Outdoor Substation Conductor Ratings

Transmission and Substation Design Committee
Substation Conductor Rating Task Force

PJM Interconnection, LLC

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1.0 Scope / Introduction

The PJM Transmission and Substation Design Subcommittee (TSDS) was requested to review and update the existing Determination of Ratings for Tubular Bus document issued by the TSDS in August 1979. This document contains ampacity ratings for tubular bus used in substations and was based on calculations performed using a similar methodology and set of parameters determined for transmission line conductors. A task force consisting of representatives from PJM member operating companies was assigned the task of updating the tubular bus ratings. The results of the task force work are incorporated into this new document.

The task force utilized the information and methodology contained in IEEE Std 605-1998, "Guide for Design of Substation Rigid-Bus Structures" as a primary reference in developing new ampacity ratings for tubular bus as well as other wire conductors used in substations. The task force analyzed existing industry standards on bus design and line conductor ampacities, and determined the recommended values for the key parameters used in calculating conductor ampacity. Several of the key parameter values used by the task force in the ampacity calculations were changed from the values used in the 1979 tubular bus ratings.

This report includes a discussion of the key parameters used in calculating the ampacities of round shaped conductors used in outdoor substations. These parameters include wind speed and direction, ambient temperature, solar gain, emissivity, absorptivity, and maximum conductor temperature limitations for conditions of normal (continuous) and emergency (one hour and 24-hour) ratings. The report also contains a discussion on the calculation methodology, conductor materials, fittings and accessories, other ampacity considerations, and risk associated with wind speed different than assumed for calculations.

Lastly, this report includes new revised ampacity ratings for substation conductors used in facilities under the control of PJM. **The ratings provided in this document are for outdoor applications of aluminum and copper tubular bus, and bare aluminum and copper wire of various sizes.**

2.0 Definitions and Terms

Normal Conditions	All equipment in normal configuration, and normally expected range of ambient weather conditions.
Normal Rating	The maximum permissible constant load at normal conditions, at the maximum allowable conductor temperature for that conductor.
Emergency Conditions	Equipment has been operating at Normal Rating. The equipment is then exposed to an out of configuration condition.
Emergency Rating	The maximum permissible constant load at emergency conditions, at the maximum allowable conductor temperature. (for a period longer than 15 minutes, but not to exceed 24 hours)
Weather Conditions	Ambient temperature, solar and sky radiated heat flux, wind speed, wind direction, and elevation above sea level.
Max. Allowable Condr. Temp.	The maximum temperature limit that is selected in order to minimize loss of strength, conductor sag, line losses, or a combination of the above.
Time Risk	The time during which the conductor is vulnerable to operation at temperatures greater than the design temperature.
Temperature Risk	The maximum increase in conductor temperature above design temperature which can be experienced if the conductor carries its rated current simultaneously with an occurrence of the most severe set of ambient conditions.

3.0 Weather Assumptions

Ambient weather conditions have a major effect on thermal ratings of a substation conductor. There are many factors to consider when determining the precise weather model to utilize in the ampacity calculations of substation bus conductors. However, wind (speed and direction) and ambient temperature are major variables to consider and have the most effect in determining the final thermal ratings of substation conductor. The following sections will outline these major variables that are critical in the calculation of the overall thermal rating.

It is important to note that weather data was collected and analyzed in PJM work performed by the original transmission line conductor rating task force in 1973. The weather data included 10 years of data from Pittsburgh from January 1, 1949 through December 31, 1958 and 16 years of data from the Washington D.C. National Airport from January 1, 1949 through December 31, 1964. All of the data was combined to form an hourly composite record that was representative of the entire PJM service territory. The current task force evaluated this original data and believes it to remain representative of the weather conditions that exist within the present PJM territory.

3.1 Wind Speed

Wind speed is an important variable in determining the ratings of a substation conductor. The 1979 PJM tubular bus rating document followed the recommendations of the 1973 PJM transmission line rating work and used a zero wind speed in determining the normal rating of bus and 3.38 feet per second (fps) wind speed in determining the emergency rating of bus. These wind speed values were modified from those used for the transmission line rating work to acknowledge that substation environments were more open and less shielded from winds. The current task force has decided to utilize a rating philosophy for substation bus that is more consistent with other substation equipment and depart from ratings based upon different weather conditions that was used previously and is currently used for transmission line conductors. These systems operate in different clearance and safety environments and have different inherent risk limitations and therefore can have different rating assumptions. The operation of substation bus within a fenced in substation which is accessible only by trained personnel is inherently different than a transmission line which crosses a roadway, or public lands. Also, the original PJM bus rating criteria is in contrast to what is recommended in the IEEE Standard 605. Section C.3 (Heat Transfer) in Annex C of the IEEE Standard 605 document states that a wind speed of 2 fps is used for all substation conductor thermal rating calculations. In IEEE Standard 605, it is concluded that assumption of a 2 fps wind is a conservative, yet realistic approach and was chosen for the basis of the IEEE document.

In consideration of the above, the present task force recommends that a wind speed of 2 fps be used in the calculation of both normal and emergency thermal ratings of substation conductor and therefore is the basis for the published tables in this document. The inherent risks associated with utilizing this wind speed are discussed in Section 11 of this document.

3.2 Wind Direction

Both the 1979 PJM bus rating work and the IEEE Standard 605 agree in the utilization of a wind perpendicular to the substation conductor. A perpendicular wind (a 90^{o} cross wind) is recommended by this task force for the calculations of substation conductor thermal ratings and is used in the published tables.

3.3 Ambient Temperature

Ambient temperature is an important parameter to consider when calculating substation conductor thermal ratings. As stated in the 1979 PJM bus rating document, for the summer rating period, an ambient temperature of 35°C is to be used for substation conductor thermal rating calculations. Examination of the original PJM weather data indicates that the actual summer temperatures are less than or equal to 35°C over 99% of the time.

For the winter rating period an ambient temperature of 10°C is to be used for substation conductor thermal rating calculations. This is a reduction in ambient temperature versus the 1979 PJM work (10^{o}C versus 20^{o}C) and is believed to be a conservative, yet realistic selection. Examination of the original PJM weather data indicates that the actual winter temperatures are less than or equal to 10°C over 88% of the time.

The composite weather data supporting the above statistics can be found in Section 11. The inherent risk associated with utilizing the various ambient temperature parameters can be found in Section 11 of this document.

3.4 Rating Tables

The rating tables for each type of substation conductor will provide a specific thermal rating based on the wind and ambient temperature recommendations discussed above. The tables are ambient temperature adjusted so as to allow the system operator to determine the ampacity of a substation conductor based on real time information known at that specific time. Each table provides thermal ratings based on ambient temperatures from -15°C to +40°C in 5° increments.

3.5 Solar Gain & Atmosphere

The model utilized by the PJM task force is based upon the solar gain (solar heating) equations used in both IEEE Standard 605 and IEEE Standard 738-1993 “IEEE Standard for Calculating the Current-Temperature of Bare Overhead Conductors”. Both of these standards allow for adjustments in solar gain effects due to varying atmosphere clarity. The atmosphere clarity varies between a clear atmosphere and a hazy industrial atmosphere. The clear atmosphere allows for more solar heating of the bus conductor and results in a slightly lower bus ampacity rating when compared to the industrial atmosphere assumption. The bus ampacity tables published in IEEE Standard 605 are based upon a clear atmosphere. Utilizing this flexibility, the task force has chosen to utilize a clear atmosphere for ampacity calculations as defined by IEEE Standards 738 and 605. The task force believes this is a conservative, yet realistic approach and was chosen for the basis of this document.

4.0 Method of Calculation

4.1 Calculating the Current-Temperature Relationship of Conductors

Early in its deliberations, The PJM Tubular Bus Rating Task Force recognized that an updated method of calculating conductor ratings was needed to replace the original computer code that was written in FORTRAN in August 1979. Another goal of the task force was to have a user-friendly program that could operate in today's PC oriented office environment.

The task force selected the method of IEEE Standard 605. Copies of the standard are widely available and earlier IEEE source documents discuss the calculations in greater detail than the standard. IEEE Standard 605 is widely accepted as a standard within the industry and forms a commonly accepted basis for calculations. With this in mind, the task force developed a Microsoft Excel © Spreadsheet to accommodate a wide base of possible users. The spreadsheet applies the IEEE Standard 605 approach to these calculations for use by all PJM member companies.

4.2 Description of IEEE Standard 605-1998

This standard presents a method of calculating the current-temperature relationship of bare substation rigid-bus conductors based on a 2 fps wind perpendicular to the length of the conductors. The authors of the standard chose a 2 fps wind because it was, "conservative, yet realistic" and had the additional advantage of simplifying many of the equations.

The conductor temperature is a function of:

a. Conductor material
b. Conductor diameter
c. Conductor surface condition
d. Ambient weather conditions
e. Conductor electrical current

IEEE Standard 605 includes mathematical models to calculate conductor temperatures and conductor thermal ratings. The standard contains calculated tables with numerous temperature-current relationships for specific conductors (materials and shapes) and weather conditions, in all cases with a 2 fps wind present. Each user of the standard must assess which weather data and conductor characteristics are appropriate for his needs.

The source document for the ampacity calculation and table portion of IEEE Standard 605, PAS 96, No. 4, July/August 1977, Page 1341, "Thermal Considerations for Outdoor Bus Conductor Design Ampacity Tables," notes an elevation of sea level was used in preparing the ampacity tables. Conductor temperatures ranged from 70 °C to 150 °C. Ambient temperature was 40 °C.

The equations relating electrical current to conductor temperature may be used in either of the following two ways:

- To calculate the conductor temperature when the electrical current is known
- To calculate the current for a given conductor temperature (by iteration)

The Standard's approach to calculating ampacity requires first calculating the convective heat loss (q_c), the radiation loss (q_r), and the solar heat gain (q_s), of the conductor under investigation. Since the Task Force decided that calculations should be able to be performed at any wind speed, the convection equations contained in IEEE Standard 605 were modified to be suitable for variable wind speeds. The modifications were based on IEEE Standard 738.
Since both standards use the same sets of equations to calculate the radiation loss and the solar heat gain, the balance of this discussion will focus on convective heat loss considerations.

4.3 Convective Heat Loss Considerations

Convective heat loss, or the cooling due to air movement, is a major factor in determining the thermal rating of a conductor. There are two conditions to consider: (a) cooling due to natural convection – or a zero wind speed, and (b) cooling due to forced convection – or a non-zero wind speed. This section reviews material taken from IEEE Standards 605 and 738, to permit bus ampacity calculations for any wind speed.

4.3.1 Natural Convection

Natural convection applies to surfaces shielded from direct exposure to the wind. Assuming, however, that there is enough space for natural convection to occur, then surface heat loss can be calculated using generally accepted equations for natural convection. In Section C.3.2.3, IEEE Standard 605 (Substation Rigid-Bus Structures) gives equation (1.) below for natural convection over a cylindrical surface:

(1.) $$\mathbf{q_c = 0.0022 * \Delta T^{1.25} * l^{-0.25} * A}$$

ΔT = temperature difference between the conductor surface and the surrounding air in degrees Celsius.

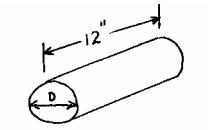
l = length of conductor surface in inches
= 12 for a one foot length of conductor.

A = conductor surface area in inches^2 / foot length.

q_c = convective heat loss in watts per linear foot.

Let's turn this into a more useful equation that can be put into a spreadsheet and used to calculate q_c.

A = area = π * D * 12 in^2 / ft
l = length of conductor surface in inches
= 12 * L = 12



Substituting into (eq. 1.) gives:

$q_c = 0.0022 * \Delta T^{1.25} * 12^{-0.25} * 12 * \pi * D$
$q_c = 0.0022 * \Delta T^{1.25} * 20.255166 * D$

(2.) $$\mathbf{q_c = .044561 * D * \Delta T^{1.25} \text{ watts / ft}}$$

By comparison, IEEE Standard 738 (Bare Overhead Conductors) explicitly recognizes more of the factors involved in natural convection heat loss. As noted in Section 2.4.4 of that Standard:

(3.) $\mathbf{q_{c0} = .283 * \rho_r^{0.5} * D^{0.75} * \Delta T^{1.25}}$ **watts/ft**

q_{c0} = convective heat loss due to zero wind
ρ_r= density of air in lb/ft^3
D= conductor outer diameter in inches
ΔT= temperature difference between the conductor surface and the surrounding air in degrees Celsius

Since the spreadsheet developed by the task force is based on the work of the previous Conductor Rating Task Force, equation (3.) above is used. This facilitates recognizing the effect of elevation upon conductor ratings (higher elevation results in lower air density and therefore lower heat transfer, all else being equal.).

4.3.2 Forced Convection

IEEE Standard 605, section C.3.2 2 gives the following equation for heat transfer where there is a 2 fps wind.

(4.) $\mathbf{q_c = .010 * (D^{-0.4}) * A * \Delta T}$

D = outer diameter of cylinder in inches
A = surface area of cylinder in inches^2 per foot length
ΔT = temperature difference in degrees Celsius between the conductor surface and the ambient air temperature.

Remembering that the surface area of a 12 inch long cylinder = 12 * π * D and then substituting in equation (4.) gives:

(5.) $\mathbf{q_c = 0.376991 * D^{0.6} * \Delta T}$

This equation, again, is valid only for a 2 fps wind. As stated in section C.3 of IEEE Standard 605, an assumption of a 2 fps wind is a conservative, yet realistic approach, and it will be used in the examples given herein.

IEEE Standard 738 notes in section 2.6.1.2, "Since the wind velocity is greater than 0 ft/second, the forced convection heat loss for perpendicular wind is calculated according to equations (6a.) and (6b.) corrected for wind direction, and compared to the natural convection heat loss. The larger of the heat losses due to both natural and forced convection is then used in calculating the thermal rating."

(6a.) $\mathbf{q_{c1} = [\ 1.01 + 0.371 * (3600\ D\ \rho_r\ V/\mu_r)^{0.52}\ ] * k_f * (T_c - T_a)}$

(6b.) $\mathbf{q_{c2} = .1695 * (3600\ D\ \rho_r\ V/\mu_r)^{0.52} * k_f * (T_c - T_a)}$

where V = wind velocity in feet per second.

Taking this guidance leads to the conclusion that the proper method of calculating q_c is to use the specific equations for q_{c0}, q_{c1}, and q_{c2} and then pick the one yielding the greatest value. To recap, q_{c0} is the convective heat loss due to zero wind, and q_{c1} is the convective heat loss due to low wind velocity. The q_{c1} equation applies at low wind speeds, but gives values that are too low at high wind speeds. q_{c2} is the convective heat loss due to high wind speed. This equation gives values that are too low at low wind speeds. Hence the largest heat loss value is chosen

In the spreadsheet, the following equations will be used for the calculations:

q_c = Maximum (q_{c0}, q_{c1}, and q_{c2})

q_{c0} = Equation (3.) = $.283 * \rho_r^{0.5} * D^{0.75} * \Delta T^{1.25}$ watts/ft

q_{c1} = Equation (6a.) = $[1.01 + 0.371*(3600 D \rho_r V/\mu_r)^{0.52}] * k_f * (T_c - T_a)$ watts/ft

q_{c2} = Equation (6b.) = $.1695 * (3600 D \rho_r V/\mu_r)^{0.52} * k_f * (T_c - T_a)$ watts/ft

The tables below compares the values of q_c obtained for a 2 fps wind speed using the equations of IEEE Standard 605 and the Task Force's spreadsheet for various diameter tubes.

6" Diameter Tubes

Tc	Ta	q_c 605	q_c spreadsheet	605/spreadsheet
60	40	22.09	21.29	3.77%
80	40	44.19	42.34	4.36%
100	40	66.28	63.16	4.94%
120	40	88.37	83.78	5.48%
150	40	121.51	114.36	6.26%
180	40	154.65	144.46	7.06%

4" Diameter Tubes

Tc	Ta	q_c 605	q_c spreadsheet	605/spreadsheet
60	40	17.32	16.70	3.73%
80	40	34.64	33.20	4.35%
100	40	51.97	49.52	4.94%
120	40	69.29	65.69	5.48%
150	40	95.27	89.66	6.26%
180	40	121.26	113.34	6.98%

2” Diameter Tubes

Tc	Ta	q_c 605	q_c spreadsheet	605/spreadsheet
60	40	11.43	11.09	3.05%
80	40	22.86	22.15	3.19%
100	40	34.29	33.19	3.30%
120	40	45.71	44.22	3.38%
150	40	62.86	60.76	3.45%
180	40	80.00	77.28	3.52%

In conclusion, the q_c calculation in the spreadsheet gives q_c values that are between 3% and 7% lower than those calculated by the formula of IEEE Standard 605. The practical impact of these upon conductor ampacity is minimal, as shown in the tables below. These tables compare the spreadsheet against the values in IEEE Standard 605, Table B.3 for schedule 40 aluminum (6063 alloy – 53.0 % conductivity) tubular bus at a 40°C ambient at sea level. The small differences are attributable to rounding errors, errors due to curve fitting to data in the standard, and unavailability of the actual conductor constants that were used in preparing the original tables.

6” Diameter Tubes

Size	Conductor Temperature					
	80°C	90 °C	100 °C	110 °C	140 °C	150 °C
6” from 605	3771	4435	5003	5506	6382	7144
6” spdsht	3876	4506	5047	5528	6366	7096
Difference	**105 amps**	**71 amps**	**44 amps**	**22 amps**	**-16 amps**	**-48 amps**

4” Diameter Tubes

Size	Conductor Temperature					
	80°C	90 °C	100 °C	110 °C	140 °C	150 °C
4” from 605	2534	2954	3315	3535	4192	4675
4” spdsht	2589	2990	3335	3642	4176	4640
Difference	**55 amps**	**46 amps**	**20 amps**	**7 amps**	**-16 amps**	**-35 amps**

2” Diameter Tubes

Size	Conductor Temperature					
	80°C	90 °C	100 °C	110 °C	140 °C	150 °C
2” from 605	1217	1402	1561	1703	1949	2161
2” spdsht	1235	1413	1566	1702	1942	2150
Difference	**18 amps**	**11 amps**	**5 amps**	**-1 amp**	**-7 amps**	**-11 amps**

5.0 Emissivity and Absorptivity

For all ampacity calculations within this guide the emissivity and absorptivity of rigid bus conductors are considered to be equal. The values used for emissivity and absorptivity for copper bus are 0.85 and for aluminum bus are 0.50. These values are typical after extended outdoor exposure resulting in weathered conductors and are in alignment with IEEE Standard 605.

The values of emissivity and absorptivity used in the original PJM document for tubular bus were based upon tests made on stranded aluminum conductors. As stated above, the task force has chosen to utilize the values for emissivity and absorptivity from IEEE Standard 605. These changes have a small impact on the ampacity of the bus.

For stranded aluminum and copper conductors used in a substation, an emissivity value of 0.7 and an absorptivity value of 0.9 will be used for both materials. These values are based on the 1973 study titled *"Determination of Bare Overhead Conductor Ratings"* and are identical to the values used in the previous tubular bus rating guide.

6.0 Maximum Conductor Temperature Limitations

It is extremely important to choose conductor operating temperatures that will enable the conductor to operate without any significant reduction in mechanical strength or life. Many studies have been performed to determine the temperatures at which conductors can operate without loss of strength or life. ECAR (East Central Area Reliability) report 74-TFP-37, "*Transmission Conductors Loss of Strength Due To Elevated Temperature"*, and report 74-EEP-42, "*A Uniform Method For the Determination of Load Capability of Line Terminal Equipment*" have both been used to assist the task force in selecting the recommendations for substation conductor maximum operating temperatures. Much of the information in this section of the report has been taken from the referenced ECAR reports.

When selecting the maximum temperature at which a conductor is to operate, one must consider the annealing characteristic of the conductor. The annealing process causes a loss of the conductor strength. A loss in strength occurs whenever the conductor is exposed to elevated temperature operation for a period of time. After a conductor is operated at an elevated temperature, there is no recovery of the amount of strength lost when the conductor is allowed to cool. Additional loss of strength from subsequent heating cycle will begin with the loss established by the previous heating cycle and will continue to accumulate as long as the elevated temperatures exist. The amount of loss of strength will increase rapidly under extreme emergency operating conditions and can be calculated if sufficient information on the conductor materials and operating history is available with respect to temperatures experienced and the duration of the exposure. ECAR report 74-TFP-37 provides a method for performing these calculations.

Conductor loss of strength is a function of the conductor temperature and the duration of time the conductor is at that temperature. For stranded conductors, factors considered in the determination of conductor loss of strength include the loss of strength factor, the strength ratio of conductor components, the strength adjustment due to stranding of cabling factor, and the adjustment to test strand data. The loss of strength factor is a percent loss of strength of test strands taken from suppliers' data. The ratios of the strength of each component part of a cable to the total strength of the cable are given in ECAR report 74-TFP-37, and reflect the composite effect of the rated strength of strands, cabling reduction, and metal proportions. The cabling process reduces the effective strength of the individual components of the cable relative to the sum of the individual strands. This factor is given by ASTM standards. The adjustment to test strand factor is needed since the entire cable is composed of strands that may not be of identical type and strength. The initial strength of strands is a function of the cold drawing process at the wire mill. The final strength in the fully annealed state is related only to the metal alloy. Consequently, the portion of the initial strength that can be lost through annealing will be greater for the higher strength strands than for the lower strength strands.

The conductor temperature limitations chosen by the task force are based on ECAR report 74-EEP-42. The temperature limits are based on the annealing characteristics of hard-drawn copper and two representative aluminum conductor materials. The maximum

normal conductor temperatures chosen are based on a normal temperature limit at which operation at this temperature will result in no reduction of conductor strength. The normal operating temperatures chosen are 75°C for copper wire, 90°C for aluminum and copper tube, and 105°C for aluminum wire (AAC, AAAC, ACAR, & ACSR). The maximum 24 hour conductor emergency operating temperatures chosen are based on a temperature limit at which operation at this temperature for 24 hours will rarely result in more than one percent loss of strength. The emergency 24 hour operating temperatures chosen are 95°C for copper wire, 115°C for aluminum and copper tube and 130°C for aluminum wire. The maximum one hour conductor emergency operating temperatures chosen are based on a temperature limit at which operation at this temperature for one hour will rarely result in more than one percent loss of strength. The emergency one hour operating temperatures chosen are 110°C for copper wire, 130°C for aluminum and copper tube, and 140°C for aluminum wire.

A ten to fifteen percent loss of initial conductor tensile strength over the lifespan of the conductor is considered to be the limit for maintaining safe mechanical integrity of the conductor.

7.0 Conductor Materials

Copper and aluminum are the main basic materials used in commercial manufacturing of most types of electrical conductors for current carrying applications in electric power systems.

Conductivity standards of copper (percent International Annealed Copper Standard (IACS)[1]) apply to pure copper in the annealed or unrestrained condition, for as the metal is cold worked its resistance is increased and conductivity decreased. The cold working of copper greatly increases its ultimate tensile strength. Likewise, greater strength is obtained if certain alloying ingredients are added, but its conductivity is decreased. Commercial hard drawn copper conductor is considered as having conductivity of 97% IACS.

Pure aluminum has an electrical conductivity of 65% IACS. Commercial high-purity aluminum alloys such as 1350, 6063 and 6061 are the forms of aluminum most widely used for electrical conductors. They have a conductivity of approximately 61, 53 and 41 % IACS respectively. Again, greater strength is obtained if certain alloying ingredients are added, but its conductivity is decreased. Aluminum conductors are manufactured to meet appropriate ASTM (American Society for Testing and Materials) specifications.

In general, a high strength metallic alloy can only be produced at the expense of conductivity. Conversely, a high conductivity metallic alloy can only be produced at the expense of high strength. Improvement of strength may be achieved by: addition of alloying elements, cold working, or heat treatment (i.e. temper).

The task force has decided to publish ampacity tables for various sized of copper and aluminum tube and wire. These tables are included in Section 13 of this document.

[1] ***Note*** : International Annealed Copper Standard (IACS) – In 1913 the International Electro-Technical Commission established an annealed copper standard (IACS) which in terms of weight resistivity specifies the resistance of a copper wire one meter long that weighs one gram. The reference temperature is taken to be at 20ºC.

8.0 Other Considerations

The purpose of this document is to define the ampacity rating method to be used for substation conductors. It is not intended to be a comprehensive bus design standard. Other elements of bus design are the responsibility of the design engineer. Some of the other elements that need to be considered are described below:

8.1 Connections to Station Equipment

Bus ratings within this document are based on maximum allowable conductor temperatures over the specified time period to prevent significant loss of conductor strength. It is important to recognize that the heat generated by a bus conductor may be conducted to any attached equipment. While fittings and connectors often act as heat sinks and can dissipate heat generated by the bus, equipment temperature limitations must be considered to insure proper bus design. Equipment temperature limitations should be obtained from the applicable specification or equipment manufacturer.

8.2 Thermal Expansion

Bus conductors expand and contract as their temperature changes. This expansion and contraction, if not properly designed for, can induce significant loadings on bus supports. For long bus spans, provisions should be made to allow for expansion and contraction of bus conductors over the operating temperature range through the use of expansion fittings.

8.3 De-rating of Parallel Busses or Conductors

All ratings within this guide apply to bus configuration with one conductor per phase and sufficient spacing between phases as to not impact the conductor rating. When more than one conductor per phase is used and the conductors are in close proximity, the conductors' ability to radiate heat is reduced. Consequently, the ampacity of the bus conductor is reduced. In these situations an appropriate ampacity rating reduction should be taken.

8.4 Uneven Loading of Parallel Conductors

Parallel conductors are often used to increase the ampacity of a bus. Depending on their physical configuration, mutual inductance between conductors can result in an impedance imbalance and uneven loading. The uneven loading of parallel conductors should be considered when calculating the overall ampacity rating of the bus.

9.0 Fittings and Accessories

The 1979 PJM Tubular Bus Rating task force contacted several manufacturers and electric utility companies to determine the effect of elevated temperatures on bus fittings and accessories. Replies confirmed that properly installed bus fittings and accessories can be operated at temperatures up to 120^{o}C without incurring either electrical or mechanical limitations. Several tests conducted by manufacturers showed that many conductor accessories operated at temperatures 50^{o}C to 100^{o}C lower than the conductor when operating at temperatures above 180^{o}C. This property is mainly dependent on the large mass and surface area of the fittings. The current PJM Tubular Bus Rating task force believes this information to still be valid. Overall, the quality of workmanship installing the fittings and accessories will directly affect the ability to operate at elevated temperatures. Therefore, it is imperative that fittings and accessories be properly installed in accordance with manufacturer's recommendations to insure the desired performance.

10.0 Rating Assumptions

Assumptions for Calculations shown in the results tables

Design Ambient Temperatures	35°C summer 10°C winter
Ambient Temperature Range	-15°C to 40°C
Wind Speed	2 Ft. per sec. (Normal & Emergency)
Wind Direction	90° to the conductor
Maximum allowable conductor Temp. range	70°C to 140°C (table 12-1, pg. 23)
Solar / Sky Radiated Heat Flux	Day Time / Clear
Elevation	1000 Ft. above sea level
latitude	40° North Latitude
Sun Time	14:00 Hrs.

Maximum **normal** operating temperature

Aluminum tube	90°C
Aluminum wire	105°C #
Copper tube	90°C
Copper wire	75°C

Maximum **emergency** (up to 24 hours) operating temperature

Aluminum tube	115°C #
Aluminum wire	130°C #
Copper tube	115°C #
Copper wire	95°C #

Maximum SHORT TERM (up to 1 hour) **emergency** operating temperature

Aluminum tube	130°C #
Aluminum wire	140°C #
Copper tube	130°C #
Copper wire	110°C #

Since heat generated in the bus conductor may be conducted to attached equipment, allowable conductor temperatures may be governed by the temperature limitations of the attached equipment. Equipment temperature limitations should be obtained from the applicable specification or equipment manufacturer.

