

- 1 **Q. Please provide tables or lists stating Newfoundland Power's Transmission and**
2 **Distribution conductor ratings and explain the bases for those ratings.**
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4 A. Attachments A through E provide conductor current ratings for the various types of
5 distribution primary and transmission conductors used by Newfoundland Power. Below
6 is a list of the attachments for each type of conductor.
7
8 Attachment A: Distribution Aerial Conductor Ratings
9
10 Attachment B: Distribution Underground Cable Ratings
11
12 Attachment C: Distribution Aerial Cable Ratings
13
14 Attachment D: Transmission Aerial Conductor Ratings
15
16 Attachment E: Transmission Underground Cable Ratings

**Newfoundland Power
Distribution Aerial Conductor Ratings**

Table 1 shows the continuous and planning ampacities of various aerial conductors used by NP.

Table 1 Distribution Conductor Ratings						
Size and Type	Continuous Winter Rating¹	Continuous Summer Rating²	Winter Planning Ratings² CLPU Factor⁴ = 2.0 Sectionalizing Factor⁵ = 1.33			
	Amps	Amps	Amps	MVA		
				4.16 kV	12.5 kV	25.0 kV
1/0 AASC	303	249	228	1.6	4.9	9.8
4/0 AASC	474	390	356	2.6	7.7	15.4
477 ASC	785	646	590	4.2	12.7	25.5
#2 ACSR	224	184	168	1.2	3.6	7.3
2/0 ACSR	353	290	265	1.9	5.7	11.4
266 ACSR	551	454	414	3.0	8.9	17.9
397 ACSR	712	587	535	3.9	11.6	23.1
#4 Copper	203	166	153	1.1	3.3	6.6
1/0 Copper	376	309	283	2.0	6.1	12.2
2/0 Copper	437	359	329	2.4	7.1	14.2

Notes:

1. The Continuous Winter Rating is the normal maximum allowable amperage on an aerial conductor during winter. This ampacity is based on the following ambient conditions:

- 75°C conductor temperature
- 0°C ambient air temperature
- 2 ft/s wind speed
- 100% load factor
- 9" minimum separation phase to neutral

This rating can be exceeded during abnormal system conditions when the ambient air temperature and wind speed allow for higher loading.

2. The Continuous Summer Rating is the normal maximum allowable amperage on an aerial conductor during summer. This ampacity is based on the following ambient conditions:

- 75°C conductor temperature
- 25°C ambient air temperature
- 2 ft/s wind speed
- 100% load factor
- 9" minimum separation phase to neutral

This rating can be exceeded during abnormal system conditions when the ambient air temperature and wind speed allow for higher loading.

3. Winter Planning Ratings is the maximum amperage allowed, for planning purposes, under normal operating conditions. Where appropriate, the planning rating may deviate from that shown in Table 1 to address specific circumstances such as: (i) the age and physical condition of the conductor, (ii) the number of customers on the feeder, (iii) the ability to transfer load to adjacent feeders and (iv) operational considerations including the geographic layout and the distribution of customers on the feeder.

The Planning Rating is determined by the following equation:

$$\text{Planning Ampacity} = \frac{\text{Continuous Winter Rating}}{\text{Sectionalizing Factor}}$$

The Summer Planning Rating is equal to the Continuous Summer Rating.

4. CLPU Factor is multiplied by the forecast winter peak demand requirements, under normal operating conditions, to estimate the load which will occur when power is restored to customers.
5. The Sectionalizing Factor is based on a single sectionalizing device located on the distribution line, just beyond 2/3 of the customer load from the substation. When restoring power after an outage, it is assumed the sectionalizing device will be opened to reduce the maximum CLPU placed on the conductor. Instead of the restoration load being 2 times the forecast winter peak demand, the restoration load is now limited to 1.33 times the forecast winter peak demand (1.33 is the Sectionalizing Factor). The following equation is used to calculate the sectionalizing factor:

$$\begin{aligned} \text{Sectionalizing Factor} &= \text{CLPU factor} \times \text{portion of distribution load restored.} \\ &= 2.0 \quad \times \quad 2/3 \\ &= 1.33 \end{aligned}$$

**Newfoundland Power
Distribution Underground Cable Ratings**

Table 1 and Table 2 provide the planning ampacity ratings of the various primary underground cables used by Newfoundland Power.

