of phases												
17		v3ph	120.0	3-phase voltage to ground												
18	UG	OH/UG Cables						Cable				Low				
19	# Cbls		Length	I1		I2		Over-	Actual	Vdrop	Volts	voltage				
20	per Ph	Cable Description	feet	theta1	Amps1	theta2	Amps2	loaded	volts	%	120 V base	at meter				
21									124.0							
22	5	500 kcmil Cu XLPE QPX UG	218	0.8	1444	-0.2	1444		120.4	2.98%	120.4					
23				Ia		Only used for Wye-Delta Banks (closed banks)										
24				thetaA	AmpsA											
25				0.3	1398											
26																
27				I1 = Secondary phase 1 line current												
28				I2 = Secondary phase 2 line current												
29				Ia = Current in lighting transformer												
30				It = 3ph load current - not considered since lighting load Vd dominates												
31																

Street Light Voltage Drop Program

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	VdropSL(Web).xls												RLH	
2	Voltage Drop for Street Lighting Cables												12/12/95	
3													Rev 02/04/10	
4						240	volts - Nominal Voltage							
5					Vs	244	volts - Actual Source Voltage (at transformer, end of secondary, etc.)							
6														
7				UG	OH/UG Cable									
8	Section				Length	Number	Amps/	Load	Vlmag	Allowed	Voltage	Vdrop	Total	Cable
9	From	To	Cable	Ballast	feet	of lights	Light	Amps	volts	Min	OK	%	Vdrop	Overload
10									244.00					
11	1	2	#4 Al XLPE DPX UG	5 W MH 240V	50	30	0.90	27.0	242.90	216.00		0.45%	0.45%	
12	2	3	#4 Al XLPE DPX UG	175 W MH 240V	50	29	0.90	26.1	241.85	216.00		0.44%	0.89%	
13	3	4	#4 Al XLPE DPX UG	175 W MH 240V	50	28	0.90	25.2	240.83	216.00		0.42%	1.31%	
14	4	5	#4 Al XLPE DPX UG	175 W MH 240V	50	27	0.90	24.3	239.84	216.00		0.41%	1.72%	
15	5	6	#4 Al XLPE DPX UG	175 W MH 240V	50	26	0.90	23.4	238.90	216.00		0.40%	2.12%	
16	6	7	#4 Al XLPE DPX UG	175 W MH 240V	50	25	0.90	22.5	237.99	216.00		0.38%	2.50%	
17	7	8	#4 Al XLPE DPX UG	175 W MH 240V	50	24	0.90	21.6	237.12	216.00		0.37%	2.87%	
18	8	9	#4 Al XLPE DPX UG	175 W MH 240V	50	23	0.90	20.7	236.28	216.00		0.35%	3.22%	
19	9	10	#4 Al XLPE DPX UG	175 W MH 240V	50	22	0.90	19.8	235.49	216.00		0.34%	3.56%	
20	10	11	#4 Al XLPE DPX UG	175 W MH 240V	50	21	0.90	18.9	234.73	216.00		0.32%	3.88%	
21	11	12	#4 Al XLPE DPX UG	175 W MH 240V	50	20	0.90	18.0	234.00	216.00		0.31%	4.19%	
22	12	13	#4 Al XLPE DPX UG	175 W MH 240V	50	19	0.90	17.1	233.32	216.00		0.29%	4.49%	
23	13	14	#4 Al XLPE DPX UG	175 W MH 240V	50	18	0.90	16.2	232.67	216.00		0.28%	4.77%	
24	14	15	#4 Al XLPE DPX UG	175 W MH 240V	50	17	0.90	15.3	232.05	216.00		0.26%	5.03%	
25	15	16	#4 Al XLPE DPX UG	175 W MH 240V	50	16	0.90	14.4	231.48	216.00		0.25%	5.28%	
26	16	17	#4 Al XLPE DPX UG	175 W MH 240V	50	15	0.90	13.5	230.93	216.00		0.23%	5.51%	
27	17	18	#4 Al XLPE DPX UG	175 W MH 240V	50	14	0.90	12.6	230.43	216.00		0.22%	5.73%	
28	18	19	#4 Al XLPE DPX UG	175 W MH 240V	50	13	0.90	11.7	229.96	216.00		0.20%	5.94%	
29	19	20	#4 Al XLPE DPX UG	175 W MH 240V	50	12	0.90	10.8	229.53	216.00		0.19%	6.12%	
30	20	21	#4 Al XLPE DPX UG	175 W MH 240V	50	11	0.90	9.9	229.13	216.00		0.17%	6.30%	
31	21	22	#4 Al XLPE DPX UG	175 W MH 240V	50	10	0.90	9.0	228.77	216.00		0.16%	6.45%	
32	22	23	#4 Al XLPE DPX UG	175 W MH 240V	50	9	0.90	8.1	228.45	216.00		0.14%	6.60%	
33	23	24	#4 Al XLPE DPX UG	175 W MH 240V	50	8	0.90	7.2	228.16	216.00		0.13%	6.72%	
34	24	25	#4 Al XLPE DPX UG	175 W MH 240V	50	7	0.90	6.3	227.91	216.00		0.11%	6.83%	
35	25	26	#4 Al XLPE DPX UG	175 W MH 240V	50	6	0.90	5.4	227.70	216.00		0.09%	6.93%	
36	26	27	#4 Al XLPE DPX UG	175 W MH 240V	50	5	0.90	4.5	227.52	216.00		0.08%	7.01%	
37	27	28	#4 Al XLPE DPX UG	175 W MH 240V	50	4	0.90	3.6	227.37	216.00		0.06%	7.07%	
38	28	29	#4 Al XLPE DPX UG	175 W MH 240V	50	3	0.90	2.7	227.27	216.00		0.05%	7.12%	
39	29	30	#4 Al XLPE DPX UG	175 W MH 240V	50	2	0.90	1.8	227.19	216.00		0.03%	7.15%	
40	30	31	#4 Al XLPE DPX UG	175 W MH 240V	50	1	0.90	0.9	227.16	216.00		0.02%	7.16%	