11.0 Risk

As discussed previously, bus conductor ratings are affected by many factors. The most significant of these is wind speed. Unlike many of the other factors such as absorptivity, ambient temperature, conductor resistance, etc., wind speed is truly variable in magnitude and direction. In the early PJM work on transmission line conductors, summarized by the "Determination of Thermal Ratings for Bare Overhead Conductor, 1973", weather data was collected from Washington DC over a period of 16 years, and from Pittsburgh over a 10 year period. These data were pooled to represent a 26-year span of conditions in the PJM service territory. The weather data were summarized on pages A18 and A19 in the 1973 Report in a table format for the frequency distribution of wind and ambient temperature conditions. The tables are reprinted below. In these tables each row lists the probability of occurrence of a given wind speed at a specified ambient temperature. Alternately, each row gives the probability of occurrence of different ambient temperatures given the particular wind speed.

COMPOSITE WEATHER DATA
PITTSBURGH AND WASHINGTON, D.C.

PITTSBURGH 1/1/49 – 12/31/58	-	10 YEARS
NATIONAL AIRPORT 1/1/49 – 12/31/64	-	16 YEARS
TOTAL COMPOSITE HOURLY RECORD	-	26 YEARS

FREQUENCY OF OCCURRENCE (PERCENT)

SUMMER DAYS

	WIND SPEED-KNOTS						
AMBIENT TEMP.°*C*	***0***	***1***	***2***	***3***	***4***	***5***	***OVER 5***
0	0.009	0.025	0.042	0.024	0.059	0.070	1.830
5	0.038	0.115	0.195	0.247	0.326	0.427	6.455
10	0.059	0.176	0.299	0.345	0.519	0.634	8.811
15	0.070	0.209	0.355	0.484	0.741	0.955	11.147
20	0.103	0.311	0.528	0.655	1.049	1.401	14.559
25	0.109	0.324	0.550	0.791	1.405	1.743	17.949
30	0.059	0.178	0.302	0.496	0.962	1.381	14.708
35	0.012	0.034	0.058	0.127	0.261	0.389	4.650
Over 35	0.000	0.001	0.001	0.003	0.009	0.010	0.187
Total	**0.459**	**1.373**	**2.330**	**3.172**	**5.331**	**7.010**	**80.296**

SUMMER NIGHTS

	WIND SPEED-KNOTS						
AMBIENT TEMP.°*C*	***0***	***1***	***2***	***3***	***4***	***5***	***OVER 5***
0	0.031	0.090	0.153	0.114	0.248	0.271	2.998
5	0.125	0.373	0.632	0.659	0.921	1.135	8.495
10	0.174	0.524	0.887	0.987	1.340	1.453	10.003
15	0.257	0.773	1.312	1.174	1.654	2.089	11.975
20	0.351	1.020	1.730	1.582	2.254	2.600	13.952
25	0.236	0.711	1.207	1.671	2.205	2.582	12.846
30	0.037	0.112	0.188	0.342	0.426	0.516	2.490
35	0.000	0.001	0.002	0.006	0.013	0.011	0.064
Over 35	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	**1.211**	**3.604**	**6.111**	**6.535**	**9.061**	**10.657**	**62.823**

Note: Data is taken from page A-18 of 1973 PJM Report, "Determination of Thermal Ratings for Bare Overhead Conductors".

COMPOSITE WEATHER DATA
PITTSBURGH AND WASHINGTON, D.C.

PITTSBURGH 1/1/49 – 12/31/58	-	10 YEARS
NATIONAL AIRPORT 1/1/49 – 12/31/64	-	16 YEARS
TOTAL COMPOSITE HOURLY RECORD	-	26 YEARS

FREQUENCY OF OCCURRENCE (PERCENT)

WINTER DAYS

	WIND SPEED-KNOTS						
AMBIENT TEMP.*°C*	***0***	***1***	***2***	***3***	***4***	***5***	***OVER 5***
0	0.105	0.321	0.541	0.751	1.315	1.649	22.146
5	0.233	0.695	1.184	1.633	2.380	2.912	31.418
10	0.118	0.354	0.600	0.875	1.079	1.351	16.749
15	0.046	0.134	0.230	0.282	0.344	0.433	7.302
20	0.007	0.023	0.039	0.062	0.062	0.082	2.164
25	0.000	0.000	0.000	0.003	0.000	0.003	0.348
30	0.000	0.000	0.000	0.000	0.000	0.000	0.007
35	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Over 35	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	**0.509**	**1.527**	**2.594**	**3.606**	**5.180**	**6.430**	**80.134**

WINTER NIGHTS

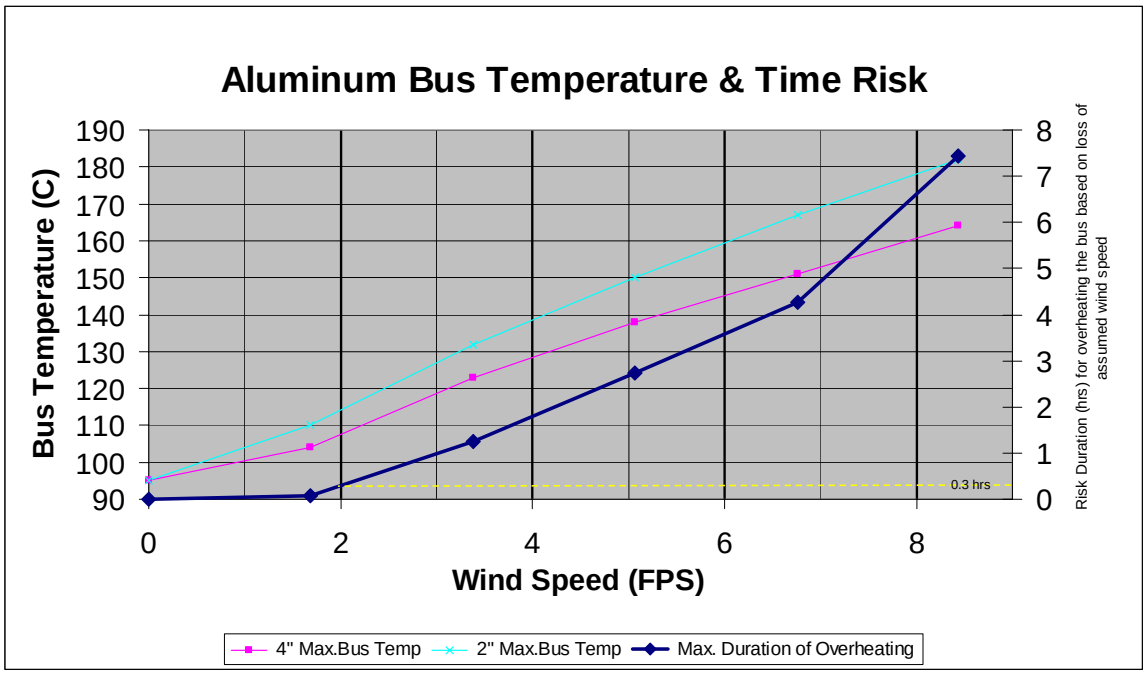
	WIND SPEED-KNOTS						
AMBIENT TEMP.*°C*	***0***	***1***	***2***	***3***	***4***	***5***	***OVER 5***
0	0.287	0.856	1.453	1.581	2.709	3.038	27.265
5	0.450	1.345	2.282	2.778	3.286	3.592	28.548
10	0.136	0.411	0.791	0.709	0.884	1.073	10.873
15	0.023	0.078	0.132	0.151	0.213	0.190	3.953
20	0.004	0.008	0.016	0.004	0.012	0.012	0.918
25	0.000	0.000	0.000	0.000	0.000	0.000	0.008
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000
35	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Over 35	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	**0.900**	**2.698**	**4.674**	**5.223**	**7.104**	**7.905**	**71.565**

Note: Data is taken from page A-19 of 1973 PJM Report, "Determination of Thermal Ratings for Bare Overhead Conductors".

When rating bus conductors, the choice of wind speed used is important due to the significant effect on the rating. While a higher wind speed is desired for the higher rating, there is a cost. What happens if the wind speed that actually occurs at the substation is less than the assumed value? As the original PJM work showed, the wind speed is characterized by a distribution of wind speeds with higher and lower values. A wind speed lower than assumed would result in a higher bus temperature than designed. For example, if a rating were based upon 100°C with 2 feet/sec. of wind and a lesser wind were to occur it would cause an increase in conductor temperature to a temperature above 100°C. The risk due to the magnitude of the over temperature condition is called temperature risk.

The duration of these lower wind speeds is also of concern. The acceptability of a particular temperature risk changes with the duration of that risk. For example, while a temperature overrun of 25°C would not be of major concern for 5 minutes, it would be more problematic if it were for 6 hours during mid-day. The risk due to the duration of the over temperature condition is called time risk.

The figure shown below illustrates these risks. On the horizontal axis are listed the wind speeds that could be used for the basis of a bus rating. On the left vertical axis are the bus temperatures that would result if the assumed wind conditions were not achieved. On the right are the durations for the wind speeds at or less than the rated values. For example with a rating of a section of 2" aluminum bus based upon 90°C and a wind speed of 2 feet per second, for times when the wind speed drops below 2 fps, the bus could rise in temperature up to approximately 115°C and may experience overheating above 90°C for about ¼% of the time.



From this chart it can be seen that the magnitude of over temperature condition is higher with small bus sizes, and reduced with large bus sizes. Additionally, it can be seen that the duration of an over temperature condition does not vary by bus size.

While the original PJM transmission line work evaluated these risks and developed a reasonable approach to manage these risks using normal ratings based upon 0 knots of wind, this approach is not applicable for substation bus conductor. It is not appropriate for substation ratings because transmission conductors are often sag limited. The maximum sags are controlled by operating and legal limitations. For substation bus, sag limitations do not typically exist, but thermal expansion issues and loss of mechanical strength is of concern.

11.1 Normal Ratings

The task force recommends normal ratings based upon 2 fps at normal bus operating temperatures of 90°C for aluminum tube, 105°C for aluminum wire, 90°C for copper tube, and 75°C for copper wire. These temperatures have been chosen to generally mitigate loss of mechanical strength of the aluminum or copper conductors through annealing. This philosophy includes an inherent temperature risk of overheating that can be quantified. For example, 4" schedule 80, 6063 aluminum bus has a proposed summer normal rating of 3713 amperes. This is based on a 35°C ambient temperature, a wind of 2 fps, and a bus operating temperature of 90°C. If during this period the wind speed were to fall to zero, then the bus temperature would rise due to the decrease in heat loss from the bus. In this case the bus temperature would rise to approximately 108°C. This represents a temperature risk of 18°C. While this may be relatively small, ratings based upon higher wind speeds will have commensurately higher temperature risk. The substation designer must consider the magnitude of temperature risk when designing for expansion and contraction of the bus over the wide range of possible operating temperatures. The temperature risk will change with changes in bus conductor size.

Once the temperature risk has been evaluated, the next logical question is how long will this over temperature condition exist. There are discrete probabilities that exist for weather conditions that will cause an overheated conductor based upon the assumed conditions. For a summer time assumed ambient temperature of 35°C and a wind speed of 2 fps, there is a possibility that the ambient temperature could actually be higher than 35°C and winds at or below 2 fps. From the composite weather figures shown earlier, it is possible to calculate the joint probability of summer daytime temperatures above 35°C and wind speeds of 2 fps. It is also possible to calculate the joint probabilities of occurrence for lesser wind speeds and ambient temperature combinations that result in bus overheating. These probabilities can then be summed to calculate the total probability of bus overheating for an assumed set of ambient conditions such as 35°C and 2 fps of wind. For the 4" aluminum bus described above, this calculation summing probabilities result in any bus overheating above 90°C yields a 0.3% duration of risk for summer daylight hours. Assuming 15 daylight hours per day in the summer time, and 180 days of summertime rating, this equates to 8 hours of risk per year.

Therefore, the bus conductor could be expected to overheat by up to 18°C for up to 0.3% of the time or about 8 hours per summer. This quantifies the magnitude of temperature and time risk in this example. In reality the probability is small of the bus operating at the rated load concurrently and with less than assumed wind.

Based on this type of analysis, it is possible to calculate the cumulative time and temperature risk for a 40 year expected lifetime of substation bus, and use these results to make a judgment about any concerns of loss of bus strength due to annealing. The task force believes the time and temperature risk in the magnitude depicted in this example does not represent a significant design concern for the substation bus conductor. The substation designer must make this evaluation for each individual substation design to determine what maximum operating temperature to utilize.

11.2 Emergency Ratings

Emergency ratings are provided for abnormal out of configuration system conditions. The duration of emergency conditions is much shorter, and based upon previous PJM work on transmission line conductors; PJM assumes emergency operations could exist for up to 4 hours per year. This is also a reasonable assumption for substation bus conductors. To help manage abnormal conditions, emergency ratings with durations of 24 hours and 1 hour are provided by this document.

While there is some non-zero additional time and temperature risk that is accumulated by emergency operation, the various emergency operating temperatures (95^{o}C, 115^{o}C and 130^{o}C) do not significantly increase loss of strength from annealing above the values previously described because the duration of temperatures above normal operating temperatures are small in the overall bus lifespan. The concern with emergency operations at high temperature becomes the adequate management of the expansion of the bus. Emergency rating periods are not to exceed 24 hours.

12.0 PJM Method Comparison

In the previous sections, the task force has detailed the changes recommended in the method and parameters for the calculation of substation bus conductor ratings.

Table 12-1 summarizes the changes in input parameters and provides a qualitative impact to the ratings for the change. The effect of any change in individual parameter should not be considered excessively, but the cumulative effect of all of the changes needs to be evaluated.

Table 12-2 summarizes the effective changes in ratings for 3 sizes of aluminum tubular bus between the original PJM ratings and the proposed ratings recommended in this document. It can be seen from the table that while the new ratings generally show an increase in capability when compared to the original PJM ratings, the table shows that there is a reduction in rating by between 5% and 8% for summer emergency conditions. The task force generally believes this reduction to be tolerable for a number of reasons. Firstly, some utility companies utilize the normal ratings for both normal and emergency conditions which render this concern meaningless. Second, some utility companies utilize a lower bus design temperature which provides a lower rating and therefore eliminates the concern.

The task force believes that there will be an inherent variance between any old method and a new one due to rounding issues, and variability in the bus resistance and temperature values. As a result of these alone, the task force believes that ratings that are within a few percent tolerance essentially represent identical ratings. As a result, the 5% to 8% reduction shown for summer emergency conditions in Table 12-2 are thought to be of little concern.

Table 12-1
PJM Substation Bus Conductor
Ampacity Parameter Summary

Parameter		Original PJM Value	New PJM Value	Resultant effect on ampacity
Wind Speed	Normal	0 fps	2 fps	Increase
	Emergency	3.38 fps	2 fps	Decrease
Summer Ambient	Normal	35°C	35°C	No change
	Emergency	20°C	35°C	Decrease
Winter Ambient	Normal	20°C	10°C	Increase
	Emergency	10°C	10°C	No change
Emissivity	Al Tube	0.7	0.5	Decrease
	Cu Tube	0.7	0.85	Increase
Absorptivity	Al Tube	0.9	0.5	Increase
	Cu Tube	0.9	0.85	Increase
Atmosphere Clarity		Clear	Clear	No Change
Normal Operating Temperature	Al Tube	*	90°C	Undefined : New values based on ECAR Study 74-EEP-42
	Al Wire	*	105°C	
	Cu Tube	*	90°C	
	Cu Wire	*	75°C	
24 Hr. Emergency Operating Temperature	Al Tube	*	115°C	
	Al Wire	*	130°C	
	Cu Tube	*	115°C	
	Cu Wire	*	95°C	
1 Hour Emergency Operating Temperature	Al Tube	*	130°C	
	Al Wire	*	140°C	
	Cu Tube	*	130°C	
	Cu Wire	*	110°C	

* Operating temperatures were selected by individual utility companies in the range of 70°C to 120°C

Table 12-2
PJM Substation Bus Conductor
Rating Comparison Table

Bus Size	Rating Condition	Original PJM (Amperes) *(See Note Below)*	New PJM Ratings (Amperes)	Change
2" Aluminum Sch. 40 6061 Alloy	Summer Normal	1170	1313	+12%
	Summer Emergency <24 Hrs.	1740	1623	**-7%**
	Summer Emergency <1 Hr.	1855	1781	**-4%**
	Winter Normal	1345	1614	+20%
	Winter Emergency <24 Hrs.	1855	1860	0%
	Winter Emergency <1 Hr.	1855	1991	+7%
4" Aluminum Sch. 40 6061 Alloy	Summer Normal	2620	2783	+6%
	Summer Emergency <24 Hrs.	3665	3477	**-5%**
	Summer Emergency <1 Hr.	4030	3829	**-5%**
	Winter Normal	3015	3434	+14%
	Winter Emergency <24 Hrs.	3910	3989	+2%
	Winter Emergency <1 Hr.	4030	4285	+6%
5" Aluminum Sch. 40 6061 Alloy	Summer Normal	3340	3479	+4%
	Summer Emergency <24 Hrs.	4585	4365	**-5%**
	Summer Emergency <1 Hr.	5135	4816	**-6%**
	Winter Normal	3840	4298	+12%
	Winter Emergency <24 Hrs.	4890	5008	+2%
	Winter Emergency <1 Hr.	5135	5387	+5%

Note: The original PJM ratings published in the "Determination of Ratings for Tubular Bus" dated 1979 establish bus conductor ratings based upon a bus conductor design temperature ranging between 70°C and 120°C. The ratings shown in the table above are based on 90°C and represent typical values used. Individual substation owners may currently use different ratings due to the use of a different design temperature.

Table 12-2 (cont'd)
PJM Substation Bus Conductor
Rating Comparison Table

Bus Size	Rating Condition	Original PJM (Amperes) *(See Note Below)*	New PJM Ratings (Amperes)	Change
2" Aluminum Sch. 40 6063 Alloy	Summer Normal	1310	1473	+12%
	Summer Emergency <24 Hrs.	1950	1808	**-7%**
	Summer Emergency <1 Hr.	2085	1977	**-5%**
	Winter Normal	1505	1811	+20%
	Winter Emergency <24 Hrs.	2080	2073	0%
	Winter Emergency <1 Hr.	2085	2211	+6%
4" Aluminum Sch. 40 6063 Alloy	Summer Normal	2940	3122	+6%
	Summer Emergency <24 Hrs.	4115	3872	**-6%**
	Summer Emergency <1 Hr.	4555	4248	**-7%**
	Winter Normal	3380	3852	+14%
	Winter Emergency <24 Hrs.	4385	4443	+1%
	Winter Emergency <1 Hr.	4555	4754	+4%
5" Aluminum Sch. 40 6063 Alloy	Summer Normal	3740	3899	+4%
	Summer Emergency <24 Hrs.	5135	4857	**-5%**
	Summer Emergency <1 Hr.	5825	5338	**-8%**
	Winter Normal	4300	4817	+12%
	Winter Emergency <24 Hrs.	5475	5572	+2%
	Winter Emergency <1 Hr.	5825	5971	+3%

Note: The original PJM ratings published in the "Determination of Ratings for Tubular Bus" dated 1979 establish bus conductor ratings based upon a bus conductor design temperature ranging between 70°C and 120°C. The ratings shown in the table above are based on 90°C and represent typical values used. Individual substation owners may currently use different ratings due to the use of a different design temperature.

Table 12-2 (cont'd)
PJM Substation Bus Conductor
Rating Comparison Table

Bus Size	Rating Condition	Original PJM (Amperes) *(See Note Below)*	New PJM Ratings (Amperes)	Change
2" Aluminum Sch. 80 6061 Alloy	Summer Normal	1370	1539	+12%
	Summer Emergency <24 Hrs.	2040	1902	**-7%**
	Summer Emergency <1 Hr.	2175	2087	**-4%**
	Winter Normal	1575	1892	+20%
	Winter Emergency <24 Hrs.	2175	2180	0%
	Winter Emergency <1 Hr.	2175	2334	+7%
4" Aluminum Sch. 80 6061 Alloy	Summer Normal	3075	3263	+6%
	Summer Emergency <24 Hrs.	4305	4070	**-5%**
	Summer Emergency <1 Hr.	4980	4479	**-10%**
	Winter Normal	3540	4025	+14%
	Winter Emergency <24 Hrs.	4590	4669	+2%
	Winter Emergency <1 Hr.	4980	5012	+1%
5" Aluminum Sch. 80 6061 Alloy	Summer Normal	3955	4115	+4%
	Summer Emergency <24 Hrs.	5425	5159	**-5%**
	Summer Emergency <1 Hr.	6495	5689	**-12%**
	Winter Normal	4545	5084	+12%
	Winter Emergency <24 Hrs.	5785	5918	+2%
	Winter Emergency <1 Hr.	6495	6364	**-2%**

Note: The original PJM ratings published in the "Determination of Ratings for Tubular Bus" dated 1979 establish bus conductor ratings based upon a bus conductor design temperature ranging between 70°C and 120°C. The ratings shown in the table above are based on 90°C and represent typical values used. Individual substation owners may currently use different ratings due to the use of a different design temperature.

Table 12-2 (cont'd)
PJM Substation Bus Conductor
Rating Comparison Table

Bus Size	Rating Condition	Original PJM (Amperes) *(See Note Below)*	New PJM Ratings (Amperes)	Change
2" Aluminum Sch. 80 6063 Alloy	Summer Normal	1530	1722	+13%
	Summer Emergency <24 Hrs.	2280	2112	**-7%**
	Summer Emergency <1 Hr.	2435	2308	**-5%**
	Winter Normal	1760	2116	+20%
	Winter Emergency <24 Hrs.	2435	2421	**-1%**
	Winter Emergency <1 Hr.	2435	2581	+6%
4" Aluminum Sch. 80 6063 Alloy	Summer Normal	3445	3713	+8%
	Summer Emergency <24 Hrs.	4815	4617	**-4%**
	Summer Emergency <1 Hr.	5575	5072	**-9%**
	Winter Normal	3960	4580	+16%
	Winter Emergency <24 Hrs.	5135	5296	+3%
	Winter Emergency <1 Hr.	5575	5676	+2%
5" Aluminum Sch. 80 6063 Alloy	Summer Normal	4420	4586	+4%
	Summer Emergency <24 Hrs.	6065	5693	**-6%**
	Summer Emergency <1 Hr.	7265	6244	**-14%**
	Winter Normal	5080	5665	+12%
	Winter Emergency <24 Hrs.	6470	6530	+1%
	Winter Emergency <1 Hr.	7265	6984	**-4%**

Note: The original PJM ratings published in the "Determination of Ratings for Tubular Bus" dated 1979 establish bus conductor ratings based upon a bus conductor design temperature ranging between 70°C and 120°C. The ratings shown in the table above are based on 90°C and represent typical values used. Individual substation owners may currently use different ratings due to the use of a different design temperature.

13.0 Ampacity Tables

Below are tubular bus sizes and wire sizes that are included in the following in the published ampacity tables of this report:

Tubular Bus Conductors

Aluminum Tubular Bus

Schedule 40, 6061 Alloy	Schedule 80, 6061 Alloy	Schedule 40, 6063 Alloy	Schedule 80, 6063 Alloy
1" Alum, Sched 40, 6061 Alloy	1" Alum, Sched 80, 6061 Alloy	1" Alum, Sched 40, 6063 Alloy	1" Alum, Sched 80, 6063 Alloy
1-1/2" Alum, Sched 40, 6061 Alloy	1-1/2" Alum, Sched 80, 6061 Alloy	1-1/2" Alum, Sched 40, 6063 Alloy	1-1/2" Alum, Sched 80, 6063 Alloy
2" Alum, Sched 40, 6061 Alloy	2" Alum, Sched 80, 6061 Alloy	2" Alum, Sched 40, 6063 Alloy	2" Alum, Sched 80, 6063 Alloy
2-1/2" Alum, Sched 40, 6061 Alloy	2-1/2" Alum, Sched 80, 6061 Alloy	2-1/2" Alum, Sched 40, 6063 Alloy	2-1/2" Alum, Sched 80, 6063 Alloy
3" Alum, Sched 40, 6061 Alloy	3" Alum, Sched 80, 6061 Alloy	3" Alum, Sched 40, 6063 Alloy	3" Alum, Sched 80, 6063 Alloy
3-1/2" Alum, Sched 40, 6061 Alloy	3-1/2" Alum, Sched 80, 6061 Alloy	3-1/2" Alum, Sched 40, 6063 Alloy	3-1/2" Alum, Sched 80, 6063 Alloy
4" Alum, Sched 40, 6061 Alloy	4" Alum, Sched 80, 6061 Alloy	4" Alum, Sched 40, 6063 Alloy	4" Alum, Sched 80, 6063 Alloy
5" Alum, Sched 40, 6061 Alloy	5" Alum, Sched 80, 6061 Alloy	4-1/2" Alum, Sched 40, 6063 Alloy	4-1/2" Alum, Sched 80, 6063 Alloy
6" Alum, Sched 40, 6061 Alloy	6" Alum, Sched 80, 6061 Alloy	5" Alum, Sched 40, 6063 Alloy	5" Alum, Sched 80, 6063 Alloy
		6" Alum, Sched 40, 6063 Alloy	6" Alum, Sched 80, 6063 Alloy

Copper Tubular Bus

Schedule 40	Schedule 80
¾" Schedule 40	
1" Schedule 40	1" Schedule 80
1 ¼" Schedule 40	
1 ½" Schedule 40	1 ½" Schedule 80
2" Schedule 40	2" Schedule 80
2 ½" Schedule 40	2 ½" Schedule 80
3" Schedule 40	3" Schedule 80
4" Schedule 40	4" Schedule 80

Strain Bus Conductors

AAC Wire

3/0 7 str	350 kcm 19 str	795 kcm 61 str	1590 kcm 61 str	
250 kcm 19 str	500 kcm 19 str	1000 kcm 37 str	2000 kcm 127 str	
300 kcm 19 str.	556.5 kcm 37 str	1033.5 kcm 61 str	3500 kcm 127 str.	
336.4 kcm 19 str	795 kcm 37 str	1510.5 kcm 61 str		

ACAR Wire

2493 kcm 54/37

ACSR Wire

1/0 6/1	266.8 kcm 26/7	477 kcm 26/7	795 kcm 26/7	1272 kcm 45/7
2/0 6/1	266.8 kcm 30/7		795 kcm 30/7	
3/0 6/1			795 kcm 30/19	
4/0 6/1	336 kcm 18/1	556.5 kcm 24/7	954 kcm, 45/7	1590 kcm 45/7
	336.4 kcm 26/7	556.5 kcm 26/7	954 kcm 48/7	1590 kcm 54/19
159 kcm 12/7	336.4 kcm 30/7	556.5 kcm 30/7		
203.2 kcm 16/19	397.5 kcm 26/7	605 kcm 24/7	1033.5 kcm 45/7	2167 kcm 72/7
	397.5 kcm 30/7		1033.5 kcm 54/7	

Copper Wire

1/0 7 Str	4/0 7 str	350 kcm 19 str	750 kcm 37 str	1500 kcm SD 61 str
	4/0 19 str	350 kcm 37 str	750 kcm HD 61 str	
2/0 7 Str	250 kcm 19 str	500 kcm 19 str	1000 kcm 37 str	2000 kcm 127 str
		500 kcm HD 37 Str	1000 kcm SD 61 str	