Table 1 Winter Planning Ampacity Ratings for PILC Cables (Copper Conductor)								
Size	Direct Buried		Number of Cables in Ductbank					
	1 Circuit	2 Circuit	1	2	3	4	5	10
4/0	327	305	294	267	241	226	212	173
250	361	335	323	294	265	248	231	188
350	438	404	390	353	317	296	275	222
400	470	434	418	378	338	315	293	235
500	535	492	473	426	380	354	329	263
750	669	609	682	522	462	430	398	315
1000	774	701	666	595	523	486	448	353

Table 2 Winter Planning Ampacity for XLPE Cables (Copper Conductor)						
Size	Number of Cables in Ductbank					
	1	2	3	4	5	10
1/0	214	195	176	165	154	126
4/0	316	288	260	244	228	186
250	347	316	285	266	248	203
350	419	379	340	318	295	238
500	510	460	409	382	354	284
750	629	564	499	465	430	341

Table 1 and Table 2 are based on the following set of environmental and operating conditions:

- 80°C conductor temperature for PILC
- 90°C conductor temperature for XLPE
- 5°C ambient earth temperature
- 100% load factor
- 90 [°C x cm/watt] earth thermal resistivity

Overload is permissible for short periods of time. CLPU of up to 2.0 times the planning rating is acceptable assuming the CPLU event is limited to 1.0 hr.

Tables 3 and Table 4 provide the emergency continuous ratings for cables. The emergency ratings are the maximum load that may be carried for an extended period in winter.

Table 3 Emergency Winter Ampacity for PILC Cables (Copper Conductor)		
Size	Buried	Duct
4/0	357	321
250	394	353
350	478	427
400	514	457
500	585	518
750	731	637
1000	847	729

Table 4 Emergency Winter Ampacity for XLPE Cables (Copper Conductor)	
Size	Ampacity
1/0	245
4/0	362
250	397
350	479
500	584
750	720

Tables 3 and 4 are based on the following conditions:

100°C conductor temperature for PILC Cables

130°C conductor temperature for XLPE Cables

5°C ambient earth temperature

100% load factor

90 [°C x cm/watt] earth thermal resistivity

Maximum duration for emergency ratings:

PILC Cables - 36 hours for PILC Cables, and there shall be no more than three emergency operations per year and only one emergency period per year for the life of the cable.

XLPE Cables 100 hours per year and 500 hours over the entire life of the cable.

Tables 5 and Table 6 provide the summer continuous ratings for cables.

Table 5								
Continuous Summer Ampacity Ratings for PILC Cables (Copper Conductor)								
Size	Direct Buried		Number of Cables in Ductbank					
	1 Circuit	2 Circuit	1	2	3	4	5	10
4/0	279	260	251	228	206	193	180	147
250	308	286	275	251	226	211	196	160
350	374	345	333	301	270	252	234	188
400	402	370	356	322	287	268	249	199
500	457	420	404	363	323	301	279	222
750	571	519	496	444	393	365	337	265
1000	661	598	568	506	444	412	379	297

Table 6						
Continuous Summer Ampacity Ratings for PILC Cables (Copper Conductor)						
Size	Number of Cables in Ductbank					
	1	2	3	4	5	10
1/0	187	170	154	144	135	110
4/0	277	252	227	213	199	163
250	304	276	249	233	217	177
350	366	332	297	278	258	208
500	446	402	358	334	310	248
750	550	493	437	406	376	298

Table 5 and 6 are based on the following set of environmental and operating conditions:

- 80°C conductor temperature for PILC
- 90°C conductor temperature for XLPE
- 25°C ambient temperature
- 100% load factor
- 90 [°C x cm/watt] earth thermal resistivity

**Newfoundland Power
Distribution Aerial Cable Ratings**

Table 1 provide the planning ampacity ratings of the various aerial cables used by Newfoundland Power.