Bus Conductor: **1" Alum, Sched 40, 6061 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	891	859	825	789	752	712	670	624	574	519	457	384
	70	949	920	889	857	823	788	751	711	669	624	574	520
	80	1003	976	948	918	888	856	823	787	751	711	669	624
Normal	**90**	**1053**	**1028**	**1002**	**975**	**947**	**917**	**887**	**855**	**822**	**788**	**751**	**712**
	100	1100	1076	1052	1027	1001	974	946	917	887	856	823	788
	110	1145	1122	1100	1076	1052	1027	1001	974	947	918	888	857
Emergency (<24 hrs)	**115**	**1166**	**1144**	**1122**	**1100**	**1076**	**1052**	**1027**	**1001**	**975**	**947**	**918**	**889**
	120	1187	1166	1144	1122	1100	1076	1052	1028	1002	975	948	919
Emergency (< 1 hr)	**130**	**1227**	**1208**	**1187**	**1166**	**1145**	**1123**	**1101**	**1077**	**1054**	**1029**	**1003**	**977**
	140	1266	1248	1228	1209	1188	1168	1147	1125	1102	1079	1056	1031
	150	1304	1286	1268	1249	1230	1210	1190	1170	1149	1127	1105	1082
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1" Alum, Sched 40, 6061 Alloy		Outside Diameter =	1.315 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	4.1E-05 ohms/ft	R_{high} =	4.7E-05 ohms/ft

Bus Conductor: **1-1/2" Alum, Sched 40, 6061 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	1256	1209	1160	1109	1056	999	937	871	799	719	628	520
	70	1340	1298	1254	1208	1160	1110	1056	1000	939	873	802	722
	80	1418	1380	1339	1298	1254	1209	1161	1111	1058	1002	941	876
Normal	**90**	**1492**	**1456**	**1419**	**1380**	**1340**	**1299**	**1256**	**1211**	**1163**	**1114**	**1061**	**1005**
	100	1561	1527	1493	1457	1420	1382	1342	1301	1258	1213	1166	1117
	110	1626	1595	1562	1529	1495	1460	1423	1385	1346	1305	1262	1217
Emergency (<24 hrs)	**115**	**1658**	**1627**	**1596**	**1564**	**1531**	**1496**	**1461**	**1425**	**1387**	**1348**	**1307**	**1264**
	120	1689	1659	1629	1597	1565	1532	1498	1463	1427	1389	1350	1309
Emergency (< 1 hr)	**130**	**1748**	**1721**	**1692**	**1663**	**1632**	**1601**	**1570**	**1537**	**1503**	**1468**	**1432**	**1394**
	140	1806	1780	1753	1725	1697	1667	1637	1607	1575	1542	1508	1474
	150	1862	1837	1811	1785	1758	1731	1702	1673	1643	1613	1581	1549
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1-1/2" Alum, Sched 40, 6061 Alloy		Outside Diameter =	1.9 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	2.5E-05 ohms/ft	R_{high} =	2.9E-05 ohms/ft

Bus Conductor: **2" Alum, Sched 40, 6061 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	1563	1504	1443	1378	1310	1238	1160	1076	984	882	766	626
	70	1669	1616	1560	1502	1441	1377	1309	1238	1161	1078	987	885
	80	1767	1718	1667	1614	1559	1501	1441	1378	1310	1239	1163	1080
Normal	**90**	**1858**	**1812**	**1765**	**1717**	**1666**	**1614**	**1559**	**1502**	**1442**	**1379**	**1313**	**1242**
	100	1944	1901	1858	1812	1766	1717	1667	1615	1561	1505	1445	1383
	110	2025	1985	1944	1902	1859	1814	1768	1720	1670	1619	1566	1510
Emergency (<24 hrs)	**115**	**2064**	**2026**	**1986**	**1945**	**1903**	**1860**	**1816**	**1769**	**1722**	**1673**	**1623**	**1570**
	120	2103	2065	2027	1987	1947	1905	1862	1818	1773	1726	1677	1626
Emergency (< 1 hr)	**130**	**2177**	**2142**	**2105**	**2068**	**2030**	**1991**	**1952**	**1911**	**1869**	**1826**	**1781**	**1734**
	140	2249	2215	2181	2146	2111	2075	2038	2000	1961	1920	1878	1835
	150	2318	2287	2255	2223	2190	2156	2121	2085	2048	2010	1971	1931
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	2" Alum, Sched 40, 6061 Alloy		Outside Diameter =	2.375 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	1.9E-05 ohms/ft	R_{high} =	2.1E-05 ohms/ft

Bus Conductor: **2-1/2" Alum, Sched 40, 6061 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	2091	2012	1930	1843	1751	1653	1548	1434	1310	1170	1011	819
	70	2236	2164	2089	2011	1929	1843	1752	1655	1551	1438	1314	1177
	80	2369	2303	2235	2164	2090	2012	1931	1846	1755	1659	1555	1444
Normal	**90**	**2494**	**2433**	**2370**	**2304**	**2236**	**2166**	**2092**	**2016**	**1935**	**1850**	**1760**	**1664**
	100	2611	2554	2496	2435	2372	2307	2240	2170	2097	2021	1941	1856
	110	2723	2669	2614	2558	2500	2439	2377	2313	2246	2177	2104	2028
Emergency (<24 hrs)	**115**	**2776**	**2724**	**2671**	**2617**	**2560**	**2502**	**2443**	**2381**	**2317**	**2250**	**2181**	**2108**
	120	2829	2778	2727	2674	2620	2564	2506	2446	2385	2321	2254	2185
Emergency (< 1 hr)	**130**	**2931**	**2883**	**2835**	**2785**	**2734**	**2682**	**2628**	**2572**	**2515**	**2455**	**2394**	**2330**
	140	3029	2984	2938	2891	2843	2794	2743	2691	2638	2582	2525	2466
	150	3125	3082	3039	2994	2949	2902	2854	2805	2755	2703	2650	2595
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	2-1/2" Alum, Sched 40, 6061 Alloy		Outside Diameter =	2.875 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	1.2E-05 ohms/ft	R_{high} =	1.4E-05 ohms/ft

Bus Conductor: **3" Alum, Sched 40, 6061 Alloy**

Rating	Rated Operating Temperature	Assumed Wind Speed = 2 fps Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	2546	2450	2348	2241	2128	2008	1879	1738	1584	1412	1212	970
	70	2726	2638	2546	2451	2350	2244	2132	2013	1885	1746	1593	1422
	80	2892	2811	2727	2640	2550	2455	2355	2250	2139	2020	1893	1755
Normal	**90**	**3047**	**2972**	**2895**	**2815**	**2732**	**2646**	**2556**	**2461**	**2362**	**2258**	**2148**	**2030**
	100	3192	3123	3051	2977	2901	2822	2739	2654	2564	2471	2372	2269
	110	3331	3266	3199	3130	3059	2986	2910	2831	2749	2664	2575	2482
Emergency (<24 hrs)	**115**	**3398**	**3335**	**3270**	**3203**	**3135**	**3064**	**2991**	**2915**	**2837**	**2755**	**2670**	**2582**
	120	3463	3402	3339	3275	3209	3140	3070	2997	2922	2843	2762	2677
Emergency (< 1 hr)	**130**	**3591**	**3533**	**3474**	**3413**	**3351**	**3287**	**3221**	**3153**	**3083**	**3011**	**2936**	**2858**
	140	3714	3659	3603	3546	3488	3428	3366	3302	3237	3169	3100	3027
	150	3833	3781	3729	3674	3619	3562	3504	3445	3383	3320	3255	3188
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	3" Alum, Sched 40, 6061 Alloy		Outside Diameter =	3.5 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	9.1E-06 ohms/ft	R_{high} =	1E-05 ohms/ft

Bus Conductor: **3-1/2" Alum, Sched 40, 6061 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	2901	2791	2675	2552	2423	2284	2136	1974	1797	1597	1366	1084
	70	3122	3021	2916	2806	2690	2569	2439	2302	2154	1993	1816	1618
	80	3328	3235	3138	3038	2933	2824	2709	2587	2459	2321	2174	2014
Normal	**90**	**3522**	**3436**	**3346**	**3254**	**3158**	**3058**	**2954**	**2845**	**2730**	**2609**	**2481**	**2343**
	100	3706	3626	3543	3457	3368	3276	3181	3081	2977	2868	2754	2633
	110	3883	3808	3730	3650	3567	3482	3393	3302	3206	3107	3003	2894
Emergency (<24 hrs)	**115**	**3969**	**3896**	**3821**	**3743**	**3663**	**3580**	**3495**	**3407**	**3315**	**3220**	**3121**	**3017**
	120	4054	3983	3909	3834	3757	3677	3595	3509	3421	3330	3234	3135
Emergency (< 1 hr)	**130**	**4219**	**4152**	**4083**	**4012**	**3939**	**3864**	**3787**	**3707**	**3625**	**3540**	**3452**	**3360**
	140	4380	4316	4250	4183	4115	4044	3971	3897	3820	3740	3658	3573
	150	4537	4476	4414	4350	4285	4218	4150	4079	4007	3932	3856	3776
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	3-1/2" Alum, Sched 40, 6061 Alloy		Outside Diameter =	4 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	8E-06 ohms/ft	R_{high} =	8.6E-06 ohms/ft

Bus Conductor: **4" Alum, Sched 40, 6061 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	3292	3166	3034	2894	2746	2588	2418	2234	2030	1801	1534	1206
	70	3530	3416	3296	3172	3041	2902	2755	2599	2430	2247	2045	1818
	80	3750	3645	3536	3423	3305	3181	3051	2914	2768	2612	2445	2263
Normal	**90**	**3955**	**3858**	**3758**	**3654**	**3546**	**3434**	**3317**	**3194**	**3065**	**2928**	**2783**	**2629**
	100	4148	4058	3965	3869	3770	3667	3560	3449	3332	3210	3081	2946
	110	4332	4248	4161	4072	3980	3885	3786	3684	3578	3467	3351	3229
Emergency (<24 hrs)	**115**	**4421**	**4340**	**4256**	**4170**	**4081**	**3989**	**3894**	**3796**	**3694**	**3588**	**3477**	**3361**
	120	4508	4429	4348	4265	4179	4090	3999	3904	3806	3704	3599	3488
Emergency (< 1 hr)	**130**	**4678**	**4603**	**4527**	**4449**	**4368**	**4285**	**4200**	**4112**	**4021**	**3927**	**3829**	**3728**
	140	4842	4771	4699	4625	4550	4472	4392	4310	4225	4137	4047	3953
	150	5001	4934	4866	4796	4725	4652	4577	4499	4420	4338	4253	4166
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	4" Alum, Sched 40, 6061 Alloy		Outside Diameter =	4.5 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	6.4E-06 ohms/ft	R_{high} =	7.3E-06 ohms/ft

Bus Conductor: **5" Alum, Sched 40, 6061 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	4104	3946	3779	3604	3417	3218	3003	2769	2510	2217	1874	1447
	70	4407	4264	4115	3958	3793	3619	3434	3236	3023	2790	2534	2244
	80	4688	4557	4420	4278	4130	3975	3811	3638	3454	3258	3046	2815
Normal	**90**	**4950**	**4829**	**4704**	**4574**	**4439**	**4298**	**4150**	**3996**	**3833**	**3662**	**3479**	**3283**
	100	5198	5085	4969	4849	4725	4596	4462	4322	4175	4022	3860	3689
	110	5433	5328	5220	5109	4994	4874	4751	4623	4489	4350	4204	4051
Emergency (<24 hrs)	**115**	**5547**	**5446**	**5341**	**5233**	**5122**	**5008**	**4889**	**4766**	**4638**	**4504**	**4365**	**4220**
	120	5659	5561	5459	5355	5248	5137	5023	4904	4781	4654	4521	4382
Emergency (< 1 hr)	**130**	**5877**	**5784**	**5689**	**5591**	**5491**	**5387**	**5281**	**5170**	**5057**	**4939**	**4816**	**4689**
	140	6087	6000	5910	5818	5724	5627	5527	5424	5318	5208	5095	4977
	150	6292	6209	6125	6038	5949	5857	5763	5667	5568	5465	5359	5250
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	5" Alum, Sched 40, 6061 Alloy		Outside Diameter =	5.563 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	4.7E-06 ohms/ft	R_{high} =	5.4E-06 ohms/ft

Bus Conductor: **6" Alum, Sched 40, 6061 Alloy**

Rating	Rated Operating Temperature	Assumed Wind Speed = 2 fps Ambient Temperature (^{o}C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	4948	4756	4554	4341	4114	3871	3608	3322	3004	2643	2219	1683
	70	5322	5148	4967	4777	4576	4364	4139	3898	3638	3353	3038	2681
	80	5667	5508	5343	5171	4991	4802	4604	4393	4169	3930	3671	3389
Normal	**90**	**5990**	**5844**	**5692**	**5535**	**5371**	**5200**	**5021**	**4834**	**4636**	**4427**	**4204**	**3966**
	100	6295	6159	6019	5874	5723	5567	5404	5235	5057	4870	4673	4465
	110	6586	6459	6328	6194	6054	5910	5761	5605	5443	5274	5097	4911
Emergency (<24 hrs)	**115**	**6726**	**6604**	**6478**	**6347**	**6213**	**6074**	**5931**	**5781**	**5626**	**5465**	**5296**	**5119**
	120	6864	6746	6623	6498	6368	6234	6096	5952	5803	5649	5487	5319
Emergency (< 1 hr)	**130**	**7133**	**7021**	**6907**	**6789**	**6668**	**6543**	**6414**	**6280**	**6143**	**6000**	**5851**	**5697**
	140	7394	7288	7180	7069	6955	6838	6718	6593	6465	6332	6195	6052
	150	7647	7548	7446	7341	7234	7123	7010	6893	6773	6649	6521	6389
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	6" Alum, Sched 40, 6061 Alloy		Outside Diameter =	6.625 inches
	T_{low} =	20 ^{o}C	T_{high} =	70 ^{o}C
	R_{low} =	3.6E-06 ohms/ft	R_{high} =	4.1E-06 ohms/ft

Bus Conductor: **1" Alum, Sched 80, 6061 Alloy**

Rating	Rated Operating Temperature	Assumed Wind Speed = 2 fps Ambient Temperature (^{o}C)											
		-15	**-10**	**-5**	**0**	**5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**
	60	1014	977	938	898	855	810	762	710	653	591	520	437
	70	1080	1046	1011	975	937	896	854	809	761	710	653	591
	80	1141	1110	1078	1044	1010	974	936	896	854	809	761	710
Normal	**90**	**1198**	**1169**	**1139**	**1109**	**1077**	**1044**	**1009**	**973**	**935**	**896**	**854**	**810**
	100	1251	1225	1197	1168	1139	1108	1076	1043	1009	973	936	897
	110	1302	1277	1251	1224	1196	1168	1139	1108	1077	1044	1010	975
Emergency (<24 hrs)	**115**	**1326**	**1302**	**1277**	**1251**	**1224**	**1197**	**1168**	**1139**	**1109**	**1077**	**1045**	**1011**
	120	1350	1326	1302	1277	1251	1224	1197	1169	1140	1110	1078	1046
Emergency (< 1 hr)	**130**	**1396**	**1374**	**1351**	**1327**	**1303**	**1278**	**1252**	**1226**	**1199**	**1170**	**1141**	**1111**
	140	1441	1419	1397	1375	1352	1328	1304	1280	1254	1228	1201	1173
	150	1483	1463	1442	1421	1399	1377	1354	1331	1307	1282	1257	1231
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1" Alum, Sched 80, 6061 Alloy		Outside Diameter =	1.315 inches
	T_{low} =	20 ^{o}C	T_{high} =	70 ^{o}C
	R_{low} =	3.2E-05 ohms/ft	R_{high} =	3.6E-05 ohms/ft

Bus Conductor: **1-1/2" Alum, Sched 80, 6061 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	1452	1397	1341	1282	1220	1154	1083	1007	924	831	726	600
	70	1548	1499	1449	1396	1341	1282	1221	1155	1085	1009	926	834
	80	1639	1594	1548	1499	1449	1397	1342	1284	1223	1157	1088	1012
Normal	**90**	**1723**	**1682**	**1639**	**1595**	**1549**	**1501**	**1451**	**1399**	**1344**	**1286**	**1226**	**1161**
	100	1803	1764	1724	1683	1641	1597	1551	1503	1454	1402	1348	1290
	110	1879	1842	1805	1767	1727	1686	1644	1600	1555	1507	1458	1406
Emergency (<24 hrs)	**115**	**1915**	**1880**	**1844**	**1807**	**1768**	**1729**	**1688**	**1646**	**1602**	**1557**	**1510**	**1460**
	120	1951	1917	1882	1845	1808	1770	1731	1690	1648	1605	1559	1512
Emergency (< 1 hr)	**130**	**2020**	**1988**	**1955**	**1921**	**1886**	**1850**	**1813**	**1775**	**1736**	**1696**	**1654**	**1610**
	140	2087	2056	2025	1993	1960	1926	1891	1856	1819	1781	1742	1702
	150	2151	2122	2092	2062	2031	1999	1966	1933	1898	1863	1827	1789
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1-1/2" Alum, Sched 80, 6061 Alloy		Outside Diameter =	1.9 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	1.9E-05 ohms/ft	R_{high} =	2.2E-05 ohms/ft

Bus Conductor: **2" Alum, Sched 80, 6061 Alloy**

Rating	Rated Operating Temperature	Assumed Wind Speed = 2 fps Ambient Temperature (^{o}C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	1832	1763	1691	1616	1536	1451	1360	1261	1154	1034	897	734
	70	1957	1894	1829	1761	1689	1614	1535	1451	1361	1263	1157	1038
	80	2071	2013	1954	1892	1827	1760	1689	1615	1536	1453	1363	1266
Normal	**90**	**2178**	**2125**	**2069**	**2012**	**1953**	**1892**	**1828**	**1761**	**1691**	**1617**	**1539**	**1456**
	100	2279	2229	2177	2124	2070	2013	1954	1894	1830	1764	1694	1621
	110	2374	2327	2279	2230	2179	2126	2072	2016	1958	1898	1835	1770
Emergency (<24 hrs)	**115**	**2420**	**2374**	**2328**	**2280**	**2231**	**2180**	**2128**	**2074**	**2019**	**1961**	**1902**	**1840**
	120	2465	2421	2375	2329	2282	2233	2182	2131	2078	2023	1966	1906
Emergency (< 1 hr)	**130**	**2552**	**2510**	**2468**	**2424**	**2379**	**2334**	**2288**	**2240**	**2191**	**2140**	**2087**	**2033**
	140	2636	2596	2556	2516	2475	2432	2389	2344	2298	2251	2202	2151
	150	2717	2680	2643	2605	2566	2527	2486	2444	2400	2356	2310	2263
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	2" Alum, Sched 80, 6061 Alloy		Outside Diameter =	2.375 inches
	T_{low} =	20 ^{o}C	T_{high} =	70 ^{o}C
	R_{low} =	1.4E-05 ohms/ft	R_{high} =	1.6E-05 ohms/ft

Bus Conductor: **2-1/2" Alum, Sched 80, 6061 Alloy**

Rating	Rated Operating Temperature	Assumed Wind Speed = 2 fps Ambient Temperature (^{o}C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	2401	2311	2216	2116	2010	1898	1777	1647	1504	1344	1161	940
	70	2566	2484	2398	2308	2214	2115	2011	1899	1780	1650	1509	1350
	80	2719	2643	2564	2483	2398	2309	2216	2118	2014	1903	1785	1656
Normal	**90**	**2861**	**2790**	**2718**	**2643**	**2565**	**2484**	**2400**	**2312**	**2219**	**2122**	**2019**	**1909**
	100	2994	2929	2861	2792	2720	2646	2569	2488	2405	2317	2225	2129
	110	3121	3059	2997	2932	2865	2796	2725	2651	2575	2495	2412	2325
Emergency (<24 hrs)	**115**	**3182**	**3122**	**3061**	**2999**	**2934**	**2868**	**2799**	**2729**	**2655**	**2579**	**2499**	**2416**
	120	3241	3184	3125	3064	3002	2938	2872	2803	2733	2659	2583	2504
Emergency (< 1 hr)	**130**	**3357**	**3303**	**3247**	**3190**	**3132**	**3072**	**3010**	**2946**	**2881**	**2813**	**2743**	**2670**
	140	3469	3418	3365	3312	3256	3200	3142	3082	3021	2958	2892	2825
	150	3578	3529	3479	3428	3376	3323	3268	3212	3154	3095	3034	2971
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	2-1/2" Alum, Sched 80, 6061 Alloy		Outside Diameter =	2.875 inches
	T_{low} =	20 ^{o}C	T_{high} =	70 ^{o}C
	R_{low} =	9E-06 ohms/ft	R_{high} =	1E-05 ohms/ft

Bus Conductor: **3" Alum, Sched 80, 6061 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (^{o}C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	2957	2844	2727	2603	2471	2332	2181	2019	1840	1639	1408	1127
	70	3164	3062	2956	2844	2728	2605	2475	2336	2187	2026	1849	1650
	80	3355	3261	3164	3063	2958	2848	2732	2611	2481	2344	2196	2036
Normal	**90**	**3533**	**3447**	**3357**	**3264**	**3168**	**3068**	**2964**	**2855**	**2740**	**2619**	**2491**	**2354**
	100	3701	3620	3537	3452	3363	3271	3176	3076	2973	2864	2750	2630
	110	3860	3785	3707	3627	3545	3460	3372	3281	3186	3088	2984	2877
Emergency (<24 hrs)	**115**	**3937**	**3864**	**3789**	**3712**	**3632**	**3550**	**3466**	**3378**	**3287**	**3193**	**3094**	**2991**
	120	4012	3941	3869	3794	3717	3638	3556	3472	3385	3294	3200	3102
Emergency (< 1 hr)	**130**	**4158**	**4092**	**4023**	**3953**	**3881**	**3807**	**3731**	**3652**	**3571**	**3487**	**3400**	**3310**
	140	4299	4236	4172	4106	4038	3968	3897	3823	3747	3669	3588	3505
	150	4436	4376	4315	4253	4189	4123	4056	3987	3916	3842	3767	3689
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	3" Alum, Sched 80, 6061 Alloy		Outside Diameter =	3.5 inches
	T_{low} =	20 ^{o}C	T_{high} =	70 ^{o}C
	R_{low} =	6.8E-06 ohms/ft	R_{high} =	7.7E-06 ohms/ft

Bus Conductor: **3-1/2" Alum, Sched 80, 6061 Alloy**

Rating	Rated Operating Temperature	Assumed Wind Speed = 2 fps Ambient Temperature (^{o}C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	3405	3275	3139	2996	2843	2681	2507	2317	2109	1875	1604	1272
	70	3647	3529	3406	3277	3142	3000	2849	2689	2516	2328	2121	1889
	80	3869	3761	3649	3532	3411	3283	3150	3008	2859	2699	2527	2341
Normal	**90**	**4077**	**3977**	**3874**	**3767**	**3656**	**3540**	**3419**	**3293**	**3160**	**3020**	**2871**	**2713**
	100	4272	4179	4084	3985	3882	3776	3666	3551	3432	3306	3174	3035
	110	4458	4371	4282	4190	4095	3997	3895	3790	3680	3566	3447	3322
Emergency (<24 hrs)	**115**	**4547**	**4463**	**4377**	**4288**	**4196**	**4102**	**4004**	**3903**	**3798**	**3689**	**3575**	**3456**
	120	4635	4554	4470	4384	4295	4204	4110	4013	3912	3807	3698	3585
Emergency (< 1 hr)	**130**	**4806**	**4729**	**4650**	**4569**	**4486**	**4401**	**4313**	**4223**	**4129**	**4032**	**3932**	**3828**
	140	4970	4898	4824	4747	4669	4589	4507	4422	4335	4245	4152	4055
	150	5130	5061	4991	4919	4846	4770	4693	4613	4531	4447	4360	4270
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	3-1/2" Alum, Sched 80, 6061 Alloy		Outside Diameter =	4 inches
	T_{low} =	20 ^{o}C	T_{high} =	70 ^{o}C
	R_{low} =	5.5E-06 ohms/ft	R_{high} =	6.3E-06 ohms/ft

Bus Conductor: **4" Alum, Sched 80, 6061 Alloy**

Rating	Rated Operating Temperature	Assumed Wind Speed = 2 fps Ambient Temperature (^{o}C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	3867	3719	3564	3400	3226	3040	2841	2624	2384	2115	1802	1417
	70	4143	4009	3869	3723	3569	3406	3234	3050	2853	2637	2400	2134
	80	4398	4275	4148	4015	3876	3731	3579	3418	3247	3064	2868	2654
Normal	**90**	**4636**	**4522**	**4405**	**4283**	**4157**	**4025**	**3888**	**3744**	**3592**	**3432**	**3263**	**3081**
	100	4860	4754	4646	4533	4417	4296	4171	4040	3904	3761	3610	3451
	110	5072	4974	4872	4768	4660	4549	4433	4313	4189	4059	3923	3781
Emergency (<24 hrs)	**115**	**5175**	**5080**	**4982**	**4881**	**4777**	**4669**	**4558**	**4443**	**4324**	**4199**	**4070**	**3934**
	120	5276	5183	5088	4991	4890	4786	4679	4569	4454	4335	4211	4082
Emergency (< 1 hr)	**130**	**5471**	**5384**	**5295**	**5203**	**5109**	**5012**	**4912**	**4809**	**4703**	**4593**	**4479**	**4360**
	140	5660	5578	5493	5407	5319	5228	5134	5038	4939	4837	4731	4621
	150	5843	5765	5686	5604	5521	5435	5347	5257	5164	5068	4970	4868
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	4" Alum, Sched 80, 6061 Alloy		Outside Diameter =	4.5 inches
	T_{low} =	20 ^{o}C	T_{high} =	70 ^{o}C
	R_{low} =	4.6E-06 ohms/ft	R_{high} =	5.3E-06 ohms/ft

Bus Conductor: **5" Alum, Sched 80, 6061 Alloy**

Rating	Rated Operating Temperature	Assumed Wind Speed = 2 fps Ambient Temperature (^{o}C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	4861	4674	4477	4269	4048	3812	3557	3280	2973	2626	2220	1714
	70	5218	5049	4871	4686	4491	4285	4065	3831	3579	3304	3000	2656
	80	5548	5393	5231	5063	4888	4704	4510	4306	4088	3856	3605	3332
Normal	**90**	**5856**	**5713**	**5564**	**5411**	**5251**	**5084**	**4910**	**4727**	**4535**	**4331**	**4115**	**3884**
	100	6146	6013	5876	5734	5587	5435	5276	5110	4937	4756	4564	4362
	110	6423	6298	6171	6039	5903	5762	5616	5464	5306	5142	4969	4789
Emergency (<24 hrs)	**115**	**6556**	**6436**	**6312**	**6185**	**6054**	**5918**	**5778**	**5632**	**5481**	**5324**	**5159**	**4987**
	120	6687	6571	6451	6328	6201	6070	5935	5795	5650	5499	5342	5178
Emergency (< 1 hr)	**130**	**6942**	**6832**	**6720**	**6604**	**6486**	**6364**	**6238**	**6107**	**5973**	**5834**	**5689**	**5539**
	140	7188	7085	6979	6870	6759	6644	6526	6405	6279	6150	6016	5877
	150	7428	7330	7230	7127	7022	6914	6804	6690	6572	6451	6326	6197
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	5" Alum, Sched 80, 6061 Alloy		Outside Diameter =	5.563 inches
	T_{low} =	20 ^{o}C	T_{high} =	70 ^{o}C
	R_{low} =	3.4E-06 ohms/ft	R_{high} =	3.8E-06 ohms/ft

Bus Conductor: **6" Alum, Sched 80, 6061 Alloy**

Rating	Rated Operating Temperature	Assumed Wind Speed = 2 fps Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	6035	5801	5554	5294	5017	4721	4401	4051	3663	3224	2706	2052
	70	6482	6271	6050	5818	5574	5316	5042	4748	4431	4084	3701	3266
	80	6894	6701	6500	6291	6072	5843	5601	5345	5073	4781	4466	4123
Normal	**90**	**7279**	**7101**	**6917**	**6726**	**6527**	**6319**	**6102**	**5874**	**5634**	**5380**	**5109**	**4819**
	100	7641	7477	7306	7130	6948	6758	6560	6354	6138	5912	5673	5420
	110	7986	7832	7674	7511	7342	7167	6986	6797	6601	6396	6181	5955
Emergency (<24 hrs)	**115**	**8153**	**8004**	**7851**	**7693**	**7531**	**7362**	**7188**	**7007**	**6819**	**6623**	**6419**	**6204**
	120	8316	8172	8024	7872	7715	7552	7385	7211	7031	6843	6648	6443
Emergency (< 1 hr)	**130**	**8633**	**8498**	**8359**	**8217**	**8070**	**7918**	**7762**	**7601**	**7434**	**7261**	**7082**	**6895**
	140	8940	8813	8682	8548	8411	8269	8123	7973	7817	7657	7491	7318
	150	9239	9119	8995	8869	8739	8606	8469	8328	8183	8033	7879	7719
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	6" Alum, Sched 80, 6061 Alloy		Outside Diameter =	6.625 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	2.4E-06 ohms/ft	R_{high} =	2.8E-06 ohms/ft

Bus Conductor: **1" Alum, Sched 40, 6063 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	1010	974	935	895	852	807	759	707	651	588	518	436
	70	1073	1039	1004	968	930	890	848	804	756	705	649	587
	80	1130	1099	1067	1034	1000	964	926	887	845	801	754	703
Normal	**90**	**1183**	**1154**	**1125**	**1094**	**1063**	**1030**	**996**	**961**	**923**	**884**	**843**	**799**
	100	1232	1206	1178	1150	1121	1091	1060	1027	994	958	921	883
	110	1278	1254	1228	1202	1175	1147	1118	1088	1057	1025	992	957
Emergency (<24 hrs)	**115**	**1301**	**1277**	**1252**	**1226**	**1200**	**1173**	**1146**	**1117**	**1087**	**1056**	**1025**	**991**
	120	1322	1299	1275	1250	1225	1199	1172	1145	1116	1087	1056	1024
Emergency (< 1 hr)	**130**	**1364**	**1342**	**1319**	**1296**	**1273**	**1248**	**1223**	**1197**	**1171**	**1143**	**1115**	**1086**
	140	1404	1383	1362	1340	1318	1295	1271	1247	1222	1197	1170	1143
	150	1443	1423	1403	1382	1361	1339	1317	1294	1271	1247	1222	1197
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1" Alum, Sched 40, 6063 Alloy		Outside Diameter =	1.315 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	3.1E-05 ohms/ft	R_{high} =	3.7E-05 ohms/ft

Bus Conductor: **1-1/2" Alum, Sched 40, 6063 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	1424	1371	1315	1257	1196	1132	1062	988	906	815	712	589
	70	1513	1466	1416	1365	1310	1254	1193	1129	1061	987	906	816
	80	1597	1553	1508	1461	1412	1361	1308	1251	1191	1128	1060	987
Normal	**90**	**1675**	**1634**	**1593**	**1549**	**1505**	**1458**	**1410**	**1359**	**1306**	**1250**	**1191**	**1128**
	100	1747	1710	1671	1631	1590	1547	1503	1457	1409	1358	1306	1250
	110	1815	1780	1744	1707	1669	1629	1589	1546	1502	1457	1409	1359
Emergency (<24 hrs)	**115**	**1848**	**1814**	**1779**	**1744**	**1707**	**1669**	**1629**	**1588**	**1546**	**1503**	**1457**	**1409**
	120	1880	1847	1814	1779	1743	1706	1668	1629	1589	1547	1503	1458
Emergency (< 1 hr)	**130**	**1942**	**1911**	**1879**	**1847**	**1813**	**1779**	**1744**	**1707**	**1669**	**1630**	**1590**	**1548**
	140	2002	1972	1942	1912	1880	1848	1815	1780	1745	1709	1672	1633
	150	2059	2031	2003	1974	1944	1914	1882	1850	1817	1783	1748	1712
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1-1/2" Alum, Sched 40, 6063 Alloy		Outside Diameter =	1.9 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	1.9E-05 ohms/ft	R_{high} =	2.3E-05 ohms/ft

Bus Conductor: **2" Alum, Sched 40, 6063 Alloy**

Rating	Rated Operating Temperature	Assumed Wind Speed = 2 fps Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	1771	1704	1635	1562	1484	1402	1314	1219	1115	1000	868	710
	70	1885	1824	1762	1696	1627	1555	1479	1398	1311	1217	1114	1000
	80	1989	1934	1876	1817	1755	1690	1622	1551	1475	1395	1309	1216
Normal	**90**	**2085**	**2034**	**1981**	**1927**	**1870**	**1811**	**1750**	**1686**	**1619**	**1548**	**1473**	**1394**
	100	2175	2128	2079	2028	1976	1922	1866	1808	1747	1684	1617	1548
	110	2260	2215	2170	2123	2074	2024	1973	1919	1864	1807	1748	1685
Emergency (<24 hrs)	**115**	**2301**	**2258**	**2213**	**2168**	**2121**	**2073**	**2023**	**1972**	**1919**	**1865**	**1808**	**1749**
	120	2340	2299	2256	2212	2167	2120	2072	2023	1973	1921	1867	1810
Emergency (< 1 hr)	**130**	**2417**	**2378**	**2337**	**2296**	**2254**	**2211**	**2167**	**2122**	**2075**	**2027**	**1977**	**1925**
	140	2491	2454	2416	2377	2338	2299	2258	2215	2172	2127	2081	2033
	150	2562	2527	2492	2457	2420	2382	2344	2304	2263	2221	2178	2133
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	2" Alum, Sched 40, 6063 Alloy		Outside Diameter =	2.375 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	1.4E-05 ohms/ft	R_{high} =	1.7E-05 ohms/ft

Bus Conductor: **2-1/2" Alum, Sched 40, 6063 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	2370	2280	2186	2088	1984	1873	1754	1625	1484	1326	1145	928
	70	2525	2444	2359	2271	2179	2081	1978	1869	1751	1624	1484	1329
	80	2667	2593	2516	2436	2352	2265	2174	2077	1976	1867	1751	1625
Normal	**90**	**2799**	**2730**	**2659**	**2586**	**2510**	**2431**	**2348**	**2262**	**2171**	**2076**	**1975**	**1868**
	100	2922	2858	2792	2724	2654	2582	2507	2428	2347	2261	2172	2077
	110	3038	2978	2917	2854	2789	2722	2653	2581	2506	2429	2348	2263
Emergency (<24 hrs)	**115**	**3094**	**3036**	**2977**	**2916**	**2853**	**2789**	**2722**	**2653**	**2582**	**2507**	**2430**	**2349**
	120	3148	3092	3035	2976	2915	2853	2789	2723	2654	2583	2509	2432
Emergency (< 1 hr)	**130**	**3253**	**3201**	**3147**	**3092**	**3035**	**2977**	**2917**	**2855**	**2791**	**2726**	**2658**	**2587**
	140	3355	3305	3254	3202	3149	3094	3038	2980	2921	2860	2797	2731
	150	3452	3405	3357	3308	3258	3207	3154	3100	3044	2987	2928	2867
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	2-1/2" Alum, Sched 40, 6063 Alloy		Outside Diameter =	2.875 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	9E-06 ohms/ft	R_{high} =	1.1E-05 ohms/ft

Bus Conductor: **3" Alum, Sched 40, 6063 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	2885	2775	2660	2539	2411	2275	2128	1969	1795	1599	1373	1099
	70	3077	2978	2875	2767	2653	2534	2407	2272	2128	1970	1798	1605
	80	3254	3163	3069	2971	2869	2762	2650	2532	2406	2273	2130	1974
Normal	**90**	**3417**	**3333**	**3247**	**3157**	**3064**	**2967**	**2866**	**2761**	**2650**	**2533**	**2409**	**2277**
	100	3570	3492	3412	3329	3244	3155	3063	2968	2868	2763	2653	2537
	110	3715	3642	3567	3491	3411	3329	3245	3157	3066	2971	2872	2768
Emergency (<24 hrs)	**115**	**3784**	**3714**	**3642**	**3567**	**3491**	**3412**	**3331**	**3247**	**3159**	**3068**	**2974**	**2875**
	120	3852	3784	3714	3642	3568	3492	3414	3333	3249	3162	3072	2977
Emergency (< 1 hr)	**130**	**3983**	**3919**	**3854**	**3786**	**3717**	**3646**	**3573**	**3498**	**3420**	**3340**	**3257**	**3170**
	140	4109	4049	3987	3924	3859	3793	3724	3654	3582	3507	3430	3350
	150	4232	4174	4116	4056	3995	3933	3869	3803	3735	3665	3593	3519
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	3" Alum, Sched 40, 6063 Alloy		Outside Diameter =	3.5 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	6.9E-06 ohms/ft	R_{high} =	8.1E-06 ohms/ft

Bus Conductor: **3-1/2" Alum, Sched 40, 6063 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	3301	3175	3043	2903	2756	2599	2430	2246	2044	1817	1554	1233
	70	3524	3410	3292	3167	3037	2899	2754	2598	2431	2250	2050	1826
	80	3729	3625	3517	3404	3287	3164	3035	2899	2755	2601	2436	2256
Normal	**90**	**3919**	**3823**	**3723**	**3621**	**3514**	**3403**	**3287**	**3165**	**3038**	**2903**	**2760**	**2608**
	100	4096	4007	3916	3821	3723	3621	3515	3405	3290	3170	3043	2910
	110	4264	4181	4096	4008	3917	3823	3726	3625	3521	3412	3298	3178
Emergency (<24 hrs)	**115**	**4345**	**4265**	**4182**	**4097**	**4010**	**3919**	**3826**	**3729**	**3629**	**3525**	**3416**	**3303**
	120	4424	4346	4266	4184	4100	4013	3923	3830	3734	3634	3530	3421
Emergency (< 1 hr)	**130**	**4577**	**4504**	**4429**	**4352**	**4273**	**4192**	**4108**	**4022**	**3932**	**3840**	**3745**	**3645**
	140	4724	4655	4584	4512	4438	4362	4284	4203	4120	4034	3946	3854
	150	4866	4801	4735	4666	4597	4525	4451	4376	4298	4218	4136	4051
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	3-1/2" Alum, Sched 40, 6063 Alloy		Outside Diameter =	4 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	5.7E-06 ohms/ft	R_{high} =	6.8E-06 ohms/ft

Bus Conductor: **4" Alum, Sched 40, 6063 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	3729	3586	3437	3278	3111	2932	2739	2530	2299	2040	1738	1367
	70	3985	3856	3721	3580	3432	3276	3110	2934	2743	2536	2308	2052
	80	4219	4101	3979	3851	3718	3579	3433	3278	3114	2939	2751	2546
Normal	**90**	**4436**	**4327**	**4215**	**4099**	**3978**	**3852**	**3720**	**3582**	**3437**	**3284**	**3122**	**2948**
	100	4639	4539	4435	4327	4216	4101	3981	3857	3726	3590	3446	3294
	110	4831	4738	4641	4541	4439	4333	4223	4109	3990	3866	3737	3601
Emergency (<24 hrs)	**115**	**4924**	**4833**	**4740**	**4644**	**4545**	**4443**	**4337**	**4227**	**4114**	**3996**	**3872**	**3744**
	120	5014	4926	4836	4743	4648	4549	4448	4342	4233	4120	4002	3880
Emergency (< 1 hr)	**130**	**5189**	**5107**	**5022**	**4935**	**4846**	**4754**	**4660**	**4562**	**4461**	**4357**	**4248**	**4136**
	140	5358	5280	5201	5119	5035	4949	4861	4770	4676	4579	4479	4375
	150	5522	5448	5373	5296	5217	5136	5053	4968	4880	4790	4696	4600
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	4" Alum, Sched 40, 6063 Alloy		Outside Diameter =	4.5 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	4.8E-06 ohms/ft	R_{high} =	5.7E-06 ohms/ft

Bus Conductor: **4-1/2" Alum, Sched 40, 6063 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	4158	3998	3830	3653	3465	3265	3048	2813	2553	2260	1919	1496
	70	4446	4302	4151	3993	3828	3653	3467	3269	3055	2823	2566	2277
	80	4710	4578	4441	4299	4150	3994	3831	3657	3474	3277	3066	2836
Normal	**90**	**4955**	**4833**	**4708**	**4578**	**4443**	**4302**	**4155**	**4001**	**3838**	**3667**	**3485**	**3290**
	100	5184	5072	4956	4836	4712	4583	4450	4310	4164	4011	3850	3680
	110	5401	5296	5189	5078	4963	4844	4722	4594	4461	4323	4178	4026
Emergency (<24 hrs)	**115**	**5506**	**5404**	**5300**	**5193**	**5083**	**4969**	**4851**	**4728**	**4601**	**4469**	**4331**	**4187**
	120	5608	5510	5409	5306	5199	5089	4976	4858	4736	4610	4478	4340
Emergency (< 1 hr)	**130**	**5806**	**5714**	**5619**	**5523**	**5423**	**5321**	**5215**	**5106**	**4993**	**4876**	**4755**	**4630**
	140	5997	5910	5821	5730	5637	5541	5442	5341	5236	5127	5015	4899
	150	6181	6100	6016	5930	5842	5752	5660	5564	5466	5365	5261	5154
							WINTER					SUMMER	

Weather Assumptions:

Emissivity =	0.5	Suntime =	14
Absorptivity =	0.5	Degrees North Latitude=	40
Atmosphere =	Clear	Elevation Above Sea Level=	1000
Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90

Conductor : 4-1/2" Alum, Sched 40, 6063 Alloy

T_{low} =	20 °C	Outside Diameter =	5 inches
R_{low} =	4.2E-06 ohms/ft	T_{high} =	70 °C
		R_{high} =	4.9E-06 ohms/ft

Bus Conductor: **5" Alum, Sched 40, 6063 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	4647	4468	4279	4080	3869	3643	3400	3135	2842	2510	2122	1639
	70	4973	4811	4642	4465	4279	4083	3874	3651	3410	3148	2858	2531
	80	5271	5124	4971	4811	4644	4469	4285	4091	3884	3663	3425	3166
Normal	**90**	**5548**	**5413**	**5272**	**5127**	**4975**	**4817**	**4652**	**4479**	**4297**	**4104**	**3899**	**3680**
	100	5808	5683	5553	5419	5280	5136	4986	4829	4666	4494	4313	4122
	110	6054	5937	5817	5692	5564	5431	5294	5151	5002	4847	4684	4514
Emergency (<24 hrs)	**115**	**6173**	**6060**	**5943**	**5823**	**5700**	**5572**	**5440**	**5303**	**5160**	**5012**	**4857**	**4696**
	120	6288	6179	6067	5951	5832	5709	5581	5450	5313	5171	5024	4869
Emergency (< 1 hr)	**130**	**6513**	**6410**	**6305**	**6197**	**6085**	**5971**	**5852**	**5730**	**5604**	**5473**	**5338**	**5197**
	140	6730	6633	6534	6432	6328	6221	6110	5996	5879	5758	5632	5502
	150	6940	6848	6755	6659	6561	6460	6357	6250	6141	6027	5911	5790
							WINTER					SUMMER	

Weather Assumptions:

Emissivity =	0.5	Suntime =	14
Absorptivity =	0.5	Degrees North Latitude=	40
Atmosphere =	Clear	Elevation Above Sea Level=	1000
Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90

Conductor : 5" Alum, Sched 40, 6063 Alloy

		Outside Diameter =	5.563 inches
T_{low} =	20 °C	T_{high} =	70 °C
R_{low} =	3.6E-06 ohms/ft	R_{high} =	4.2E-06 ohms/ft

Bus Conductor: **6" Alum, Sched 40, 6063 Alloy**

Rating	Rated Operating Temperature	Assumed Wind Speed = 2 fps Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	5599	5382	5154	4912	4655	4380	4083	3759	3399	2991	2511	1904
	70	6000	5804	5600	5385	5159	4921	4667	4395	4101	3781	3425	3023
	80	6367	6188	6003	5810	5608	5396	5172	4936	4684	4415	4125	3807
Normal	**90**	**6707**	**6544**	**6374**	**6198**	**6014**	**5823**	**5623**	**5413**	**5192**	**4957**	**4708**	**4441**
	100	7027	6876	6719	6557	6389	6215	6033	5843	5645	5437	5217	4984
	110	7330	7189	7043	6893	6738	6578	6412	6239	6058	5870	5673	5466
Emergency (<24 hrs)	**115**	**7476**	**7339**	**7199**	**7055**	**6905**	**6751**	**6591**	**6425**	**6253**	**6073**	**5886**	**5689**
	120	7618	7487	7351	7211	7068	6919	6765	6606	6441	6269	6090	5903
Emergency (< 1 hr)	**130**	**7895**	**7772**	**7645**	**7514**	**7380**	**7242**	**7099**	**6952**	**6799**	**6641**	**6477**	**6306**
	140	8163	8046	7927	7805	7679	7550	7416	7279	7137	6991	6839	6682
	150	8422	8312	8200	8085	7966	7845	7720	7592	7459	7323	7182	7036
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	6" Alum, Sched 40, 6063 Alloy		Outside Diameter =	6.625 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	2.8E-06 ohms/ft	R_{high} =	3.3E-06 ohms/ft

Bus Conductor: **1" Alum, Sched 80, 6063 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	1149	1107	1064	1018	969	918	863	804	740	669	589	496
	70	1220	1182	1142	1101	1058	1013	965	914	860	802	738	668
	80	1285	1250	1214	1176	1137	1096	1054	1009	961	911	858	800
Normal	**90**	**1345**	**1313**	**1279**	**1245**	**1209**	**1172**	**1133**	**1093**	**1050**	**1006**	**959**	**909**
	100	1401	1371	1340	1308	1275	1241	1205	1168	1130	1090	1048	1004
	110	1454	1426	1397	1367	1336	1304	1272	1238	1203	1166	1128	1088
Emergency (<24 hrs)	**115**	**1479**	**1452**	**1424**	**1395**	**1365**	**1335**	**1303**	**1270**	**1237**	**1202**	**1165**	**1127**
	120	1504	1477	1450	1422	1393	1364	1333	1302	1269	1236	1201	1165
Emergency (< 1 hr)	**130**	**1552**	**1526**	**1501**	**1474**	**1448**	**1420**	**1391**	**1362**	**1332**	**1301**	**1268**	**1235**
	140	1597	1573	1549	1524	1499	1473	1446	1419	1390	1361	1331	1300
	150	1641	1618	1595	1572	1548	1523	1498	1472	1446	1418	1390	1361
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1" Alum, Sched 80, 6063 Alloy		Outside Diameter =	1.315 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	2.4E-05 ohms/ft	R_{high} =	2.8E-05 ohms/ft

Bus Conductor: **1-1/2" Alum, Sched 80, 6063 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	1645	1584	1520	1453	1383	1308	1228	1141	1047	942	822	681
	70	1749	1694	1637	1577	1515	1449	1379	1305	1226	1140	1047	943
	80	1846	1795	1743	1689	1632	1573	1511	1446	1377	1304	1225	1140
Normal	**90**	**1936**	**1889**	**1841**	**1791**	**1739**	**1686**	**1630**	**1571**	**1510**	**1445**	**1376**	**1304**
	100	2019	1976	1931	1885	1838	1788	1737	1684	1628	1570	1509	1445
	110	2098	2058	2016	1973	1929	1883	1836	1787	1736	1684	1628	1571
Emergency (<24 hrs)	**115**	**2136**	**2097**	**2057**	**2015**	**1973**	**1929**	**1883**	**1836**	**1787**	**1737**	**1684**	**1629**
	120	2173	2135	2096	2056	2015	1972	1929	1883	1836	1788	1737	1685
Emergency (< 1 hr)	**130**	**2245**	**2209**	**2172**	**2135**	**2096**	**2056**	**2015**	**1973**	**1930**	**1885**	**1838**	**1790**
	140	2314	2280	2245	2210	2173	2136	2097	2058	2017	1975	1932	1888
	150	2380	2348	2315	2282	2247	2212	2176	2139	2101	2061	2021	1979
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1-1/2" Alum, Sched 80, 6063 Alloy		Outside Diameter =	1.9 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	1.4E-05 ohms/ft	R_{high} =	1.7E-05 ohms/ft

Bus Conductor: **2" Alum, Sched 80, 6063 Alloy**

Rating	Rated Operating Temperature	Assumed Wind Speed = 2 fps Ambient Temperature (°C)											
		-15	**-10**	**-5**	**0**	**5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**
	60	2072	1994	1913	1827	1737	1640	1538	1426	1305	1170	1015	830
	70	2204	2133	2060	1983	1903	1819	1729	1634	1533	1423	1303	1169
	80	2325	2260	2193	2124	2051	1975	1896	1813	1724	1631	1530	1422
Normal	**90**	**2437**	**2377**	**2315**	**2251**	**2185**	**2116**	**2045**	**1970**	**1892**	**1809**	**1722**	**1629**
	100	2541	2485	2428	2369	2308	2245	2180	2112	2041	1967	1889	1808
	110	2639	2587	2534	2479	2422	2364	2304	2241	2177	2110	2041	1968
Emergency (<24 hrs)	**115**	**2686**	**2636**	**2584**	**2531**	**2477**	**2421**	**2363**	**2303**	**2241**	**2178**	**2112**	**2042**
	120	2732	2684	2634	2582	2529	2475	2419	2362	2304	2243	2179	2113
Emergency (< 1 hr)	**130**	**2821**	**2775**	**2728**	**2680**	**2631**	**2581**	**2529**	**2477**	**2422**	**2366**	**2308**	**2247**
	140	2906	2863	2819	2774	2729	2682	2634	2585	2534	2482	2428	2372
	150	2988	2948	2907	2866	2823	2779	2734	2688	2640	2591	2541	2489
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	2" Alum, Sched 80, 6063 Alloy		Outside Diameter =	2.375 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	1E-05 ohms/ft	R_{high} =	1.2E-05 ohms/ft

Bus Conductor: **2-1/2" Alum, Sched 80, 6063 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	2719	2616	2509	2395	2276	2149	2012	1864	1702	1522	1314	1064
	70	2896	2802	2706	2604	2498	2387	2269	2143	2008	1862	1702	1524
	80	3057	2972	2884	2792	2696	2596	2491	2381	2264	2140	2007	1862
Normal	**90**	**3207**	**3128**	**3047**	**2963**	**2875**	**2785**	**2690**	**2591**	**2488**	**2379**	**2263**	**2140**
	100	3346	3273	3198	3120	3040	2957	2871	2781	2688	2590	2487	2379
	110	3478	3409	3339	3267	3193	3116	3037	2955	2869	2780	2688	2591
Emergency (<24 hrs)	**115**	**3541**	**3475**	**3407**	**3337**	**3266**	**3192**	**3115**	**3036**	**2955**	**2870**	**2781**	**2689**
	120	3602	3538	3473	3405	3336	3265	3191	3115	3037	2955	2871	2783
Emergency (< 1 hr)	**130**	**3722**	**3661**	**3600**	**3537**	**3472**	**3405**	**3337**	**3266**	**3193**	**3118**	**3040**	**2959**
	140	3836	3779	3721	3662	3601	3538	3474	3408	3340	3270	3198	3123
	150	3946	3893	3838	3782	3724	3665	3605	3543	3480	3414	3347	3278
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	2-1/2" Alum, Sched 80, 6063 Alloy		Outside Diameter =	2.875 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	6.8E-06 ohms/ft	R_{high} =	8.1E-06 ohms/ft

Bus Conductor: **3" Alum, Sched 80, 6063 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	3345	3218	3085	2944	2796	2638	2468	2284	2081	1854	1593	1275
	70	3566	3451	3331	3206	3075	2936	2790	2633	2465	2283	2084	1860
	80	3768	3663	3554	3440	3322	3199	3069	2932	2787	2632	2466	2286
Normal	**90**	**3955**	**3858**	**3758**	**3654**	**3547**	**3435**	**3318**	**3195**	**3067**	**2932**	**2788**	**2635**
	100	4130	4040	3947	3852	3753	3650	3544	3433	3317	3196	3069	2935
	110	4295	4211	4124	4036	3944	3849	3752	3650	3545	3435	3320	3200
Emergency (<24 hrs)	**115**	**4374**	**4293**	**4209**	**4124**	**4035**	**3944**	**3850**	**3753**	**3652**	**3547**	**3437**	**3323**
	120	4451	4373	4292	4209	4124	4036	3945	3852	3755	3654	3550	3441
Emergency (< 1 hr)	**130**	**4601**	**4527**	**4451**	**4373**	**4294**	**4212**	**4127**	**4040**	**3951**	**3858**	**3762**	**3662**
	140	4745	4675	4604	4531	4456	4379	4300	4219	4135	4049	3960	3868
	150	4883	4818	4750	4681	4611	4539	4465	4388	4310	4230	4147	4061
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	3" Alum, Sched 80, 6063 Alloy		Outside Diameter =	3.5 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	5.1E-06 ohms/ft	R_{high} =	6E-06 ohms/ft

Bus Conductor: **3-1/2" Alum, Sched 80, 6063 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	3851	3704	3550	3388	3215	3032	2835	2621	2385	2120	1813	1438
	70	4108	3975	3837	3692	3540	3380	3210	3029	2834	2623	2390	2128
	80	4343	4222	4096	3965	3829	3686	3536	3377	3209	3030	2837	2628
Normal	**90**	**4561**	**4449**	**4334**	**4214**	**4090**	**3960**	**3825**	**3684**	**3535**	**3379**	**3212**	**3035**
	100	4764	4661	4554	4444	4330	4211	4088	3960	3827	3687	3540	3384
	110	4956	4860	4760	4658	4553	4444	4331	4214	4092	3965	3833	3694
Emergency (<24 hrs)	**115**	**5048**	**4955**	**4859**	**4760**	**4659**	**4554**	**4445**	**4333**	**4217**	**4095**	**3969**	**3837**
	120	5139	5048	4955	4860	4762	4661	4556	4448	4337	4221	4100	3974
Emergency (< 1 hr)	**130**	**5313**	**5228**	**5141**	**5052**	**4960**	**4866**	**4768**	**4668**	**4565**	**4458**	**4347**	**4232**
	140	5481	5401	5319	5235	5149	5060	4970	4876	4780	4680	4578	4471
	150	5643	5567	5490	5411	5330	5247	5161	5074	4984	4891	4796	4697
							WINTER					SUMMER	

Weather Assumptions:

Emissivity =	0.5	Suntime =	14
Absorptivity =	0.5	Degrees North Latitude=	40
Atmosphere =	Clear	Elevation Above Sea Level=	1000
Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90

Conductor : 3-1/2" Alum, Sched 80, 6063 Alloy

Outside Diameter =	4 inches		
T_{low} =	20 °C	T_{high} =	70 °C
R_{low} =	4.2E-06 ohms/ft	R_{high} =	5E-06 ohms/ft

Bus Conductor: **4" Alum, Sched 80, 6063 Alloy**

Rating	Rated Operating Temperature	Assumed Wind Speed = 2 fps Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	4419	4250	4073	3885	3687	3475	3246	2998	2725	2417	2060	1619
	70	4728	4575	4415	4248	4072	3887	3691	3481	3255	3010	2739	2435
	80	5012	4871	4726	4575	4417	4251	4078	3894	3699	3492	3268	3025
Normal	**90**	**5275**	**5146**	**5012**	**4874**	**4730**	**4580**	**4424**	**4260**	**4088**	**3906**	**3713**	**3506**
	100	5523	5403	5279	5152	5019	4882	4740	4591	4436	4274	4102	3922
	110	5757	5645	5530	5412	5289	5163	5032	4896	4754	4607	4453	4291
Emergency (<24 hrs)	**115**	**5870**	**5762**	**5651**	**5536**	**5418**	**5296**	**5170**	**5040**	**4905**	**4764**	**4617**	**4463**
	120	5981	5876	5768	5658	5544	5426	5305	5179	5049	4914	4774	4627
Emergency (< 1 hr)	**130**	**6195**	**6097**	**5996**	**5892**	**5785**	**5676**	**5563**	**5446**	**5326**	**5201**	**5072**	**4938**
	140	6402	6309	6214	6116	6016	5914	5808	5699	5587	5471	5351	5227
	150	6603	6515	6425	6333	6239	6142	6043	5940	5835	5727	5616	5501
							WINTER					SUMMER	