Table 1 Ampacity Ratings for Aerial Cables			
Size and Type	Continuous Winter Ampacity¹ (A)	Emergency Winter Ampacity² (A)	Continuous Summer Ampacity³ (A)
2/0 Rubber	312	338	258
2/0 XLPE	331	376	281
4/0 XLPE	437	496	371

Notes:

- The planning ampacity rating is the continuous winter ampacity which is based on the following set of environmental and operating conditions:

80°C conductor temperature for Rubber
90°C conductor temperature for XLPE
0°C ambient air temperature
100% load factor

Overload is permissible for short periods of time. CLPU of up to 2.0 times the planning rating is acceptable assuming the CPLU event is limited to 1.0 hr.

- The emergency winter ampacity rating can be used for up to 100 hours per year and 500 hours over the entire life of the cable. The emergency rating is based on the following:

100°C conductor temperature for Rubber Cables
130°C conductor temperature for XLPE Cables
0°C ambient air temperature
100% load factor

- The continuous summer ampacity rating is based on the following set of environmental and operating conditions:

80°C conductor temperature for Rubber
90°C conductor temperature for XLPE
25°C ambient air temperature
100% load factor

**Newfoundland Power
Transmission Aerial Conductor Ratings**

Table 1 Transmission Conductor Ratings		
Size and Type	Continuous Winter Rating¹	Continuous Summer Rating²
	Amps	Amps
4/0 AASC	474.3	389.0
477 ASC	779.9	640.6
715.5 ASC	1,003.9	825.5
397.5 ACSR	712.7	585.4
559.5 AASC	875.6	719.7
1/0 AASC	303.3	248.4
1/0 ACSR	302.3	247.6
1/0 Copper	379.3	310.6
244.4 ACSR	563.8	463.1
266.8 ACSR	550.4	451.7
2/0 AASC	352.1	288.5
2/0 ACSR	350.4	287.2
336.4 ACSR	639.9	525.4
4/0 ACSR	471.5	386.7
500 ASC	816.4	670.7
350 MCM Cable	608.0	516.1
1000 MCM Cable	865.2	754.9

Notes:

1. The continuous winter rating is based on the following conditions:

- 75°C conductor temperature
- 0°C ambient air temperature
- 2 ft/s wind speed
- 100% load factor

This rating can be exceeded during abnormal system conditions when the ambient air temperature and wind speed exceed the 25°C and 2 ft/s conditions assumed for the table.

2. The continuous summer rating is based on the following conditions:

- 75°C conductor temperature
- 25°C ambient air temperature
- 2 ft/s wind speed
- 100% load factor

This rating can be exceeded during abnormal system conditions when the ambient air temperature and wind speed exceed the 25°C and 2 ft/s conditions assumed for the table.

**Newfoundland Power
Transmission Underground Cable Ratings**

Table 1 Transmission Underground Cable Ratings		
Size and Type	Continuous Winter Rating¹	Continuous Summer Rating²
	Amps	Amps
350 MCM Cable (12L, 14L)	608.0	516.1
1000 MCM Cable (4L, 13L)	865.2	754.9

Notes:

1. The Continuous Winter Cable Rating is based on the following set of environmental and operating conditions:

- 6 single phase conductor duct bank
- 110°C conductor temperature
- 20°C ambient earth temperature
- 75% load factor
- 90 [°C x cm/watt] earth thermal resistivity

2. The Continuous Summer Cable Rating is based on the following set of environmental and operating conditions:

- 6 single phase conductor duct bank
- 85°C conductor temperature
- 20°C ambient earth temperature
- 75% load factor
- 90 [°C x cm/watt] earth thermal resistivity