Weather Assumptions:

Emissivity =	0.5	Suntime =	14
Absorptivity =	0.5	Degrees North Latitude=	40
Atmosphere =	Clear	Elevation Above Sea Level=	1000
Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90

Conductor : 4" Alum, Sched 80, 6063 Alloy

Outside Diameter =	4.5 inches		
T_{low} =	20 °C	T_{high} =	80 °C
R_{low} =	3.5E-06 ohms/ft	R_{high} =	4.2E-06 ohms/ft

Bus Conductor: **4-1/2" Alum, Sched 80, 6063 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	4895	4707	4510	4301	4080	3844	3589	3312	3006	2661	2259	1761
	70	5227	5058	4881	4695	4501	4295	4077	3843	3592	3319	3017	2677
	80	5530	5376	5215	5048	4873	4690	4498	4295	4079	3848	3600	3330
Normal	**90**	**5811**	**5669**	**5522**	**5369**	**5211**	**5045**	**4873**	**4692**	**4502**	**4300**	**4087**	**3859**
	100	6073	5942	5806	5666	5520	5369	5213	5049	4878	4699	4511	4311
	110	6321	6198	6072	5942	5808	5669	5525	5376	5221	5059	4890	4712
Emergency (<24 hrs)	**115**	**6440**	**6321**	**6199**	**6074**	**5945**	**5811**	**5673**	**5530**	**5382**	**5227**	**5066**	**4897**
	120	6556	6441	6324	6203	6078	5949	5817	5679	5537	5389	5235	5074
Emergency (< 1 hr)	**130**	**6781**	**6673**	**6563**	**6450**	**6334**	**6214**	**6091**	**5963**	**5832**	**5695**	**5554**	**5407**
	140	6997	6896	6792	6686	6577	6465	6350	6232	6109	5983	5852	5717
	150	7207	7111	7014	6914	6811	6706	6598	6487	6373	6255	6134	6008
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	4-1/2" Alum, Sched 80, 6063 Alloy		Outside Diameter =	5 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	3E-06 ohms/ft	R_{high} =	3.6E-06 ohms/ft

Bus Conductor: **5" Alum, Sched 80, 6063 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	5492	5281	5058	4823	4573	4307	4019	3705	3359	2967	2508	1937
	70	5867	5676	5477	5269	5049	4817	4571	4308	4024	3715	3373	2987
	80	6209	6035	5855	5667	5470	5265	5048	4819	4575	4315	4035	3729
Normal	**90**	**6525**	**6366**	**6201**	**6029**	**5851**	**5665**	**5471**	**5268**	**5053**	**4827**	**4586**	**4328**
	100	6821	6674	6521	6364	6201	6031	5855	5671	5479	5278	5065	4841
	110	7100	6963	6821	6676	6525	6369	6208	6040	5866	5684	5493	5293
Emergency (<24 hrs)	**115**	**7234**	**7101**	**6965**	**6825**	**6680**	**6530**	**6375**	**6215**	**6048**	**5874**	**5693**	**5503**
	120	7365	7237	7105	6969	6830	6686	6537	6383	6223	6056	5883	5703
Emergency (< 1 hr)	**130**	**7619**	**7498**	**7375**	**7248**	**7118**	**6984**	**6846**	**6703**	**6555**	**6402**	**6244**	**6079**
	140	7863	7750	7634	7515	7393	7268	7139	7006	6869	6727	6580	6429
	150	8099	7992	7883	7771	7657	7539	7418	7294	7166	7034	6898	6757
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	5" Alum, Sched 80, 6063 Alloy		Outside Diameter =	5.563 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	2.5E-06 ohms/ft	R_{high} =	3E-06 ohms/ft

Bus Conductor: **6" Alum, Sched 80, 6063 Alloy**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	6762	6500	6224	5932	5622	5290	4931	4539	4105	3612	3032	2300
	70	7222	6986	6740	6482	6210	5923	5617	5290	4936	4551	4123	3639
	80	7640	7426	7203	6971	6729	6474	6206	5923	5621	5298	4949	4569
Normal	**90**	**8025**	**7829**	**7626**	**7416**	**7196**	**6967**	**6728**	**6476**	**6212**	**5931**	**5633**	**5314**
	100	8385	8204	8017	7824	7624	7416	7199	6973	6736	6487	6225	5948
	110	8724	8556	8383	8205	8020	7829	7631	7425	7211	6987	6752	6506
Emergency (<24 hrs)	**115**	**8887**	**8725**	**8558**	**8386**	**8209**	**8025**	**7835**	**7638**	**7433**	**7220**	**6997**	**6763**
	120	9046	8889	8728	8563	8392	8215	8033	7844	7648	7444	7231	7009
Emergency (< 1 hr)	**130**	**9353**	**9207**	**9057**	**8902**	**8743**	**8579**	**8410**	**8235**	**8055**	**7867**	**7673**	**7470**
	140	9649	9512	9371	9226	9077	8925	8767	8605	8437	8264	8085	7899
	150	9936	9806	9674	9538	9398	9255	9108	8956	8800	8639	8473	8301
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.5	Suntime =	14
	Absorptivity =	0.5	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	6" Alum, Sched 80, 6063 Alloy		Outside Diameter =	6.625 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	1.8E-06 ohms/ft	R_{high} =	2.2E-06 ohms/ft

Bus Conductor: **3/4" Copper, Schedule 40, 98% ICAS**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	1081	1041	998	954	906	855	801	742	677	604	519	417
	70	1154	1117	1079	1039	997	953	906	856	802	743	679	607
	80	1220	1187	1152	1116	1078	1038	997	953	906	857	803	745
Normal	**90**	**1281**	**1250**	**1219**	**1186**	**1151**	**1115**	**1078**	**1039**	**998**	**954**	**908**	**859**
	100	1339	1310	1281	1250	1219	1186	1152	1116	1079	1040	1000	956
	110	1393	1366	1339	1311	1281	1251	1220	1187	1154	1119	1082	1043
Emergency (<24 hrs)	**115**	**1419**	**1393**	**1367**	**1339**	**1311**	**1282**	**1252**	**1221**	**1189**	**1155**	**1120**	**1083**
	120	1444	1419	1394	1367	1340	1312	1283	1253	1222	1190	1157	1122
Emergency (< 1 hr)	**130**	**1493**	**1470**	**1446**	**1421**	**1396**	**1370**	**1343**	**1315**	**1286**	**1257**	**1226**	**1194**
	140	1541	1519	1496	1473	1449	1425	1400	1374	1347	1319	1291	1261
	150	1586	1566	1544	1523	1500	1477	1453	1429	1404	1378	1352	1324
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.85	Suntime =	14
	Absorptivity =	0.85	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	3/4" Copper, Schedule 40, 98% ICAS		Outside Diameter =	1.05 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	2.5E-05 ohms/ft	R_{high} =	3E-05 ohms/ft

Bus Conductor: **1" Copper, Schedule 40, 98% ICAS**

Rating	Rated Operating Temperature	Assumed Wind Speed = 2 fps Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	1367	1316	1261	1204	1143	1078	1008	931	847	752	641	505
	70	1462	1415	1366	1315	1262	1205	1145	1080	1011	935	852	758
	80	1548	1505	1461	1415	1367	1317	1263	1207	1147	1084	1015	940
Normal	**90**	**1628**	**1589**	**1548**	**1506**	**1463**	**1417**	**1369**	**1319**	**1266**	**1211**	**1151**	**1088**
	100	1703	1667	1629	1591	1551	1509	1466	1420	1373	1323	1271	1216
	110	1774	1740	1705	1670	1632	1594	1554	1513	1470	1425	1378	1329
Emergency (<24 hrs)	**115**	**1808**	**1775**	**1742**	**1707**	**1672**	**1635**	**1596**	**1557**	**1516**	**1473**	**1428**	**1381**
	120	1841	1810	1777	1744	1710	1674	1637	1599	1560	1519	1476	1431
Emergency (< 1 hr)	**130**	**1906**	**1876**	**1846**	**1815**	**1783**	**1749**	**1715**	**1680**	**1643**	**1606**	**1566**	**1525**
	140	1968	1940	1912	1882	1852	1821	1789	1756	1722	1687	1651	1613
	150	2028	2002	1975	1947	1919	1890	1860	1829	1798	1765	1731	1696
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.85	Suntime =	14
	Absorptivity =	0.85	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1" Copper, Schedule 40, 98% ICAS		Outside Diameter =	1.315 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	1.8E-05 ohms/ft	R_{high} =	2.1E-05 ohms/ft

Bus Conductor: **1-1/4" Copper, Schedule 40, 98% ICAS**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	1772	1704	1633	1558	1477	1392	1299	1198	1085	958	808	621
	70	1898	1837	1773	1707	1636	1562	1482	1397	1306	1205	1094	969
	80	2013	1958	1900	1840	1777	1711	1641	1567	1489	1405	1314	1214
Normal	**90**	**2121**	**2070**	**2017**	**1962**	**1905**	**1846**	**1783**	**1718**	**1648**	**1575**	**1497**	**1413**
	100	2221	2174	2126	2075	2023	1969	1912	1853	1791	1726	1657	1584
	110	2317	2273	2228	2181	2133	2083	2031	1977	1921	1862	1800	1736
Emergency (<24 hrs)	**115**	**2363**	**2320**	**2277**	**2232**	**2186**	**2138**	**2088**	**2036**	**1982**	**1926**	**1867**	**1806**
	120	2408	2367	2325	2281	2237	2190	2142	2093	2041	1987	1931	1873
Emergency (< 1 hr)	**130**	**2495**	**2456**	**2417**	**2377**	**2335**	**2292**	**2247**	**2201**	**2154**	**2104**	**2053**	**1999**
	140	2579	2543	2506	2468	2429	2388	2347	2304	2260	2214	2167	2117
	150	2660	2626	2591	2556	2519	2481	2442	2402	2361	2318	2274	2229
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.85	Suntime =	14
	Absorptivity =	0.85	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1-1/4" Copper, Schedule 40, 98% ICAS		Outside Diameter =	1.66 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	1.2E-05 ohms/ft	R_{high} =	1.4E-05 ohms/ft

Bus Conductor: **1-1/2" Copper, Schedule 40, 98% ICAS**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	2009	1931	1849	1763	1671	1573	1466	1350	1221	1073	900	679
	70	2153	2083	2011	1935	1854	1769	1679	1581	1476	1361	1233	1088
	80	2286	2223	2158	2089	2018	1942	1862	1778	1688	1592	1487	1373
Normal	**90**	**2411**	**2353**	**2293**	**2230**	**2165**	**2098**	**2026**	**1951**	**1872**	**1789**	**1699**	**1604**
	100	2527	2474	2418	2361	2302	2240	2175	2108	2037	1963	1884	1801
	110	2637	2588	2537	2484	2429	2372	2313	2252	2187	2120	2050	1976
Emergency (<24 hrs)	**115**	**2691**	**2643**	**2593**	**2542**	**2490**	**2435**	**2378**	**2319**	**2258**	**2194**	**2127**	**2057**
	120	2743	2696	2649	2600	2549	2496	2442	2385	2326	2265	2201	2135
Emergency (< 1 hr)	**130**	**2844**	**2800**	**2756**	**2710**	**2662**	**2614**	**2563**	**2511**	**2457**	**2400**	**2342**	**2281**
	140	2941	2901	2859	2816	2771	2726	2679	2630	2580	2527	2473	2417
	150	3036	2998	2958	2918	2876	2833	2789	2744	2697	2648	2598	2546
							WINTER					SUMMER	

Weather Assumptions:

Emissivity =	0.85	Suntime =	14
Absorptivity =	0.85	Degrees North Latitude=	40
Atmosphere =	Clear	Elevation Above Sea Level=	1000
Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90

Conductor : 1-1/2" Copper, Schedule 40, 98% ICAS

T_{low} =	20 °C	Outside Diameter =	1.9 inches
R_{low} =	1E-05 ohms/ft	T_{high} =	70 °C
		R_{high} =	1.2E-05 ohms/ft

Bus Conductor: **2" Copper, Schedule 40, 98% ICAS**

Rating	Rated Operating Temperature	Assumed Wind Speed = 2 fps Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	2486	2389	2286	2177	2061	1936	1801	1653	1488	1300	1076	785
	70	2669	2581	2490	2393	2292	2184	2069	1946	1813	1667	1504	1319
	80	2836	2756	2674	2587	2497	2401	2301	2194	2081	1959	1827	1683
Normal	**90**	**2991**	**2918**	**2843**	**2764**	**2682**	**2597**	**2507**	**2413**	**2313**	**2207**	**2095**	**1974**
	100	3137	3070	3000	2928	2853	2775	2694	2609	2520	2427	2328	2224
	110	3275	3212	3148	3081	3012	2941	2867	2789	2709	2625	2538	2446
Emergency (<24 hrs)	**115**	**3342**	**3281**	**3219**	**3155**	**3088**	**3020**	**2949**	**2875**	**2798**	**2719**	**2636**	**2549**
	120	3407	3348	3288	3226	3162	3096	3028	2958	2885	2809	2730	2647
Emergency (< 1 hr)	**130**	**3533**	**3478**	**3422**	**3365**	**3305**	**3244**	**3182**	**3118**	**3051**	**2981**	**2908**	**2833**
	140	3655	3604	3551	3498	3443	3387	3329	3269	3207	3143	3076	3006
	150	3774	3726	3678	3628	3577	3524	3470	3414	3356	3296	3235	3170
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.85	Suntime =	14
	Absorptivity =	0.85	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	2" Copper, Schedule 40, 98% ICAS		Outside Diameter =	2.375 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	7.6E-06 ohms/ft	R_{high} =	9.1E-06 ohms/ft

Bus Conductor: **2-1/2" Copper, Schedule 40, 98% ICAS**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	3190	3064	2930	2789	2639	2477	2301	2107	1891	1643	1345	950
	70	3430	3317	3199	3074	2943	2803	2654	2494	2320	2129	1916	1672
	80	3650	3548	3441	3329	3212	3089	2959	2821	2673	2515	2343	2154
Normal	**90**	**3855**	**3761**	**3663**	**3562**	**3456**	**3346**	**3230**	**3108**	**2979**	**2842**	**2695**	**2538**
	100	4047	3960	3870	3778	3681	3581	3476	3366	3251	3130	3002	2866
	110	4229	4148	4065	3980	3891	3799	3703	3603	3499	3390	3276	3155
Emergency (<24 hrs)	**115**	**4317**	**4239**	**4159**	**4077**	**3991**	**3903**	**3811**	**3716**	**3616**	**3512**	**3404**	**3290**
	120	4402	4328	4251	4171	4089	4004	3916	3824	3729	3630	3526	3418
Emergency (< 1 hr)	**130**	**4570**	**4500**	**4428**	**4353**	**4277**	**4198**	**4116**	**4032**	**3944**	**3853**	**3759**	**3660**
	140	4731	4665	4598	4528	4457	4383	4307	4229	4148	4064	3976	3886
	150	4888	4826	4763	4698	4631	4562	4491	4417	4342	4264	4183	4099
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.85	Suntime =	14
	Absorptivity =	0.85	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	2-1/2" Copper, Schedule 40, 98% ICAS		Outside Diameter =	2.875 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	5.3E-06 ohms/ft	R_{high} =	6.3E-06 ohms/ft

Bus Conductor: **3" Copper, Schedule 40, 98% ICAS**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	4065	3903	3732	3550	3356	3146	2918	2667	2385	2059	1663	1127
	70	4380	4235	4083	3923	3753	3574	3381	3174	2949	2701	2423	2103
	80	4668	4537	4400	4256	4106	3948	3780	3602	3412	3207	2984	2739
Normal	**90**	**4936**	**4816**	**4691**	**4561**	**4426**	**4284**	**4135**	**3977**	**3811**	**3635**	**3446**	**3243**
	100	5188	5077	4963	4844	4720	4591	4457	4316	4168	4012	3847	3671
	110	5426	5324	5218	5109	4995	4877	4754	4626	4493	4353	4205	4050
Emergency (<24 hrs)	**115**	**5542**	**5443**	**5341**	**5236**	**5126**	**5013**	**4896**	**4773**	**4646**	**4512**	**4373**	**4226**
	120	5655	5559	5461	5359	5254	5146	5033	4916	4794	4666	4533	4394
Emergency (< 1 hr)	**130**	**5874**	**5785**	**5693**	**5599**	**5501**	**5400**	**5296**	**5188**	**5075**	**4959**	**4837**	**4710**
	140	6087	6003	5917	5829	5738	5644	5546	5446	5342	5234	5123	5006
	150	6294	6215	6134	6051	5966	5878	5787	5693	5597	5497	5393	5286
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.85	Suntime =	14
	Absorptivity =	0.85	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	3" Copper, Schedule 40, 98% ICAS		Outside Diameter =	3.5 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	3.7E-06 ohms/ft	R_{high} =	4.4E-06 ohms/ft

Bus Conductor: **3-1/2" Copper, Schedule 40, 98% ICAS**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	4855	4660	4454	4235	4001	3748	3473	3168	2826	2428	1942	1270
	70	5237	5063	4881	4689	4485	4269	4037	3787	3515	3215	2878	2488
	80	5588	5431	5266	5095	4914	4724	4522	4308	4078	3831	3562	3265
Normal	**90**	**5914**	**5770**	**5621**	**5465**	**5303**	**5132**	**4953**	**4764**	**4564**	**4352**	**4124**	**3879**
	100	6221	6088	5951	5809	5661	5506	5345	5176	4998	4810	4612	4400
	110	6512	6389	6262	6131	5995	5854	5707	5553	5393	5225	5048	4861
Emergency (<24 hrs)	**115**	**6652**	**6534**	**6412**	**6286**	**6155**	**6020**	**5879**	**5732**	**5579**	**5419**	**5251**	**5075**
	120	6790	6676	6558	6437	6311	6181	6046	5905	5759	5606	5446	5279
Emergency (< 1 hr)	**130**	**7058**	**6951**	**6842**	**6728**	**6612**	**6491**	**6366**	**6236**	**6102**	**5962**	**5816**	**5664**
	140	7317	7217	7115	7009	6900	6788	6671	6551	6427	6298	6163	6024
	150	7570	7476	7379	7280	7178	7073	6964	6853	6737	6617	6493	6364
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.85	Suntime =	14
	Absorptivity =	0.85	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	3-1/2" Copper, Schedule 40, 98% ICAS		Outside Diameter =	4 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	2.8E-06 ohms/ft	R_{high} =	3.4E-06 ohms/ft

Bus Conductor: **4" Copper, Schedule 40, 98% ICAS**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	5376	5159	4930	4686	4424	4142	3833	3492	3107	2658	2106	1325
	70	5807	5613	5410	5196	4969	4728	4469	4190	3886	3549	3170	2731
	80	6201	6027	5844	5653	5452	5240	5015	4776	4520	4244	3942	3610
Normal	**90**	**6569**	**6409**	**6243**	**6070**	**5889**	**5700**	**5501**	**5290**	**5067**	**4830**	**4576**	**4302**
	100	6914	6767	6615	6457	6293	6121	5941	5753	5555	5346	5125	4889
	110	7242	7106	6966	6820	6669	6512	6349	6178	6000	5812	5615	5407
Emergency (<24 hrs)	**115**	**7401**	**7270**	**7134**	**6995**	**6850**	**6699**	**6543**	**6380**	**6209**	**6031**	**5844**	**5647**
	120	7556	7430	7299	7165	7025	6881	6730	6574	6412	6242	6064	5877
Emergency (< 1 hr)	**130**	**7858**	**7740**	**7619**	**7493**	**7364**	**7230**	**7091**	**6947**	**6798**	**6642**	**6480**	**6311**
	140	8151	8040	7927	7810	7689	7564	7435	7302	7164	7020	6871	6716
	150	8436	8332	8225	8116	8003	7886	7766	7642	7513	7380	7242	7099
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.85	Suntime =	14
	Absorptivity =	0.85	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	4" Copper, Schedule 40, 98% ICAS		Outside Diameter =	4.5 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	2.5E-06 ohms/ft	R_{high} =	3E-06 ohms/ft

Bus Conductor: **1" Copper, Schedule 80, 98% ICAS**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	1601	1541	1477	1410	1339	1263	1180	1091	992	881	751	592
	70	1712	1657	1600	1541	1478	1411	1341	1265	1184	1095	998	888
	80	1813	1763	1711	1657	1601	1542	1480	1414	1344	1269	1189	1101
Normal	**90**	**1907**	**1861**	**1813**	**1764**	**1713**	**1660**	**1604**	**1545**	**1483**	**1418**	**1349**	**1274**
	100	1994	1952	1908	1863	1816	1767	1717	1664	1608	1550	1489	1424
	110	2077	2038	1997	1955	1912	1867	1821	1772	1722	1669	1614	1556
Emergency (<24 hrs)	**115**	**2117**	**2079**	**2040**	**2000**	**1958**	**1915**	**1870**	**1823**	**1775**	**1725**	**1672**	**1617**
	120	2156	2120	2082	2043	2002	1961	1918	1873	1827	1779	1728	1676
Emergency (< 1 hr)	**130**	**2232**	**2197**	**2162**	**2125**	**2088**	**2049**	**2009**	**1968**	**1925**	**1880**	**1834**	**1786**
	140	2305	2272	2239	2205	2169	2133	2096	2057	2017	1976	1934	1889
	150	2376	2345	2313	2281	2248	2214	2179	2142	2105	2067	2027	1986
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.85	Suntime =	14
	Absorptivity =	0.85	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1" Copper, Schedule 80, 98% ICAS		Outside Diameter =	1.315 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	1.3E-05 ohms/ft	R_{high} =	1.5E-05 ohms/ft

Bus Conductor: **1-1/2" Copper, Schedule 80, 98% ICAS**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	2302	2212	2118	2019	1914	1802	1680	1547	1398	1230	1031	778
	70	2466	2387	2304	2217	2125	2027	1923	1812	1691	1559	1413	1246
	80	2619	2547	2472	2394	2311	2225	2134	2037	1934	1823	1704	1573
Normal	**90**	**2762**	**2695**	**2627**	**2555**	**2481**	**2403**	**2321**	**2236**	**2145**	**2049**	**1947**	**1837**
	100	2895	2834	2771	2705	2637	2566	2492	2415	2334	2249	2159	2063
	110	3022	2965	2906	2845	2783	2718	2650	2579	2506	2429	2348	2264
Emergency (<24 hrs)	**115**	**3083**	**3028**	**2971**	**2913**	**2852**	**2790**	**2725**	**2657**	**2587**	**2514**	**2437**	**2357**
	120	3142	3089	3035	2978	2920	2860	2797	2733	2665	2595	2522	2445
Emergency (< 1 hr)	**130**	**3258**	**3208**	**3157**	**3105**	**3050**	**2994**	**2936**	**2876**	**2814**	**2750**	**2683**	**2613**
	140	3370	3323	3275	3226	3175	3123	3069	3013	2955	2896	2834	2769
	150	3478	3434	3389	3343	3295	3246	3195	3143	3089	3034	2976	2917
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.85	Suntime =	14
	Absorptivity =	0.85	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1-1/2" Copper, Schedule 80, 98% ICAS		Outside Diameter =	1.9 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	7.7E-06 ohms/ft	R_{high} =	9.2E-06 ohms/ft

Bus Conductor: **2" Copper, Schedule 80, 98% ICAS**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	2911	2797	2676	2549	2413	2267	2109	1936	1743	1522	1259	919
	70	3125	3022	2915	2802	2683	2557	2423	2279	2123	1952	1761	1544
	80	3321	3228	3131	3029	2923	2812	2694	2569	2436	2294	2139	1970
Normal	**90**	**3503**	**3417**	**3329**	**3236**	**3141**	**3040**	**2935**	**2825**	**2708**	**2585**	**2453**	**2311**
	100	3673	3594	3513	3428	3341	3249	3154	3055	2951	2841	2726	2604
	110	3835	3761	3686	3608	3527	3443	3357	3266	3172	3074	2971	2864
Emergency (<24 hrs)	**115**	**3913**	**3842**	**3769**	**3694**	**3616**	**3536**	**3453**	**3366**	**3277**	**3184**	**3086**	**2984**
	120	3989	3921	3850	3778	3703	3626	3546	3463	3378	3289	3197	3099
Emergency (< 1 hr)	**130**	**4137**	**4073**	**4007**	**3940**	**3870**	**3799**	**3726**	**3650**	**3572**	**3490**	**3406**	**3317**
	140	4280	4220	4158	4096	4032	3966	3898	3828	3755	3680	3602	3520
	150	4419	4363	4306	4248	4188	4127	4063	3998	3930	3860	3787	3712
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.85	Suntime =	14
	Absorptivity =	0.85	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	2" Copper, Schedule 80, 98% ICAS		Outside Diameter =	2.375 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	5.6E-06 ohms/ft	R_{high} =	6.6E-06 ohms/ft

Bus Conductor: **2-1/2"Copper, Schedule 80, 98% ICAS**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	3830	3679	3519	3349	3168	2974	2763	2531	2271	1973	1615	1141
	70	4119	3983	3841	3691	3533	3366	3187	2995	2786	2557	2301	2008
	80	4383	4260	4132	3998	3857	3709	3553	3387	3210	3020	2813	2587
Normal	**90**	**4629**	**4516**	**4399**	**4277**	**4150**	**4017**	**3878**	**3731**	**3577**	**3412**	**3237**	**3048**
	100	4859	4755	4648	4536	4420	4300	4174	4042	3904	3758	3604	3441
	110	5078	4981	4882	4779	4672	4562	4447	4327	4202	4071	3934	3789
Emergency (<24 hrs)	**115**	**5183**	**5090**	**4994**	**4895**	**4793**	**4686**	**4576**	**4462**	**4342**	**4218**	**4087**	**3950**
	120	5286	5197	5104	5008	4910	4808	4702	4592	4478	4359	4234	4104
Emergency (< 1 hr)	**130**	**5487**	**5403**	**5317**	**5227**	**5136**	**5041**	**4943**	**4841**	**4736**	**4627**	**4513**	**4395**
	140	5681	5602	5521	5438	5352	5264	5172	5078	4981	4880	4775	4666
	150	5870	5795	5719	5641	5560	5478	5392	5304	5214	5120	5023	4922
							WINTER					SUMMER	

Weather Assumptions:

Emissivity =	0.85	Suntime =	14
Absorptivity =	0.85	Degrees North Latitude=	40
Atmosphere =	Clear	Elevation Above Sea Level=	1000
Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90

Conductor : 2-1/2"Copper, Schedule 80, 98% ICAS

T_{low} =	20 °C	Outside Diameter =	2.875 inches
R_{low} =	3.6E-06 ohms/ft	T_{high} =	70 °C
		R_{high} =	4.3E-06 ohms/ft

Bus Conductor: **3" Copper, Schedule 80, 98% ICAS**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	4727	4539	4340	4128	3902	3658	3393	3101	2773	2394	1934	1310
	70	5093	4924	4748	4561	4365	4156	3932	3691	3429	3141	2818	2446
	80	5428	5275	5116	4950	4775	4590	4396	4189	3967	3729	3470	3185
Normal	**90**	**5740**	**5600**	**5455**	**5304**	**5146**	**4981**	**4808**	**4625**	**4432**	**4227**	**4007**	**3771**
	100	6032	5904	5771	5632	5489	5339	5182	5019	4846	4665	4473	4269
	110	6310	6191	6068	5940	5808	5671	5529	5380	5224	5061	4890	4710
Emergency (<24 hrs)	**115**	**6444**	**6329**	**6211**	**6088**	**5961**	**5830**	**5693**	**5551**	**5402**	**5247**	**5085**	**4914**
	120	6576	6465	6350	6232	6110	5983	5852	5716	5574	5426	5271	5109
Emergency (< 1 hr)	**130**	**6831**	**6727**	**6620**	**6510**	**6397**	**6280**	**6158**	**6032**	**5902**	**5766**	**5625**	**5477**
	140	7078	6981	6881	6778	6672	6563	6450	6333	6212	6087	5957	5821
	150	7319	7227	7133	7036	6937	6835	6729	6621	6508	6392	6271	6146
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.85	Suntime =	14
	Absorptivity =	0.85	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	3" Copper, Schedule 80, 98% ICAS		Outside Diameter =	3.5 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	2.7E-06 ohms/ft	R_{high} =	3.2E-06 ohms/ft

Bus Conductor: **3-1/2" Copper, Schedule 80, 98% ICAS**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	5449	5231	5000	4754	4491	4207	3898	3556	3172	2726	2180	1425
	70	5878	5683	5478	5263	5034	4791	4531	4251	3945	3608	3230	2792
	80	6272	6095	5911	5718	5515	5302	5076	4835	4577	4300	3998	3665
Normal	**90**	**6638**	**6477**	**6309**	**6134**	**5952**	**5760**	**5559**	**5347**	**5123**	**4884**	**4629**	**4354**
	100	6982	6834	6680	6520	6354	6180	5999	5809	5610	5399	5176	4939
	110	7309	7171	7029	6882	6729	6571	6406	6233	6053	5864	5666	5456
Emergency (<24 hrs)	**115**	**7466**	**7334**	**7197**	**7055**	**6909**	**6757**	**6599**	**6434**	**6262**	**6082**	**5894**	**5696**
	120	7621	7493	7361	7225	7084	6937	6786	6628	6464	6292	6113	5925
Emergency (< 1 hr)	**130**	**7922**	**7802**	**7679**	**7552**	**7421**	**7286**	**7145**	**7000**	**6849**	**6692**	**6528**	**6357**
	140	8213	8101	7986	7867	7745	7618	7488	7353	7213	7068	6918	6761
	150	8496	8391	8283	8171	8057	7939	7817	7691	7561	7427	7287	7143
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.85	Suntime =	14
	Absorptivity =	0.85	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	3-1/2" Copper, Schedule 80, 98% ICAS		Outside Diameter =	4 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	2.2E-06 ohms/ft	R_{high} =	2.7E-06 ohms/ft

Bus Conductor: **4" Copper, Schedule 80, 98% ICAS**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	60	6210	5960	5695	5413	5111	4784	4428	4034	3589	3071	2432	1530
	70	6708	6484	6250	6002	5740	5462	5163	4840	4488	4100	3662	3154
	80	7164	6962	6751	6530	6298	6053	5794	5517	5221	4902	4554	4170
Normal	**90**	**7588**	**7404**	**7212**	**7012**	**6803**	**6584**	**6354**	**6111**	**5854**	**5579**	**5286**	**4969**
	100	7987	7817	7642	7459	7269	7071	6863	6646	6417	6176	5920	5647
	110	8366	8209	8047	7879	7704	7523	7334	7137	6931	6714	6487	6246
Emergency (<24 hrs)	**115**	**8549**	**8398**	**8241**	**8080**	**7912**	**7739**	**7558**	**7369**	**7173**	**6967**	**6751**	**6524**
	120	8728	8582	8432	8276	8115	7948	7775	7594	7406	7210	7005	6789
Emergency (< 1 hr)	**130**	**9077**	**8941**	**8801**	**8656**	**8506**	**8352**	**8192**	**8025**	**7853**	**7673**	**7486**	**7290**
	140	9416	9288	9157	9021	8882	8738	8589	8435	8275	8110	7937	7758
	150	9745	9625	9502	9375	9244	9110	8971	8827	8679	8525	8366	8200
							WINTER					SUMMER	

Weather Assumptions:

Emissivity =	0.85	Suntime =	14
Absorptivity =	0.85	Degrees North Latitude=	40
Atmosphere =	Clear	Elevation Above Sea Level=	1000
Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90

Conductor : 4" Copper, Schedule 80, 98% ICAS

T_{low} =	20 °C	Outside Diameter =	4.5 inches
R_{low} =	1.9E-06 ohms/ft	T_{high} =	70 °C
		R_{high} =	2.2E-06 ohms/ft

Bus Conductor: **1/0 ACSR 6/1**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	336	327	317	307	297	286	274	263	250	237	222	207
	90	349	340	332	322	313	303	293	282	271	260	247	234
	100	361	353	345	336	328	319	310	300	290	279	268	257
Normal	**105**	**367**	**359**	**351**	**343**	**335**	**326**	**317**	**308**	**298**	**288**	**278**	**267**
	110	372	365	357	349	341	333	324	316	306	297	287	277
	120	382	376	368	361	354	346	338	330	322	313	304	294
Emergency (<24 hrs)	**130**	**392**	**386**	**379**	**372**	**365**	**358**	**351**	**343**	**335**	**327**	**319**	**310**
Emergency (< 1 hr)	**140**	**401**	**395**	**389**	**383**	**376**	**369**	**362**	**355**	**348**	**341**	**333**	**325**
	150	410	404	398	392	386	380	373	367	360	353	346	338
	160	418	413	407	402	396	390	384	378	371	365	358	351
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1/0 ACSR 6/1		Outside Diameter =	0.398 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	0.00017 ohms/ft	R_{high} =	0.00022 ohms/ft

Bus Conductor: **2/0 ACSR 6/1**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (^{o}C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	383	373	362	350	338	326	313	299	285	270	253	236
	90	396	387	377	366	356	344	333	321	308	295	281	266
	100	409	400	390	381	371	361	350	339	328	316	304	291
Normal	**105**	**414**	**406**	**397**	**388**	**378**	**368**	**358**	**348**	**337**	**326**	**314**	**302**
	110	420	411	403	394	385	376	366	356	346	335	324	312
	120	430	422	414	406	398	389	380	371	362	352	342	331
Emergency (<24 hrs)	**130**	**440**	**432**	**425**	**417**	**409**	**401**	**393**	**385**	**376**	**367**	**358**	**348**
Emergency (< 1 hr)	**140**	**449**	**442**	**435**	**428**	**420**	**413**	**405**	**397**	**389**	**381**	**372**	**363**
	150	457	451	444	438	431	424	417	409	402	394	386	378
	160	466	459	453	447	440	434	427	420	413	406	398	391
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	2/0 ACSR 6/1		Outside Diameter =	0.447 inches
	T_{low} =	25 ^{o}C	T_{high} =	75 ^{o}C
	R_{low} =	0.00013 ohms/ft	R_{high} =	0.00018 ohms/ft

Bus Conductor: **3/0 ACSR 6/1**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	437	425	412	399	385	371	356	341	324	307	288	268
	90	451	440	429	417	405	392	379	365	350	335	319	302
	100	465	454	444	433	422	410	398	386	373	359	345	330
Normal	**105**	**471**	**461**	**451**	**440**	**430**	**419**	**407**	**395**	**383**	**370**	**357**	**343**
	110	477	467	458	448	437	427	416	404	393	380	368	354
	120	488	479	470	461	451	442	431	421	410	399	388	376
Emergency (<24 hrs)	**130**	**498**	**490**	**482**	**473**	**464**	**455**	**446**	**436**	**426**	**416**	**406**	**395**
Emergency (< 1 hr)	**140**	**508**	**501**	**493**	**485**	**476**	**468**	**459**	**450**	**441**	**432**	**422**	**412**
	150	518	511	503	496	488	480	472	463	455	446	437	428
	160	527	520	513	506	498	491	483	476	468	459	451	442
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	3/0 ACSR 6/1		Outside Diameter =	0.502 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	0.0001 ohms/ft	R_{high} =	0.00014 ohms/ft

Bus Conductor: **4/0 ACSR 6/1**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	496	482	468	453	437	421	404	386	368	348	326	303
	90	511	499	486	472	458	444	429	413	397	379	361	341
	100	526	514	502	490	477	464	450	436	422	406	390	373
Normal	**105**	**532**	**521**	**510**	**498**	**486**	**473**	**460**	**447**	**433**	**418**	**403**	**387**
	110	538	528	517	505	494	482	469	457	443	430	415	400
	120	550	540	530	520	509	498	487	475	463	450	437	424
Emergency (<24 hrs)	**130**	**562**	**552**	**543**	**533**	**523**	**513**	**502**	**492**	**480**	**469**	**457**	**445**
Emergency (< 1 hr)	**140**	**572**	**563**	**555**	**546**	**536**	**527**	**517**	**507**	**497**	**486**	**475**	**464**
	150	582	574	566	557	548	540	530	521	512	502	492	481
	160	592	584	576	568	560	552	543	534	526	516	507	497
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	4/0 ACSR 6/1		Outside Diameter =	0.563 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	8.1E-05 ohms/ft	R_{high} =	0.00012 ohms/ft

Bus Conductor: **159 kcm ACSR 12/7**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	433	421	408	395	381	367	352	336	320	302	283	262
	90	443	432	421	409	397	384	371	357	343	328	311	294
	100	452	442	432	421	410	399	387	375	362	349	335	320
Normal	**105**	**456**	**447**	**437**	**427**	**416**	**405**	**394**	**383**	**371**	**358**	**345**	**331**
	110	460	451	442	432	422	412	401	390	379	367	354	341
	120	468	459	451	442	433	423	414	404	393	383	372	360
Emergency (<24 hrs)	**130**	**475**	**467**	**459**	**451**	**442**	**434**	**425**	**416**	**406**	**397**	**387**	**376**
Emergency (< 1 hr)	**140**	**482**	**474**	**467**	**459**	**452**	**444**	**435**	**427**	**418**	**409**	**400**	**391**
	150	488	481	474	467	460	453	445	437	429	421	413	404
	160	494	488	482	475	468	461	454	447	440	432	424	416
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	159 kcm ACSR 12/7		Outside Diameter =	0.756 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	0.0001 ohms/ft	R_{high} =	0.00018 ohms/ft

Bus Conductor: **203.2 kcm ACSR 16/19**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	459	446	433	419	405	389	374	357	339	321	300	279
	90	467	455	443	431	418	405	391	377	361	345	328	310
	100	474	463	453	442	430	418	406	393	380	366	351	336
Normal	**105**	**477**	**467**	**457**	**446**	**435**	**424**	**413**	**400**	**388**	**375**	**361**	**347**
	110	480	471	461	451	440	430	419	407	395	383	370	357
	120	486	478	469	459	450	440	430	420	409	398	386	374
Emergency (<24 hrs)	**130**	**492**	**484**	**476**	**467**	**459**	**450**	**440**	**431**	**421**	**411**	**401**	**390**
Emergency (< 1 hr)	**140**	**498**	**490**	**482**	**475**	**467**	**458**	**450**	**441**	**432**	**423**	**413**	**404**
	150	503	496	489	482	474	466	459	451	442	434	425	416
	160	508	502	495	488	481	474	467	459	452	444	436	428
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	203.2 kcm ACSR 16/19		Outside Diameter =	0.714 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	7.8E-05 ohms/ft	R_{high} =	0.00016 ohms/ft

Bus Conductor: **266.8 kcm ACSR 26/7**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	640	622	603	584	564	543	521	498	474	448	420	390
	90	670	653	636	618	600	581	561	541	519	496	472	446
	100	697	682	666	650	633	616	597	579	559	539	517	494
Normal	**105**	**711**	**696**	**680**	**665**	**648**	**632**	**614**	**596**	**578**	**558**	**538**	**516**
	110	723	709	694	679	663	647	631	613	595	577	557	537
	120	748	734	720	706	692	677	661	645	629	612	594	576
Emergency (<24 hrs)	**130**	**771**	**758**	**745**	**732**	**718**	**704**	**690**	**675**	**660**	**644**	**628**	**611**
Emergency (< 1 hr)	**140**	**793**	**781**	**769**	**756**	**743**	**730**	**717**	**703**	**689**	**674**	**659**	**643**
	150	814	803	791	779	767	755	742	729	716	702	688	673
	160	835	824	813	802	790	778	766	754	742	729	715	702
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	266.8 kcm ACSR 26/7		Outside Diameter =	0.642 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	6.5E-05 ohms/ft	R_{high} =	7.8E-05 ohms/ft

Bus Conductor: **266.8 kcm ACSR 30/7**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	647	629	610	591	570	549	527	504	479	452	424	394
	90	677	661	643	626	607	588	568	547	525	502	477	451
	100	705	690	674	657	640	623	604	585	566	545	523	500
Normal	**105**	**719**	**704**	**688**	**672**	**656**	**639**	**622**	**603**	**584**	**565**	**544**	**522**
	110	732	717	702	687	671	655	638	621	602	584	564	543
	120	757	743	729	715	700	685	669	653	636	619	601	582
Emergency (<24 hrs)	**130**	**780**	**767**	**754**	**741**	**727**	**713**	**698**	**683**	**668**	**652**	**635**	**618**
Emergency (< 1 hr)	**140**	**803**	**790**	**778**	**765**	**752**	**739**	**725**	**711**	**697**	**682**	**667**	**651**
	150	824	813	801	789	777	764	751	738	725	711	696	682
	160	845	834	823	812	800	788	776	764	751	738	724	711
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	266.8 kcm ACSR 30/7		Outside Diameter =	0.66 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	6.5E-05 ohms/ft	R_{high} =	7.7E-05 ohms/ft

Bus Conductor: **336.4 kcm ACSR 18/1**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	727	707	686	664	641	617	592	566	538	508	476	442
	90	761	742	723	703	682	660	638	614	590	564	536	507
	100	793	775	758	739	720	700	679	658	636	612	588	562
Normal	**105**	**808**	**791**	**774**	**756**	**737**	**718**	**699**	**678**	**657**	**635**	**611**	**587**
	110	823	806	790	772	755	736	717	698	677	656	634	611
	120	851	835	820	804	787	770	752	734	715	696	676	655
Emergency (<24 hrs)	**130**	**877**	**863**	**848**	**833**	**817**	**801**	**785**	**768**	**751**	**733**	**714**	**695**
Emergency (< 1 hr)	**140**	**903**	**889**	**875**	**861**	**846**	**831**	**816**	**800**	**784**	**767**	**750**	**732**
	150	927	914	901	887	874	860	845	830	815	799	783	767
	160	950	938	926	913	900	887	873	859	845	830	815	799
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	336.4 kcm ACSR 18/1		Outside Diameter =	0.684 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	5.2E-05 ohms/ft	R_{high} =	6.2E-05 ohms/ft

Bus Conductor: **336.4 kcm ACSR 26/7**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	741	721	699	677	653	629	603	576	548	518	485	450
	90	776	757	737	717	696	673	650	626	601	574	546	516
	100	809	791	773	754	734	714	693	671	648	624	599	573
Normal	**105**	**824**	**807**	**789**	**771**	**752**	**733**	**713**	**692**	**670**	**647**	**624**	**599**
	110	839	823	806	788	770	751	732	712	691	669	647	623
	120	868	852	836	820	803	786	768	749	730	710	690	668
Emergency (<24 hrs)	**130**	**895**	**881**	**866**	**850**	**834**	**818**	**801**	**784**	**766**	**748**	**729**	**709**
Emergency (< 1 hr)	**140**	**921**	**908**	**893**	**879**	**864**	**849**	**833**	**817**	**800**	**783**	**766**	**748**
	150	946	933	920	906	892	878	863	848	832	817	800	783
	160	971	958	945	932	919	906	892	877	863	848	832	817
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	336.4 kcm ACSR 26/7		Outside Diameter =	0.72 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	5.2E-05 ohms/ft	R_{high} =	6.2E-05 ohms/ft

Bus Conductor: **336.4 kcm ACSR 30/7**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	750	729	707	684	661	636	610	583	554	523	490	455
	90	786	766	746	725	704	681	658	634	608	581	552	522
	100	819	801	782	763	743	722	701	679	656	632	606	580
Normal	**105**	**834**	**817**	**799**	**781**	**761**	**742**	**721**	**700**	**678**	**655**	**631**	**606**
	110	850	833	815	798	779	760	741	720	699	677	655	631
	120	879	863	847	830	813	795	777	759	739	719	698	676
Emergency (<24 hrs)	**130**	**906**	**892**	**876**	**861**	**845**	**828**	**811**	**794**	**776**	**757**	**738**	**718**
Emergency (< 1 hr)	**140**	**933**	**919**	**905**	**890**	**875**	**859**	**844**	**827**	**811**	**793**	**775**	**757**
	150	958	945	931	918	903	889	874	859	843	827	810	793
	160	983	970	957	944	931	917	903	889	874	859	843	827
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	336.4 kcm ACSR 30/7		Outside Diameter =	0.741 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	5.1E-05 ohms/ft	R_{high} =	6.1E-05 ohms/ft

Bus Conductor: **397.5 kcm ACSR 26/7**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	824	801	777	752	726	699	671	640	609	575	538	499
	90	864	843	820	798	774	749	724	697	668	639	607	574
	100	900	881	860	839	817	795	771	747	721	695	667	637
Normal	**105**	**918**	**899**	**879**	**859**	**838**	**816**	**794**	**770**	**746**	**721**	**694**	**666**
	110	935	916	897	878	857	837	815	793	770	745	720	694
	120	967	950	932	914	895	876	856	835	814	791	768	745
Emergency (<24 hrs)	**130**	**998**	**982**	**965**	**948**	**930**	**912**	**893**	**874**	**854**	**834**	**813**	**791**
Emergency (< 1 hr)	**140**	**1027**	**1012**	**996**	**980**	**963**	**946**	**929**	**911**	**893**	**874**	**854**	**834**
	150	1055	1041	1026	1011	995	979	963	946	929	911	893	874
	160	1083	1069	1055	1040	1026	1010	995	979	963	946	929	911
							WINTER					SUMMER	

Weather Assumptions:

Emissivity =	0.7	Suntime =	14
Absorptivity =	0.9	Degrees North Latitude=	40
Atmosphere =	Clear	Elevation Above Sea Level=	1000
Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90

Conductor : 397.5 kcm ACSR 26/7

T_{low} =	25 °C	Outside Diameter =	0.783 inches
R_{low} =	4.4E-05 ohms/ft	T_{high} =	75 °C
		R_{high} =	5.2E-05 ohms/ft

Bus Conductor: **397.5 kcm ACSR 30/7**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	834	811	787	761	735	707	678	648	616	581	544	504
	90	874	853	830	807	783	758	732	705	676	646	614	580
	100	912	891	871	849	827	804	781	756	730	703	675	645
Normal	**105**	**929**	**910**	**890**	**869**	**848**	**826**	**803**	**780**	**755**	**730**	**703**	**675**
	110	946	928	908	889	868	847	825	803	779	755	729	702
	120	979	962	944	925	906	887	866	845	824	801	778	754
Emergency (<24 hrs)	**130**	**1011**	**994**	**977**	**960**	**942**	**924**	**905**	**885**	**865**	**845**	**823**	**801**
Emergency (< 1 hr)	**140**	**1040**	**1025**	**1009**	**993**	**976**	**959**	**941**	**923**	**904**	**885**	**865**	**845**
	150	1069	1054	1039	1024	1008	992	975	958	941	923	904	885
	160	1097	1083	1069	1054	1039	1024	1008	992	976	959	941	924
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	397.5 kcm ACSR 30/7		Outside Diameter =	0.806 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	4.3E-05 ohms/ft	R_{high} =	5.2E-05 ohms/ft

Bus Conductor: **477 kcm ACSR 26/7**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	926	900	873	845	816	785	753	719	683	644	603	559
	90	971	947	922	896	870	842	813	783	751	717	682	644
	100	1013	990	967	944	919	894	867	840	811	781	749	716
Normal	**105**	**1032**	**1011**	**989**	**966**	**942**	**918**	**893**	**866**	**839**	**810**	**781**	**749**
	110	1052	1031	1009	987	965	941	917	892	866	838	810	780
	120	1088	1069	1049	1028	1007	985	963	940	916	891	865	838
Emergency (<24 hrs)	**130**	**1123**	**1105**	**1086**	**1067**	**1047**	**1027**	**1006**	**984**	**962**	**939**	**915**	**891**
Emergency (< 1 hr)	**140**	**1157**	**1140**	**1122**	**1104**	**1085**	**1066**	**1047**	**1026**	**1006**	**984**	**962**	**939**
	150	1189	1173	1156	1139	1121	1103	1085	1066	1047	1027	1006	985
	160	1220	1205	1189	1173	1156	1139	1122	1104	1086	1067	1048	1028
							WINTER					SUMMER	

Weather Assumptions:

Emissivity =	0.7	Suntime =	14
Absorptivity =	0.9	Degrees North Latitude=	40
Atmosphere =	Clear	Elevation Above Sea Level=	1000
Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90

Conductor : 477 kcm ACSR 26/7

Outside Diameter =	0.858 inches		
T_{low} =	25 °C	T_{high} =	75 °C
R_{low} =	3.7E-05 ohms/ft	R_{high} =	4.4E-05 ohms/ft

Bus Conductor: **556. 5 kcm ACSR 24/7**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	1015	986	957	926	894	860	825	787	748	705	660	611
	90	1064	1038	1011	983	953	923	891	858	823	786	747	705
	100	1110	1086	1061	1035	1008	980	951	921	889	856	822	785
Normal	**105**	**1132**	**1109**	**1084**	**1059**	**1034**	**1007**	**979**	**950**	**920**	**889**	**856**	**821**
	110	1154	1131	1107	1083	1058	1033	1006	978	950	920	888	856
	120	1194	1173	1151	1129	1105	1081	1057	1031	1005	978	949	919
Emergency (<24 hrs)	**130**	**1233**	**1213**	**1192**	**1171**	**1150**	**1127**	**1104**	**1081**	**1056**	**1031**	**1005**	**978**
Emergency (< 1 hr)	**140**	**1270**	**1251**	**1232**	**1212**	**1192**	**1171**	**1149**	**1127**	**1104**	**1081**	**1057**	**1032**
	150	1306	1288	1270	1251	1232	1212	1192	1171	1150	1128	1105	1082
	160	1340	1323	1306	1288	1270	1251	1232	1213	1193	1172	1151	1129
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	556. 5 kcm ACSR 24/7		Outside Diameter =	0.914 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	3.1E-05 ohms/ft	R_{high} =	3.8E-05 ohms/ft

Bus Conductor: **556.5 kcm ACSR 26/7**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	1022	993	963	932	899	865	830	792	752	710	664	615
	90	1071	1045	1017	989	960	929	897	863	828	791	751	709
	100	1118	1093	1068	1042	1015	986	957	927	895	862	827	790
Normal	**105**	**1140**	**1116**	**1092**	**1067**	**1040**	**1013**	**986**	**957**	**926**	**895**	**862**	**827**
	110	1161	1138	1115	1091	1065	1040	1013	985	956	926	894	862
	120	1203	1181	1159	1136	1113	1089	1064	1038	1012	984	956	926
Emergency (<24 hrs)	**130**	**1242**	**1221**	**1201**	**1179**	**1158**	**1135**	**1112**	**1088**	**1064**	**1038**	**1012**	**984**
Emergency (< 1 hr)	**140**	**1279**	**1260**	**1241**	**1221**	**1200**	**1179**	**1157**	**1135**	**1112**	**1088**	**1064**	**1039**
	150	1315	1297	1279	1260	1240	1221	1200	1179	1158	1136	1113	1090
	160	1350	1333	1315	1297	1279	1260	1241	1222	1202	1181	1160	1138
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	556.5 kcm ACSR 26/7		Outside Diameter =	0.927 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	3.1E-05 ohms/ft	R_{high} =	3.7E-05 ohms/ft

Bus Conductor: **556.5 kcm ACSR 30/7**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	1033	1004	974	943	910	875	839	801	761	718	671	621
	90	1084	1057	1029	1001	971	940	907	873	838	800	760	717
	100	1131	1106	1081	1054	1027	998	969	938	906	872	837	799
Normal	**105**	**1154**	**1130**	**1105**	**1079**	**1053**	**1026**	**997**	**968**	**937**	**905**	**872**	**837**
	110	1175	1152	1128	1104	1078	1052	1025	997	967	937	905	872
	120	1217	1195	1173	1150	1126	1102	1077	1051	1024	996	967	937
Emergency (<24 hrs)	**130**	**1257**	**1236**	**1215**	**1194**	**1172**	**1149**	**1126**	**1102**	**1077**	**1051**	**1024**	**997**
Emergency (< 1 hr)	**140**	**1295**	**1276**	**1256**	**1236**	**1215**	**1194**	**1172**	**1149**	**1126**	**1102**	**1077**	**1052**
	150	1331	1313	1294	1275	1256	1236	1215	1194	1172	1150	1127	1103
	160	1367	1349	1332	1314	1295	1276	1257	1237	1217	1196	1174	1152
							WINTER					SUMMER	

Weather Assumptions:

Emissivity =	0.7	Suntime =	14
Absorptivity =	0.9	Degrees North Latitude=	40
Atmosphere =	Clear	Elevation Above Sea Level=	1000
Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90

Conductor : 556.5 kcm ACSR 30/7

T_{low} =	25 °C	Outside Diameter =	0.953 inches
R_{low} =	3.1E-05 ohms/ft	T_{high} =	75 °C
		R_{high} =	3.7E-05 ohms/ft

Bus Conductor: **605 kcm ACSR 24/7**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	1070	1040	1009	976	942	907	869	830	788	743	695	643
	90	1123	1095	1066	1036	1006	973	940	904	867	828	787	743
	100	1172	1146	1119	1092	1063	1034	1003	971	938	903	867	828
Normal	**105**	**1195**	**1170**	**1144**	**1118**	**1091**	**1062**	**1033**	**1003**	**971**	**938**	**903**	**867**
	110	1218	1194	1169	1143	1117	1090	1062	1032	1002	971	938	903
	120	1261	1238	1215	1191	1167	1142	1116	1089	1061	1032	1002	971
Emergency (<24 hrs)	**130**	**1302**	**1281**	**1259**	**1237**	**1214**	**1190**	**1166**	**1141**	**1115**	**1089**	**1061**	**1032**
Emergency (< 1 hr)	**140**	**1342**	**1322**	**1301**	**1280**	**1259**	**1237**	**1214**	**1191**	**1167**	**1142**	**1116**	**1090**
	150	1379	1361	1341	1321	1301	1280	1259	1237	1215	1192	1168	1143
	160	1416	1398	1380	1361	1342	1322	1302	1282	1261	1239	1217	1194
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	605 kcm ACSR 24/7		Outside Diameter =	0.953 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	2.9E-05 ohms/ft	R_{high} =	3.5E-05 ohms/ft

Bus Conductor: **795 kcm ACSR 26/7**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	1281	1245	1207	1168	1127	1084	1039	992	941	887	829	766
	90	1346	1312	1278	1242	1205	1166	1125	1083	1038	991	941	888
	100	1406	1375	1343	1310	1276	1240	1203	1165	1125	1083	1039	992
Normal	**105**	**1434**	**1404**	**1374**	**1342**	**1309**	**1275**	**1240**	**1203**	**1165**	**1125**	**1083**	**1039**
	110	1462	1433	1403	1373	1341	1309	1275	1240	1203	1165	1125	1084
	120	1515	1488	1460	1432	1402	1372	1341	1309	1275	1240	1204	1166
Emergency (<24 hrs)	**130**	**1566**	**1540**	**1514**	**1488**	**1460**	**1432**	**1403**	**1373**	**1342**	**1310**	**1277**	**1242**
Emergency (< 1 hr)	**140**	**1614**	**1591**	**1566**	**1541**	**1515**	**1489**	**1461**	**1433**	**1405**	**1375**	**1344**	**1312**
	150	1661	1639	1615	1592	1568	1543	1517	1491	1464	1436	1407	1378
	160	1707	1685	1663	1641	1618	1594	1570	1546	1520	1494	1467	1440
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	795 kcm ACSR 26/7		Outside Diameter =	1.108 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	2.2E-05 ohms/ft	R_{high} =	2.6E-05 ohms/ft

Bus Conductor: **795 kcm ACSR 30/7**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	1297	1260	1222	1182	1141	1097	1051	1003	952	897	838	774
	90	1362	1328	1293	1257	1219	1180	1139	1096	1051	1003	952	898
	100	1423	1391	1359	1326	1291	1255	1218	1179	1138	1096	1051	1004
Normal	**105**	**1452**	**1421**	**1390**	**1358**	**1325**	**1290**	**1255**	**1218**	**1179**	**1139**	**1096**	**1052**
	110	1480	1450	1420	1389	1358	1324	1290	1255	1218	1179	1139	1097
	120	1534	1506	1478	1449	1420	1389	1357	1325	1291	1255	1219	1181
Emergency (<24 hrs)	**130**	**1585**	**1559**	**1533**	**1506**	**1478**	**1450**	**1420**	**1390**	**1358**	**1326**	**1292**	**1257**
Emergency (< 1 hr)	**140**	**1634**	**1610**	**1585**	**1560**	**1534**	**1507**	**1480**	**1451**	**1422**	**1392**	**1361**	**1328**
	150	1682	1659	1635	1611	1587	1562	1536	1509	1482	1454	1425	1395
	160	1728	1706	1684	1661	1638	1614	1590	1565	1539	1513	1486	1458
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	795 kcm ACSR 30/7		Outside Diameter =	1.14 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	2.2E-05 ohms/ft	R_{high} =	2.6E-05 ohms/ft

Bus Conductor: **795 kcm ACSR 30/19**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	1296	1260	1221	1182	1140	1097	1051	1003	952	897	838	774
	90	1361	1328	1293	1256	1219	1180	1139	1096	1050	1003	952	898
	100	1422	1391	1359	1325	1291	1255	1217	1179	1138	1095	1051	1003
Normal	**105**	**1451**	**1421**	**1390**	**1358**	**1324**	**1290**	**1254**	**1217**	**1179**	**1138**	**1096**	**1051**
	110	1479	1450	1420	1389	1357	1324	1290	1254	1217	1179	1139	1096
	120	1533	1506	1478	1449	1419	1389	1357	1324	1290	1255	1218	1180
Emergency (<24 hrs)	**130**	**1585**	**1559**	**1533**	**1506**	**1478**	**1449**	**1420**	**1389**	**1358**	**1326**	**1292**	**1257**
Emergency (< 1 hr)	**140**	**1634**	**1610**	**1585**	**1559**	**1533**	**1507**	**1479**	**1451**	**1422**	**1391**	**1360**	**1328**
	150	1681	1658	1635	1611	1586	1561	1535	1509	1482	1453	1424	1395
	160	1727	1705	1683	1661	1637	1614	1589	1564	1539	1512	1485	1457
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	795 kcm ACSR 30/19		Outside Diameter =	1.14 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	2.2E-05 ohms/ft	R_{high} =	2.6E-05 ohms/ft

Bus Conductor: **954 kcm ACSR 45/7**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	1404	1364	1323	1280	1235	1188	1138	1086	1030	971	907	837
	90	1474	1437	1400	1360	1320	1277	1233	1186	1137	1085	1030	972
	100	1540	1506	1471	1435	1397	1358	1318	1276	1232	1186	1137	1086
Normal	**105**	**1571**	**1538**	**1504**	**1470**	**1434**	**1396**	**1358**	**1318**	**1276**	**1232**	**1186**	**1138**
	110	1601	1569	1537	1503	1469	1433	1396	1358	1318	1276	1232	1187
	120	1659	1630	1599	1568	1536	1503	1469	1433	1396	1358	1319	1277
Emergency (<24 hrs)	**130**	**1715**	**1687**	**1658**	**1629**	**1599**	**1568**	**1536**	**1504**	**1470**	**1434**	**1398**	**1360**
Emergency (< 1 hr)	**140**	**1768**	**1742**	**1715**	**1687**	**1659**	**1630**	**1600**	**1570**	**1538**	**1506**	**1472**	**1437**
	150	1819	1794	1769	1743	1716	1689	1661	1633	1603	1573	1541	1509
	160	1868	1845	1821	1796	1771	1746	1719	1692	1665	1636	1607	1577
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	954 kcm ACSR 45/7		Outside Diameter =	1.165 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	1.9E-05 ohms/ft	R_{high} =	2.3E-05 ohms/ft

Bus Conductor: **954 kcm ACSR 48/7**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	1402	1362	1321	1278	1233	1186	1137	1084	1029	970	906	836
	90	1472	1435	1397	1358	1317	1275	1231	1184	1135	1083	1028	970
	100	1536	1502	1468	1432	1394	1355	1315	1273	1229	1183	1135	1084
Normal	**105**	**1567**	**1534**	**1501**	**1466**	**1430**	**1393**	**1355**	**1314**	**1273**	**1229**	**1183**	**1135**
	110	1597	1565	1533	1500	1465	1429	1392	1354	1314	1273	1229	1184
	120	1654	1625	1594	1563	1531	1498	1464	1429	1392	1354	1315	1273
Emergency (<24 hrs)	**130**	**1709**	**1681**	**1653**	**1624**	**1594**	**1563**	**1531**	**1498**	**1465**	**1430**	**1393**	**1356**
Emergency (< 1 hr)	**140**	**1761**	**1735**	**1708**	**1681**	**1653**	**1624**	**1594**	**1564**	**1532**	**1500**	**1466**	**1431**
	150	1811	1786	1761	1735	1709	1682	1654	1626	1596	1566	1535	1503
	160	1859	1836	1812	1788	1763	1738	1711	1685	1657	1629	1600	1569
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	954 kcm ACSR 48/7		Outside Diameter =	1.175 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	1.9E-05 ohms/ft	R_{high} =	2.3E-05 ohms/ft

Bus Conductor: **1033.5 kcm ACSR 45/7**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	1476	1434	1390	1345	1298	1248	1196	1141	1082	1020	952	879
	90	1550	1512	1472	1431	1388	1343	1296	1247	1195	1141	1083	1021
	100	1620	1584	1547	1509	1470	1429	1386	1342	1296	1247	1196	1142
Normal	**105**	**1653**	**1618**	**1583**	**1546**	**1509**	**1469**	**1429**	**1386**	**1342**	**1296**	**1248**	**1197**
	110	1685	1652	1618	1582	1546	1508	1469	1429	1387	1343	1297	1249
	120	1747	1716	1684	1651	1617	1582	1546	1509	1470	1430	1388	1345
Emergency (<24 hrs)	**130**	**1805**	**1776**	**1746**	**1716**	**1684**	**1651**	**1618**	**1583**	**1548**	**1511**	**1472**	**1432**
Emergency (< 1 hr)	**140**	**1862**	**1834**	**1806**	**1777**	**1748**	**1717**	**1686**	**1654**	**1620**	**1586**	**1551**	**1514**
	150	1916	1890	1863	1836	1808	1780	1750	1720	1689	1657	1624	1590
	160	1968	1944	1919	1893	1867	1840	1812	1784	1754	1724	1694	1662
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1033.5 kcm ACSR 45/7		Outside Diameter =	1.212 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	1.7E-05 ohms/ft	R_{high} =	2.1E-05 ohms/ft

Bus Conductor: **1033.5 kcm ACSR 54/7**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	1479	1437	1393	1348	1301	1251	1198	1143	1084	1021	954	880
	90	1552	1513	1473	1432	1389	1344	1297	1248	1196	1141	1083	1021
	100	1619	1583	1546	1508	1469	1428	1386	1341	1295	1246	1195	1141
Normal	**105**	**1651**	**1616**	**1581**	**1545**	**1507**	**1468**	**1427**	**1385**	**1341**	**1294**	**1246**	**1195**
	110	1682	1649	1615	1579	1543	1505	1467	1426	1384	1340	1294	1246
	120	1741	1710	1679	1646	1612	1577	1541	1504	1466	1426	1384	1340
Emergency (<24 hrs)	**130**	**1798**	**1769**	**1739**	**1708**	**1677**	**1645**	**1611**	**1577**	**1541**	**1504**	**1466**	**1426**
Emergency (< 1 hr)	**140**	**1852**	**1825**	**1797**	**1768**	**1738**	**1708**	**1677**	**1645**	**1612**	**1578**	**1542**	**1506**
	150	1904	1878	1852	1825	1797	1769	1739	1709	1679	1647	1614	1580
	160	1954	1930	1905	1879	1853	1826	1799	1771	1742	1712	1682	1650
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1033.5 kcm ACSR 54/7		Outside Diameter =	1.245 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	1.7E-05 ohms/ft	R_{high} =	2.1E-05 ohms/ft

Bus Conductor: **1272 kcm ACSR 45/7**

Rating	Rated Operating Temperature	Assumed Wind Speed = 2 fps Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	1680	1632	1582	1530	1476	1420	1360	1297	1230	1158	1080	996
	90	1767	1723	1677	1630	1581	1530	1476	1420	1361	1298	1232	1161
	100	1848	1807	1765	1721	1676	1630	1581	1530	1477	1422	1363	1301
Normal	**105**	**1886**	**1847**	**1807**	**1765**	**1722**	**1677**	**1630**	**1582**	**1531**	**1479**	**1423**	**1365**
	110	1924	1886	1847	1807	1765	1722	1677	1631	1583	1533	1480	1425
	120	1996	1960	1924	1887	1848	1808	1767	1724	1680	1634	1586	1537
Emergency (<24 hrs)	**130**	**2065**	**2032**	**1997**	**1962**	**1926**	**1889**	**1851**	**1811**	**1770**	**1728**	**1684**	**1639**
Emergency (< 1 hr)	**140**	**2131**	**2100**	**2067**	**2034**	**2001**	**1966**	**1930**	**1893**	**1855**	**1816**	**1775**	**1733**
	150	2195	2165	2135	2104	2072	2039	2006	1971	1936	1899	1861	1822
	160	2256	2228	2200	2170	2140	2109	2078	2045	2012	1978	1942	1906
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1272 kcm ACSR 45/7		Outside Diameter =	1.345 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	1.4E-05 ohms/ft	R_{high} =	1.7E-05 ohms/ft

Bus Conductor: **1590 kcm ACSR 45/7**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	1925	1870	1813	1754	1691	1626	1557	1484	1407	1324	1234	1136
	90	2027	1977	1925	1870	1814	1755	1693	1629	1560	1488	1411	1329
	100	2123	2076	2028	1978	1926	1872	1816	1758	1697	1633	1565	1493
Normal	**105**	**2168**	**2123**	**2077**	**2029**	**1979**	**1928**	**1874**	**1818**	**1760**	**1699**	**1635**	**1568**
	110	2213	2169	2124	2078	2030	1981	1930	1876	1821	1763	1702	1638
	120	2298	2257	2215	2172	2128	2082	2035	1986	1935	1882	1827	1769
Emergency (<24 hrs)	**130**	**2379**	**2341**	**2302**	**2262**	**2220**	**2178**	**2133**	**2088**	**2041**	**1992**	**1942**	**1889**
Emergency (< 1 hr)	**140**	**2458**	**2422**	**2385**	**2347**	**2308**	**2268**	**2227**	**2185**	**2141**	**2096**	**2049**	**2000**
	150	2533	2499	2464	2429	2392	2355	2316	2276	2235	2193	2150	2105
	160	2607	2574	2541	2508	2473	2438	2401	2364	2326	2286	2246	2204
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1590 kcm ACSR 45/7		Outside Diameter =	1.504 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	1.2E-05 ohms/ft	R_{high} =	1.4E-05 ohms/ft

Bus Conductor: **1590 kcm ACSR 54/19**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	1930	1875	1818	1758	1696	1630	1561	1488	1410	1327	1236	1138
	90	2030	1979	1927	1872	1816	1757	1695	1630	1562	1489	1412	1330
	100	2122	2075	2027	1977	1925	1872	1816	1757	1696	1632	1564	1492
Normal	**105**	**2166**	**2121**	**2075**	**2027**	**1977**	**1925**	**1872**	**1816**	**1758**	**1697**	**1633**	**1566**
	110	2209	2165	2120	2074	2027	1977	1926	1873	1817	1759	1699	1635
	120	2291	2250	2208	2166	2121	2076	2028	1979	1929	1876	1821	1763
Emergency (<24 hrs)	**130**	**2369**	**2331**	**2292**	**2252**	**2210**	**2168**	**2124**	**2079**	**2032**	**1983**	**1933**	**1881**
Emergency (< 1 hr)	**140**	**2444**	**2408**	**2371**	**2334**	**2295**	**2255**	**2215**	**2172**	**2129**	**2084**	**2037**	**1989**
	150	2516	2482	2448	2412	2376	2339	2301	2261	2221	2179	2136	2091
	160	2586	2554	2521	2488	2454	2419	2383	2346	2308	2269	2228	2187
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1590 kcm ACSR 54/19		Outside Diameter =	1.545 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	1.2E-05 ohms/ft	R_{high} =	1.4E-05 ohms/ft

Bus Conductor: **2167 kcm ACSR 72/7**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	2293	2227	2159	2087	2013	1935	1852	1764	1671	1571	1463	1344
	90	2420	2360	2297	2232	2165	2094	2020	1942	1860	1773	1681	1582
	100	2540	2484	2426	2367	2305	2240	2173	2103	2029	1952	1871	1784
Normal	**105**	**2597**	**2543**	**2488**	**2430**	**2371**	**2309**	**2245**	**2178**	**2108**	**2034**	**1957**	**1876**
	110	2653	2601	2547	2492	2435	2375	2314	2250	2183	2113	2040	1963
	120	2761	2712	2662	2610	2557	2502	2445	2386	2325	2261	2195	2126
Emergency (<24 hrs)	**130**	**2864**	**2818**	**2771**	**2723**	**2673**	**2622**	**2569**	**2514**	**2458**	**2399**	**2338**	**2275**
Emergency (< 1 hr)	**140**	**2963**	**2920**	**2876**	**2831**	**2784**	**2736**	**2687**	**2636**	**2583**	**2528**	**2472**	**2414**
	150	3060	3019	2977	2934	2890	2845	2799	2751	2702	2651	2599	2544
	160	3153	3115	3075	3035	2993	2950	2907	2862	2816	2768	2719	2669
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	2167 kcm ACSR 72/7		Outside Diameter =	1.735 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	9.2E-06 ohms/ft	R_{high} =	1.1E-05 ohms/ft

Bus Conductor: **2493 kcm ACAR 54/37**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	2415	2345	2273	2198	2119	2037	1949	1857	1758	1653	1538	1412
	90	2554	2490	2424	2355	2284	2209	2131	2049	1962	1870	1772	1667
	100	2685	2626	2565	2501	2436	2367	2296	2222	2144	2063	1976	1885
Normal	**105**	**2748**	**2690**	**2632**	**2571**	**2508**	**2442**	**2374**	**2303**	**2229**	**2152**	**2070**	**1984**
	110	2809	2754	2697	2638	2578	2515	2449	2382	2311	2237	2160	2078
	120	2927	2876	2823	2768	2711	2653	2593	2530	2465	2398	2327	2254
Emergency (<24 hrs)	**130**	**3041**	**2993**	**2943**	**2891**	**2839**	**2784**	**2728**	**2670**	**2610**	**2548**	**2483**	**2416**
Emergency (< 1 hr)	**140**	**3151**	**3105**	**3058**	**3010**	**2960**	**2909**	**2857**	**2803**	**2747**	**2689**	**2629**	**2567**
	150	3257	3214	3170	3124	3078	3030	2980	2930	2877	2823	2767	2710
	160	3361	3320	3278	3235	3191	3146	3099	3051	3002	2952	2900	2846
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	2493 kcm ACAR 54/37		Outside Diameter =	1.821 inches
	T_{low} =	20 °C	T_{high} =	100 °C
	R_{low} =	8.5E-06 ohms/ft	R_{high} =	1E-05 ohms/ft

Bus Conductor: **3/0 AAC 7 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	460	448	434	421	406	391	376	359	342	324	304	283
	90	481	469	457	444	431	418	404	389	373	357	340	322
	100	500	489	478	466	454	442	429	415	401	387	372	356
Normal	**105**	**509**	**499**	**488**	**476**	**465**	**453**	**440**	**428**	**414**	**400**	**386**	**371**
	110	518	508	497	486	475	464	452	439	427	413	399	385
	120	535	525	515	505	495	484	473	461	450	437	425	412
Emergency (<24 hrs)	**130**	**551**	**541**	**532**	**523**	**513**	**503**	**492**	**482**	**471**	**460**	**448**	**436**
Emergency (< 1 hr)	**140**	**566**	**557**	**548**	**539**	**530**	**521**	**511**	**501**	**491**	**480**	**469**	**458**
	150	580	572	564	555	546	537	528	519	509	500	489	479
	160	594	586	578	570	562	554	545	536	527	518	508	499
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	3/0 AAC 7 str		Outside Diameter =	0.464 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	0.0001 ohms/ft	R_{high} =	0.00013 ohms/ft

Bus Conductor: **250 kcm AAC 19 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	595	579	561	544	525	506	485	464	441	417	391	364
	90	623	607	591	575	558	540	522	503	483	462	439	416
	100	648	634	619	604	588	572	555	538	520	501	481	460
Normal	**105**	**660**	**646**	**632**	**618**	**602**	**587**	**571**	**554**	**537**	**519**	**500**	**480**
	110	672	658	645	631	616	601	586	570	553	536	518	499
	120	694	682	669	656	642	628	614	599	584	568	551	534
Emergency (<24 hrs)	**130**	**715**	**704**	**692**	**679**	**666**	**653**	**640**	**626**	**612**	**597**	**582**	**567**
Emergency (< 1 hr)	**140**	**736**	**724**	**713**	**701**	**689**	**677**	**665**	**652**	**639**	**625**	**611**	**596**
	150	755	744	734	723	711	700	688	676	663	651	638	624
	160	774	764	753	743	732	721	710	699	687	675	663	650
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	250 kcm AAC 19 str		Outside Diameter =	0.574 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	7.1E-05 ohms/ft	R_{high} =	8.5E-05 ohms/ft

Bus Conductor: **300 kcm AAC 19 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	668	650	630	610	589	567	545	520	495	468	439	407
	90	700	682	664	646	627	607	586	565	542	518	493	466
	100	728	712	696	679	661	643	624	604	584	563	540	517
Normal	**105**	**742**	**727**	**711**	**694**	**677**	**660**	**642**	**623**	**603**	**583**	**562**	**539**
	110	755	740	725	709	693	676	659	641	622	602	582	561
	120	781	767	752	738	722	707	691	674	657	639	620	601
Emergency (<24 hrs)	**130**	**805**	**792**	**778**	**764**	**750**	**735**	**720**	**705**	**689**	**672**	**655**	**638**
Emergency (< 1 hr)	**140**	**828**	**815**	**803**	**790**	**776**	**762**	**748**	**734**	**719**	**704**	**688**	**671**
	150	850	838	826	814	801	788	775	761	747	733	718	703
	160	871	860	849	837	825	813	800	787	774	761	747	733
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	300 kcm AAC 19 str		Outside Diameter =	0.629 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	5.9E-05 ohms/ft	R_{high} =	7.1E-05 ohms/ft

Bus Conductor: **336.4 kcm AAC 19 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	719	699	678	656	634	610	585	559	532	503	471	437
	90	753	734	715	695	674	653	631	607	583	557	530	501
	100	784	767	749	730	711	692	671	650	628	605	581	556
Normal	**105**	**799**	**782**	**765**	**747**	**729**	**710**	**691**	**670**	**649**	**627**	**604**	**580**
	110	813	797	780	763	746	728	709	689	669	648	627	604
	120	841	825	810	794	778	761	743	726	707	688	668	647
Emergency (<24 hrs)	**130**	**867**	**853**	**838**	**823**	**808**	**792**	**776**	**759**	**742**	**724**	**706**	**687**
Emergency (< 1 hr)	**140**	**892**	**878**	**865**	**850**	**836**	**821**	**806**	**791**	**774**	**758**	**741**	**723**
	150	916	903	890	877	863	849	835	820	805	790	774	757
	160	939	927	914	902	889	876	862	848	834	820	805	790
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	336.4 kcm AAC 19 str		Outside Diameter =	0.666 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	5.3E-05 ohms/ft	R_{high} =	6.3E-05 ohms/ft

Bus Conductor: **350 kcm AAC 19 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	737	716	695	673	650	625	600	573	545	515	483	448
	90	772	753	733	713	691	669	647	623	598	571	543	514
	100	804	786	768	749	730	709	689	667	644	621	596	570
Normal	**105**	**819**	**802**	**784**	**766**	**747**	**728**	**708**	**687**	**666**	**643**	**620**	**595**
	110	834	817	800	783	765	746	727	707	686	665	643	619
	120	862	847	831	814	798	780	763	744	725	705	685	664
Emergency (<24 hrs)	**130**	**889**	**874**	**859**	**844**	**828**	**812**	**796**	**779**	**761**	**743**	**724**	**704**
Emergency (< 1 hr)	**140**	**915**	**901**	**887**	**872**	**858**	**842**	**827**	**811**	**794**	**778**	**760**	**742**
	150	939	926	913	899	885	871	856	841	826	810	794	777
	160	963	951	938	925	912	898	885	871	856	841	826	810
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	350 kcm AAC 19 str		Outside Diameter =	0.679 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	5.1E-05 ohms/ft	R_{high} =	6.1E-05 ohms/ft

Bus Conductor: **500 kcm AAC 19 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	924	898	871	843	814	783	751	717	682	644	603	558
	90	968	944	920	894	867	840	811	781	749	716	680	642
	100	1010	987	964	941	916	891	865	837	809	779	748	714
Normal	**105**	**1029**	**1008**	**986**	**963**	**939**	**915**	**890**	**864**	**836**	**808**	**778**	**747**
	110	1048	1027	1006	984	962	938	914	889	863	836	808	778
	120	1085	1065	1045	1025	1004	982	960	936	913	888	862	835
Emergency (<24 hrs)	**130**	**1119**	**1101**	**1082**	**1063**	**1043**	**1023**	**1002**	**981**	**959**	**936**	**912**	**887**
Emergency (< 1 hr)	**140**	**1153**	**1135**	**1118**	**1100**	**1081**	**1062**	**1042**	**1022**	**1002**	**980**	**958**	**936**
	150	1184	1168	1151	1134	1117	1099	1081	1062	1042	1022	1002	981
	160	1215	1200	1184	1168	1151	1134	1117	1099	1081	1062	1043	1023
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	500 kcm AAC 19 str		Outside Diameter =	0.811 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	3.6E-05 ohms/ft	R_{high} =	4.3E-05 ohms/ft

Bus Conductor: **556.5 kcm AAC 37 str**

Rating	Rated Operating Temperature	Assumed Wind Speed = 2 fps Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	989	961	933	903	871	838	804	768	729	688	644	597
	90	1037	1012	985	958	929	899	868	836	802	766	728	688
	100	1082	1058	1033	1008	982	955	926	897	866	834	801	765
Normal	**105**	**1103**	**1080**	**1056**	**1032**	**1007**	**981**	**954**	**926**	**896**	**866**	**834**	**800**
	110	1124	1101	1078	1055	1031	1006	980	953	925	896	865	834
	120	1163	1142	1121	1099	1076	1053	1029	1004	978	952	924	895
Emergency (<24 hrs)	**130**	**1200**	**1181**	**1161**	**1140**	**1119**	**1097**	**1075**	**1052**	**1028**	**1003**	**978**	**952**
Emergency (< 1 hr)	**140**	**1236**	**1218**	**1199**	**1180**	**1160**	**1139**	**1118**	**1097**	**1075**	**1052**	**1028**	**1004**
	150	1271	1253	1235	1217	1198	1179	1160	1139	1119	1097	1075	1053
	160	1304	1287	1271	1253	1235	1217	1199	1180	1160	1140	1120	1098
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	556.5 kcm AAC 37 str		Outside Diameter =	0.858 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	3.2E-05 ohms/ft	R_{high} =	3.8E-05 ohms/ft

Bus Conductor: **795 kcm AAC 37 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	1238	1203	1167	1129	1090	1049	1005	959	911	859	803	742
	90	1300	1268	1235	1200	1164	1127	1088	1047	1004	959	910	859
	100	1358	1328	1297	1265	1232	1198	1162	1125	1087	1046	1004	959
Normal	**105**	**1385**	**1356**	**1326**	**1296**	**1264**	**1231**	**1197**	**1162**	**1125**	**1087**	**1046**	**1004**
	110	1412	1384	1355	1325	1295	1263	1231	1197	1162	1125	1087	1047
	120	1463	1437	1410	1382	1354	1325	1294	1263	1231	1197	1162	1126
Emergency (<24 hrs)	**130**	**1511**	**1487**	**1462**	**1436**	**1409**	**1382**	**1354**	**1325**	**1295**	**1264**	**1232**	**1198**
Emergency (< 1 hr)	**140**	**1558**	**1535**	**1511**	**1487**	**1462**	**1436**	**1410**	**1383**	**1355**	**1326**	**1296**	**1266**
	150	1603	1581	1558	1535	1512	1488	1463	1438	1412	1385	1357	1329
	160	1646	1625	1604	1582	1560	1537	1514	1490	1466	1441	1415	1388
							WINTER					SUMMER	

Weather Assumptions:

Emissivity =	0.7	Suntime =	14
Absorptivity =	0.9	Degrees North Latitude=	40
Atmosphere =	Clear	Elevation Above Sea Level=	1000
Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90

Conductor : 795 kcm AAC 37 str

		Outside Diameter =	1.026 inches
T_{low} =	25 °C	T_{high} =	75 °C
R_{low} =	2.3E-05 ohms/ft	R_{high} =	2.7E-05 ohms/ft

Bus Conductor: **795 kcm AAC 61 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	1239	1204	1168	1130	1090	1049	1006	960	911	859	803	743
	90	1301	1269	1235	1201	1165	1127	1088	1047	1004	959	911	859
	100	1358	1329	1298	1266	1233	1199	1163	1126	1087	1047	1004	959
Normal	**105**	**1386**	**1357**	**1327**	**1297**	**1265**	**1232**	**1198**	**1163**	**1126**	**1087**	**1047**	**1005**
	110	1412	1385	1356	1326	1296	1264	1232	1198	1162	1126	1087	1047
	120	1463	1437	1411	1383	1355	1325	1295	1264	1231	1198	1163	1127
Emergency (<24 hrs)	**130**	**1512**	**1488**	**1462**	**1437**	**1410**	**1383**	**1355**	**1326**	**1296**	**1265**	**1233**	**1199**
Emergency (< 1 hr)	**140**	**1559**	**1536**	**1512**	**1488**	**1463**	**1437**	**1411**	**1384**	**1356**	**1327**	**1297**	**1266**
	150	1604	1582	1559	1536	1513	1489	1464	1439	1413	1386	1358	1329
	160	1647	1626	1605	1583	1561	1538	1515	1491	1467	1441	1416	1389
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	795 kcm AAC 61 str		Outside Diameter =	1.028 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	2.3E-05 ohms/ft	R_{high} =	2.7E-05 ohms/ft

Bus Conductor: **1000 kcm AAC 37 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	1429	1388	1346	1303	1257	1209	1159	1105	1049	988	923	853
	90	1502	1464	1426	1386	1344	1301	1256	1208	1158	1106	1050	990
	100	1569	1535	1499	1462	1424	1385	1343	1301	1256	1209	1159	1107
Normal	**105**	**1602**	**1568**	**1534**	**1499**	**1462**	**1424**	**1385**	**1344**	**1301**	**1256**	**1209**	**1160**
	110	1633	1601	1568	1534	1498	1462	1424	1385	1344	1302	1257	1210
	120	1694	1663	1632	1601	1568	1534	1499	1463	1425	1386	1346	1304
Emergency (<24 hrs)	**130**	**1751**	**1723**	**1694**	**1664**	**1633**	**1602**	**1569**	**1535**	**1501**	**1465**	**1428**	**1389**
Emergency (< 1 hr)	**140**	**1806**	**1780**	**1752**	**1724**	**1695**	**1666**	**1635**	**1604**	**1572**	**1538**	**1504**	**1468**
	150	1859	1834	1808	1782	1755	1727	1698	1669	1639	1608	1576	1543
	160	1911	1887	1862	1837	1812	1786	1759	1731	1703	1674	1644	1613
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1000 kcm AAC 37 str		Outside Diameter =	1.15 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	1.8E-05 ohms/ft	R_{high} =	2.2E-05 ohms/ft

Bus Conductor: **1033.5 kcm AAC 61 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	1459	1418	1375	1330	1283	1234	1183	1128	1071	1009	942	870
	90	1534	1496	1456	1415	1373	1329	1282	1234	1183	1129	1072	1011
	100	1603	1568	1531	1494	1455	1414	1372	1328	1283	1235	1184	1131
Normal	**105**	**1636**	**1602**	**1567**	**1531**	**1493**	**1455**	**1414**	**1373**	**1329**	**1283**	**1235**	**1185**
	110	1668	1636	1602	1567	1531	1493	1455	1415	1373	1330	1284	1237
	120	1730	1700	1668	1635	1602	1567	1532	1495	1456	1417	1375	1332
Emergency (<24 hrs)	**130**	**1789**	**1760**	**1731**	**1700**	**1669**	**1637**	**1603**	**1569**	**1534**	**1497**	**1459**	**1420**
Emergency (< 1 hr)	**140**	**1846**	**1819**	**1791**	**1762**	**1733**	**1702**	**1671**	**1639**	**1606**	**1572**	**1537**	**1501**
	150	1901	1875	1848	1821	1794	1765	1736	1706	1675	1643	1611	1577
	160	1953	1929	1904	1878	1852	1825	1798	1770	1741	1711	1680	1649
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1033.5 kcm AAC 61 str		Outside Diameter =	1.172 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	1.8E-05 ohms/ft	R_{high} =	2.1E-05 ohms/ft

Bus Conductor: **1510.5 kcm AAC 61 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	1838	1785	1731	1674	1615	1553	1487	1418	1344	1265	1180	1087
	90	1936	1887	1838	1786	1732	1676	1617	1555	1490	1422	1349	1271
	100	2027	1982	1936	1889	1839	1788	1735	1679	1621	1560	1495	1427
Normal	**105**	**2071**	**2028**	**1983**	**1938**	**1890**	**1841**	**1790**	**1737**	**1681**	**1623**	**1562**	**1498**
	110	2113	2072	2029	1985	1939	1892	1843	1792	1739	1684	1626	1565
	120	2195	2156	2116	2075	2033	1989	1944	1897	1848	1798	1745	1690
Emergency (<24 hrs)	**130**	**2274**	**2237**	**2199**	**2161**	**2121**	**2080**	**2038**	**1995**	**1950**	**1903**	**1855**	**1805**
Emergency (< 1 hr)	**140**	**2349**	**2314**	**2279**	**2243**	**2205**	**2167**	**2128**	**2087**	**2045**	**2002**	**1957**	**1911**
	150	2421	2389	2355	2321	2286	2250	2213	2175	2136	2096	2054	2011
	160	2492	2461	2429	2397	2364	2330	2295	2259	2223	2185	2146	2106
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1510.5 kcm AAC 61 str		Outside Diameter =	1.417 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	1.3E-05 ohms/ft	R_{high} =	1.5E-05 ohms/ft

Bus Conductor: **1590 kcm AAC 61 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	1895	1841	1785	1726	1665	1601	1533	1461	1385	1304	1216	1120
	90	1996	1947	1895	1842	1786	1728	1668	1604	1537	1466	1391	1310
	100	2092	2045	1998	1949	1898	1845	1790	1732	1672	1609	1542	1472
Normal	**105**	**2137**	**2093**	**2047**	**1999**	**1950**	**1900**	**1847**	**1792**	**1735**	**1675**	**1612**	**1546**
	110	2181	2138	2094	2049	2001	1953	1902	1850	1795	1738	1678	1615
	120	2267	2226	2185	2143	2099	2054	2007	1958	1908	1856	1802	1745
Emergency (<24 hrs)	**130**	**2348**	**2310**	**2272**	**2232**	**2191**	**2149**	**2105**	**2060**	**2014**	**1966**	**1916**	**1864**
Emergency (< 1 hr)	**140**	**2427**	**2391**	**2354**	**2317**	**2279**	**2239**	**2198**	**2157**	**2113**	**2069**	**2023**	**1975**
	150	2502	2469	2434	2399	2363	2326	2287	2248	2208	2166	2123	2079
	160	2576	2544	2511	2478	2444	2409	2373	2336	2298	2259	2219	2177
							WINTER					SUMMER	

Weather Assumptions:

Emissivity =	0.7	Suntime =	14
Absorptivity =	0.9	Degrees North Latitude=	40
Atmosphere =	Clear	Elevation Above Sea Level=	1000
Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90

Conductor : 1590 kcm AAC 61 str

		Outside Diameter =	1.454 inches
T_{low} =	25 °C	T_{high} =	75 °C
R_{low} =	1.2E-05 ohms/ft	R_{high} =	1.4E-05 ohms/ft

Bus Conductor: **2000 kcm AAC 127 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	2210	2146	2081	2012	1941	1865	1786	1702	1612	1516	1413	1299
	90	2340	2282	2222	2159	2094	2025	1954	1879	1800	1716	1627	1532
	100	2464	2410	2354	2296	2236	2173	2108	2040	1969	1894	1816	1732
Normal	**105**	**2524**	**2471**	**2417**	**2361**	**2303**	**2243**	**2181**	**2116**	**2048**	**1977**	**1903**	**1824**
	110	2582	2531	2479	2425	2369	2311	2252	2189	2124	2057	1986	1911
	120	2695	2647	2598	2548	2496	2442	2386	2329	2269	2207	2142	2075
Emergency (<24 hrs)	**130**	**2804**	**2759**	**2713**	**2665**	**2616**	**2566**	**2514**	**2461**	**2405**	**2348**	**2288**	**2226**
Emergency (< 1 hr)	**140**	**2909**	**2866**	**2823**	**2778**	**2732**	**2685**	**2637**	**2586**	**2535**	**2481**	**2426**	**2369**
	150	3011	2971	2930	2888	2844	2800	2754	2707	2658	2608	2557	2503
	160	3111	3073	3034	2994	2953	2911	2867	2823	2777	2730	2682	2632
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	2000 kcm AAC 127 str		Outside Diameter =	1.63 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	0.00001 ohms/ft	R_{high} =	1.1E-05 ohms/ft

Bus Conductor: **3500 kcm AAC 127 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	80	2914	2828	2740	2647	2550	2448	2341	2227	2107	1978	1838	1684
	90	3086	3007	2926	2841	2753	2661	2566	2466	2361	2249	2130	2001
	100	3248	3175	3100	3022	2942	2860	2774	2683	2589	2489	2384	2273
Normal	**105**	**3326**	**3256**	**3183**	**3110**	**3033**	**2954**	**2871**	**2785**	**2695**	**2601**	**2502**	**2397**
	110	3403	3334	3266	3195	3121	3045	2966	2884	2798	2708	2614	2514
	120	3552	3489	3425	3359	3290	3220	3147	3071	2992	2910	2824	2734
Emergency (<24 hrs)	**130**	**3697**	**3638**	**3578**	**3516**	**3452**	**3386**	**3318**	**3247**	**3174**	**3099**	**3020**	**2938**
Emergency (< 1 hr)	**140**	**3837**	**3782**	**3725**	**3667**	**3607**	**3545**	**3481**	**3415**	**3347**	**3277**	**3204**	**3129**
	150	3974	3921	3868	3813	3756	3698	3638	3576	3513	3447	3379	3309
	160	4107	4057	4007	3954	3901	3846	3790	3732	3672	3610	3547	3481
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	3500 kcm AAC 127 str		Outside Diameter =	2.158 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	6.7E-06 ohms/ft	R_{high} =	7.6E-06 ohms/ft

Bus Conductor: **1/0 Copper 7 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	50	363	347	330	312	293	273	251	226	199	167	126	62
	60	389	374	359	344	327	310	291	271	249	225	198	166
	70	412	399	385	371	356	341	325	307	289	269	247	224
Normal	**75**	**422**	**410**	**397**	**384**	**370**	**355**	**340**	**323**	**306**	**288**	**268**	**247**
	80	433	421	408	396	382	368	354	338	322	305	287	267
	90	452	441	430	418	405	393	380	366	351	336	320	304
Emergency (<24 hrs)	**95**	**461**	**451**	**439**	**428**	**416**	**404**	**392**	**378**	**365**	**351**	**335**	**320**
	100	470	460	449	438	427	415	403	390	377	364	350	335
Emergency (< 1 hr)	**110**	**487**	**477**	**467**	**457**	**446**	**436**	**424**	**413**	**401**	**389**	**376**	**362**
	120	503	493	484	475	465	455	444	433	422	411	399	387
	130	517	509	500	491	482	472	463	453	442	432	421	410
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1/0 Copper 7 str		Outside Diameter =	0.3684 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	0.00011 ohms/ft	R_{high} =	0.00013 ohms/ft

Bus Conductor: **2/0 Copper 7 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	50	419	401	381	361	339	315	289	260	228	190	142	62
	60	450	433	416	397	378	358	336	313	287	259	227	189
	70	477	462	446	429	412	394	375	355	334	311	285	258
Normal	**75**	**489**	**475**	**460**	**444**	**428**	**411**	**393**	**374**	**354**	**333**	**310**	**285**
	80	501	487	473	458	443	426	410	392	373	353	332	309
	90	524	511	498	484	470	455	440	424	407	390	371	351
Emergency (<24 hrs)	**95**	**535**	**522**	**510**	**496**	**483**	**469**	**454**	**439**	**423**	**406**	**389**	**370**
	100	545	533	521	508	495	481	467	453	438	422	405	388
Emergency (< 1 hr)	**110**	**565**	**554**	**542**	**530**	**518**	**505**	**492**	**479**	**465**	**451**	**436**	**420**
	120	583	573	562	551	539	528	516	503	490	477	463	449
	130	601	591	581	570	560	549	537	526	514	501	489	476
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	2/0 Copper 7 str		Outside Diameter =	0.4137 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	8.4E-05 ohms/ft	R_{high} =	1E-04 ohms/ft

Bus Conductor: **4/0 Copper 7 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	50	560	535	508	480	450	418	383	343	299	246	177	44
	60	601	579	555	531	505	477	447	416	381	342	298	246
	70	639	618	597	575	552	527	502	474	445	414	379	341
Normal	**75**	**656**	**636**	**616**	**595**	**573**	**550**	**526**	**500**	**473**	**444**	**413**	**379**
	80	673	654	634	614	593	571	549	524	499	472	443	412
	90	704	686	669	650	631	611	590	569	546	522	497	470
Emergency (<24 hrs)	**95**	**719**	**702**	**685**	**667**	**648**	**629**	**610**	**589**	**567**	**545**	**521**	**496**
	100	733	717	700	683	665	647	628	608	588	566	544	520
Emergency (< 1 hr)	**110**	**760**	**745**	**729**	**713**	**697**	**680**	**663**	**644**	**626**	**606**	**586**	**565**
	120	785	771	757	742	727	711	695	678	660	643	624	605
	130	810	796	783	769	754	740	724	709	693	676	659	641
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	4/0 Copper 7 str		Outside Diameter =	0.5217 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	5.3E-05 ohms/ft	R_{high} =	6.3E-05 ohms/ft

Bus Conductor: **4/0 Copper 19 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	50	561	536	510	482	452	419	384	344	299	246	177	41
	60	603	581	557	532	506	478	449	417	382	343	299	246
	70	641	620	599	577	553	529	503	476	446	415	380	342
Normal	**75**	**658**	**638**	**618**	**597**	**575**	**552**	**527**	**502**	**474**	**445**	**414**	**379**
	80	675	656	636	616	595	573	550	526	501	473	444	413
	90	706	689	671	652	633	613	592	570	548	524	499	472
Emergency (<24 hrs)	**95**	**721**	**704**	**687**	**669**	**650**	**631**	**611**	**591**	**569**	**547**	**523**	**498**
	100	735	719	702	685	667	649	630	610	590	568	546	522
Emergency (< 1 hr)	**110**	**762**	**747**	**732**	**716**	**699**	**682**	**665**	**646**	**628**	**608**	**588**	**567**
	120	788	774	759	744	729	713	697	680	663	645	626	607
	130	812	799	785	771	757	742	727	711	695	678	661	643
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	4/0 Copper 19 str		Outside Diameter =	0.5275 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	5.3E-05 ohms/ft	R_{high} =	6.3E-05 ohms/ft

Bus Conductor: **250 kcm Copper 19 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	50	623	595	565	534	500	464	424	380	330	269	190	#NUM!
	60	670	644	618	591	561	530	497	461	422	379	329	270
	70	711	689	665	640	614	587	558	528	495	459	421	378
Normal	**75**	**731**	**709**	**687**	**663**	**638**	**613**	**585**	**557**	**526**	**494**	**459**	**420**
	80	750	729	707	685	661	637	611	584	556	525	493	458
	90	785	765	745	725	703	681	658	634	609	582	554	524
Emergency (<24 hrs)	**95**	**801**	**783**	**764**	**744**	**723**	**702**	**680**	**657**	**633**	**607**	**581**	**553**
	100	817	799	781	762	742	722	701	679	656	632	607	580
Emergency (< 1 hr)	**110**	**848**	**831**	**814**	**796**	**778**	**759**	**739**	**719**	**698**	**676**	**654**	**630**
	120	877	861	845	828	811	794	775	757	737	717	697	675
	130	904	889	874	858	842	826	809	792	774	755	736	716
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	250 kcm Copper 19 str		Outside Diameter =	0.5735 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	4.5E-05 ohms/ft	R_{high} =	5.3E-05 ohms/ft

Bus Conductor: **350 kcm Copper 19 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	50	767	732	695	656	614	569	519	463	399	323	219	#NUM!
	60	826	795	762	728	691	653	611	566	517	462	399	324
	70	879	851	821	790	758	724	688	650	609	565	516	462
Normal	**75**	**904**	**877**	**848**	**819**	**789**	**756**	**723**	**687**	**649**	**608**	**564**	**516**
	80	927	901	874	846	817	787	755	721	686	648	607	564
	90	972	948	923	897	871	843	814	784	753	719	684	647
Emergency (<24 hrs)	**95**	**993**	**970**	**946**	**921**	**896**	**869**	**842**	**813**	**783**	**752**	**719**	**684**
	100	1013	991	968	944	919	894	868	840	812	782	751	718
Emergency (< 1 hr)	**110**	**1052**	**1031**	**1009**	**987**	**965**	**941**	**917**	**892**	**866**	**839**	**811**	**781**
	120	1088	1069	1049	1028	1007	985	963	939	915	890	865	838
	130	1123	1105	1086	1066	1047	1026	1005	984	961	938	914	890
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	350 kcm Copper 19 str		Outside Diameter =	0.6785 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	3.2E-05 ohms/ft	R_{high} =	3.8E-05 ohms/ft

Bus Conductor: **350 kcm Copper 37 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	50	768	733	696	657	615	569	519	464	400	323	219	#NUM!
	60	827	796	763	728	692	653	612	567	518	463	400	324
	70	880	852	822	791	759	725	689	651	610	565	517	462
Normal	**75**	**905**	**877**	**849**	**820**	**789**	**757**	**723**	**688**	**650**	**609**	**565**	**516**
	80	928	902	875	847	818	788	756	722	686	649	608	564
	90	973	949	924	898	872	844	815	785	753	720	685	647
Emergency (<24 hrs)	**95**	**994**	**971**	**947**	**922**	**897**	**870**	**843**	**814**	**784**	**752**	**719**	**684**
	100	1014	992	969	945	920	895	869	841	813	783	752	719
Emergency (< 1 hr)	**110**	**1053**	**1032**	**1011**	**988**	**966**	**942**	**918**	**893**	**867**	**840**	**811**	**782**
	120	1090	1070	1050	1029	1008	986	964	940	916	891	866	839
	130	1124	1106	1087	1068	1048	1027	1006	985	962	939	916	891
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	350 kcm Copper 37 str		Outside Diameter =	0.6811 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	3.2E-05 ohms/ft	R_{high} =	3.8E-05 ohms/ft

Bus Conductor: **500 kcm Copper 19 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	50	955	911	865	815	762	704	641	570	488	388	249	#NUM!
	60	1031	991	950	907	861	812	759	702	640	570	489	391
	70	1098	1063	1026	987	946	903	858	810	758	701	640	570
Normal	**75**	**1130**	**1096**	**1061**	**1024**	**985**	**945**	**902**	**857**	**809**	**757**	**701**	**640**
	80	1160	1128	1094	1059	1022	984	943	901	856	808	757	701
	90	1217	1187	1156	1124	1090	1056	1019	981	942	900	855	808
Emergency (<24 hrs)	**95**	**1244**	**1215**	**1185**	**1154**	**1122**	**1089**	**1055**	**1018**	**981**	**941**	**899**	**855**
	100	1270	1243	1214	1184	1153	1121	1088	1054	1018	980	941	899
Emergency (< 1 hr)	**110**	**1320**	**1294**	**1267**	**1240**	**1211**	**1182**	**1151**	**1120**	**1087**	**1053**	**1017**	**980**
	120	1368	1343	1318	1292	1266	1238	1210	1181	1151	1119	1087	1053
	130	1413	1390	1366	1342	1317	1291	1265	1238	1210	1181	1151	1120
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	500 kcm Copper 19 str		Outside Diameter =	0.811 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	2.3E-05 ohms/ft	R_{high} =	2.7E-05 ohms/ft

Bus Conductor: **500 kcm Copper 37 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	50	956	912	865	816	762	705	641	570	488	388	249	#NUM!
	60	1031	992	951	907	861	812	760	703	640	570	489	391
	70	1099	1064	1026	988	947	904	859	810	758	702	640	571
Normal	**75**	**1131**	**1097**	**1061**	**1024**	**986**	**945**	**903**	**858**	**809**	**758**	**702**	**640**
	80	1161	1129	1095	1059	1023	984	944	902	857	809	757	702
	90	1218	1188	1157	1125	1091	1057	1020	982	942	900	856	808
Emergency (<24 hrs)	**95**	**1245**	**1216**	**1186**	**1155**	**1123**	**1090**	**1055**	**1019**	**982**	**942**	**900**	**856**
	100	1272	1244	1215	1185	1154	1122	1089	1055	1019	981	942	900
Emergency (< 1 hr)	**110**	**1322**	**1295**	**1269**	**1241**	**1212**	**1183**	**1152**	**1121**	**1088**	**1054**	**1018**	**981**
	120	1369	1344	1319	1293	1267	1239	1211	1182	1152	1120	1088	1054
	130	1414	1391	1367	1343	1318	1292	1266	1239	1211	1182	1152	1121
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	500 kcm Copper 37 str		Outside Diameter =	0.8134 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	2.3E-05 ohms/ft	R_{high} =	2.7E-05 ohms/ft

Bus Conductor: **750 kcm Copper 37 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	50	1219	1162	1102	1037	968	892	809	716	606	471	274	#NUM!
	60	1319	1268	1215	1159	1099	1035	967	892	810	718	610	478
	70	1409	1363	1315	1265	1212	1157	1097	1034	967	893	812	721
Normal	**75**	**1451**	**1407**	**1362**	**1314**	**1264**	**1211**	**1156**	**1097**	**1035**	**967**	**894**	**813**
	80	1492	1449	1406	1360	1313	1263	1211	1156	1097	1035	968	895
	90	1568	1529	1489	1447	1404	1359	1312	1263	1211	1156	1098	1036
Emergency (<24 hrs)	**95**	**1604**	**1566**	**1528**	**1488**	**1446**	**1403**	**1359**	**1312**	**1263**	**1211**	**1157**	**1099**
	100	1639	1603	1566	1527	1487	1446	1403	1359	1312	1263	1212	1158
Emergency (< 1 hr)	**110**	**1706**	**1672**	**1637**	**1602**	**1565**	**1527**	**1487**	**1446**	**1404**	**1360**	**1313**	**1265**
	120	1769	1738	1705	1672	1638	1602	1566	1528	1489	1448	1406	1362
	130	1830	1800	1770	1738	1706	1673	1639	1604	1568	1530	1491	1451
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	750 kcm Copper 37 str		Outside Diameter =	0.9968 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	1.6E-05 ohms/ft	R_{high} =	1.8E-05 ohms/ft

Bus Conductor: **750 kcm Copper 61 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	50	1219	1162	1102	1037	968	893	809	716	607	471	274	#NUM!
	60	1320	1269	1215	1159	1099	1036	967	892	810	718	610	478
	70	1410	1364	1316	1265	1213	1157	1098	1035	967	893	812	721
Normal	**75**	**1452**	**1408**	**1362**	**1314**	**1264**	**1212**	**1156**	**1098**	**1035**	**967**	**894**	**813**
	80	1492	1450	1406	1361	1313	1264	1211	1156	1098	1035	968	895
	90	1568	1529	1489	1448	1404	1359	1312	1263	1211	1157	1099	1037
Emergency (<24 hrs)	**95**	**1604**	**1567**	**1528**	**1488**	**1447**	**1404**	**1359**	**1312**	**1263**	**1212**	**1157**	**1099**
	100	1639	1603	1566	1528	1488	1447	1404	1359	1312	1264	1212	1158
Emergency (< 1 hr)	**110**	**1706**	**1673**	**1638**	**1602**	**1565**	**1527**	**1488**	**1447**	**1405**	**1360**	**1314**	**1265**
	120	1770	1738	1706	1672	1638	1603	1566	1528	1489	1449	1406	1363
	130	1831	1801	1770	1739	1707	1674	1640	1605	1568	1531	1492	1452
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	750 kcm Copper 61 str		Outside Diameter =	0.9981 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	1.6E-05 ohms/ft	R_{high} =	1.8E-05 ohms/ft

Bus Conductor: **1000 kcm Copper 37 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	50	1440	1372	1299	1222	1139	1048	948	835	702	535	278	#NUM!
	60	1562	1501	1437	1370	1298	1222	1140	1050	951	839	708	545
	70	1671	1617	1559	1499	1436	1370	1299	1223	1142	1053	955	845
Normal	**75**	**1723**	**1670**	**1616**	**1559**	**1499**	**1436**	**1370**	**1300**	**1224**	**1143**	**1055**	**958**
	80	1772	1722	1670	1615	1559	1499	1437	1371	1301	1226	1145	1057
	90	1865	1819	1771	1721	1670	1616	1560	1501	1439	1373	1304	1230
Emergency (<24 hrs)	**95**	**1910**	**1865**	**1819**	**1771**	**1722**	**1670**	**1617**	**1561**	**1502**	**1440**	**1375**	**1306**
	100	1952	1909	1865	1819	1772	1723	1671	1618	1562	1504	1442	1377
Emergency (< 1 hr)	**110**	**2035**	**1995**	**1953**	**1911**	**1867**	**1821**	**1774**	**1725**	**1675**	**1622**	**1566**	**1508**
	120	2113	2075	2037	1997	1956	1914	1870	1825	1778	1730	1679	1626
	130	2187	2152	2116	2078	2040	2001	1960	1918	1875	1830	1783	1735
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1000 kcm Copper 37 str		Outside Diameter =	1.1508 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	1.2E-05 ohms/ft	R_{high} =	1.4E-05 ohms/ft

Bus Conductor: **1000 kcm Copper 61 str**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	50	1440	1372	1300	1222	1139	1049	948	835	702	535	278	#NUM!
	60	1562	1501	1438	1370	1299	1222	1140	1050	951	839	708	545
	70	1672	1617	1560	1500	1437	1370	1299	1224	1142	1053	956	845
Normal	**75**	**1723**	**1671**	**1616**	**1559**	**1500**	**1437**	**1370**	**1300**	**1225**	**1144**	**1055**	**958**
	80	1773	1722	1670	1616	1559	1500	1437	1371	1301	1226	1146	1058
	90	1866	1820	1772	1722	1670	1616	1560	1501	1439	1374	1304	1230
Emergency (<24 hrs)	**95**	**1910**	**1866**	**1819**	**1772**	**1722**	**1671**	**1617**	**1561**	**1503**	**1441**	**1376**	**1306**
	100	1953	1910	1866	1820	1772	1723	1672	1619	1563	1504	1443	1378
Emergency (< 1 hr)	**110**	**2035**	**1995**	**1954**	**1911**	**1867**	**1822**	**1775**	**1726**	**1675**	**1622**	**1567**	**1509**
	120	2113	2076	2037	1997	1956	1914	1871	1825	1779	1730	1680	1627
	130	2188	2153	2116	2079	2041	2001	1961	1919	1875	1831	1784	1736
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1000 kcm Copper 61 str		Outside Diameter =	1.152 inches
	T_{low} =	25 °C	T_{high} =	75 °C
	R_{low} =	1.2E-05 ohms/ft	R_{high} =	1.4E-05 ohms/ft

Bus Conductor: **1500 kcm Copper 61 str HD**

Rating	Rated Operating Temperature	Assumed Wind Speed = 2 fps Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	50	1973	1878	1777	1669	1552	1425	1283	1121	930	684	257	#NUM!
	60	2159	2074	1985	1890	1790	1682	1566	1439	1298	1138	949	708
	70	2329	2252	2171	2087	1998	1904	1804	1697	1581	1455	1315	1156
Normal	**75**	**2409**	**2336**	**2259**	**2178**	**2094**	**2005**	**1911**	**1811**	**1705**	**1589**	**1463**	**1323**
	80	2487	2416	2343	2266	2186	2102	2013	1919	1819	1713	1597	1472
	90	2636	2570	2502	2432	2358	2282	2202	2118	2030	1936	1837	1730
Emergency (<24 hrs)	**95**	**2707**	**2644**	**2578**	**2510**	**2440**	**2367**	**2291**	**2211**	**2127**	**2039**	**1945**	**1846**
	100	2776	2715	2652	2587	2519	2449	2376	2300	2220	2136	2048	1955
Emergency (< 1 hr)	**110**	**2911**	**2854**	**2795**	**2734**	**2671**	**2606**	**2538**	**2468**	**2395**	**2319**	**2239**	**2156**
	120	3040	2986	2931	2874	2815	2754	2691	2626	2559	2489	2416	2340
	130	3165	3114	3061	3008	2952	2896	2837	2776	2714	2649	2582	2512
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	1500 kcm Copper 61 str HD		Outside Diameter =	1.411 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	7.3E-06 ohms/ft	R_{high} =	8E-06 ohms/ft

Bus Conductor: **2000 kcm Copper 127 str HD**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	50	2299	2187	2068	1940	1801	1649	1480	1286	1054	750	80	#NUM!
	60	2500	2401	2296	2185	2068	1941	1804	1655	1488	1297	1071	776
	70	2680	2590	2497	2399	2296	2186	2070	1945	1810	1662	1498	1310
Normal	**75**	**2763**	**2678**	**2590**	**2497**	**2399**	**2297**	**2188**	**2072**	**1948**	**1814**	**1667**	**1503**
	80	2844	2762	2678	2590	2497	2400	2298	2190	2075	1952	1818	1672
	90	2995	2920	2843	2763	2679	2592	2500	2404	2303	2196	2082	1960
Emergency (<24 hrs)	**95**	**3067**	**2995**	**2921**	**2844**	**2764**	**2681**	**2594**	**2503**	**2407**	**2307**	**2200**	**2087**
	100	3136	3067	2996	2922	2846	2766	2683	2597	2506	2411	2311	2205
Emergency (< 1 hr)	**110**	**3269**	**3205**	**3139**	**3071**	**3000**	**2927**	**2851**	**2772**	**2690**	**2604**	**2514**	**2420**
	120	3395	3335	3274	3210	3145	3077	3007	2934	2859	2781	2699	2614
	130	3516	3460	3402	3342	3281	3218	3153	3086	3017	2944	2870	2792
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	2000 kcm Copper 127 str HD		Outside Diameter =	1.632 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	5.5E-06 ohms/ft	R_{high} =	6.6E-06 ohms/ft

Appendix A

Substation Bus Rating Calculation Spreadsheet
Program File (EXCEL Spreadsheet)

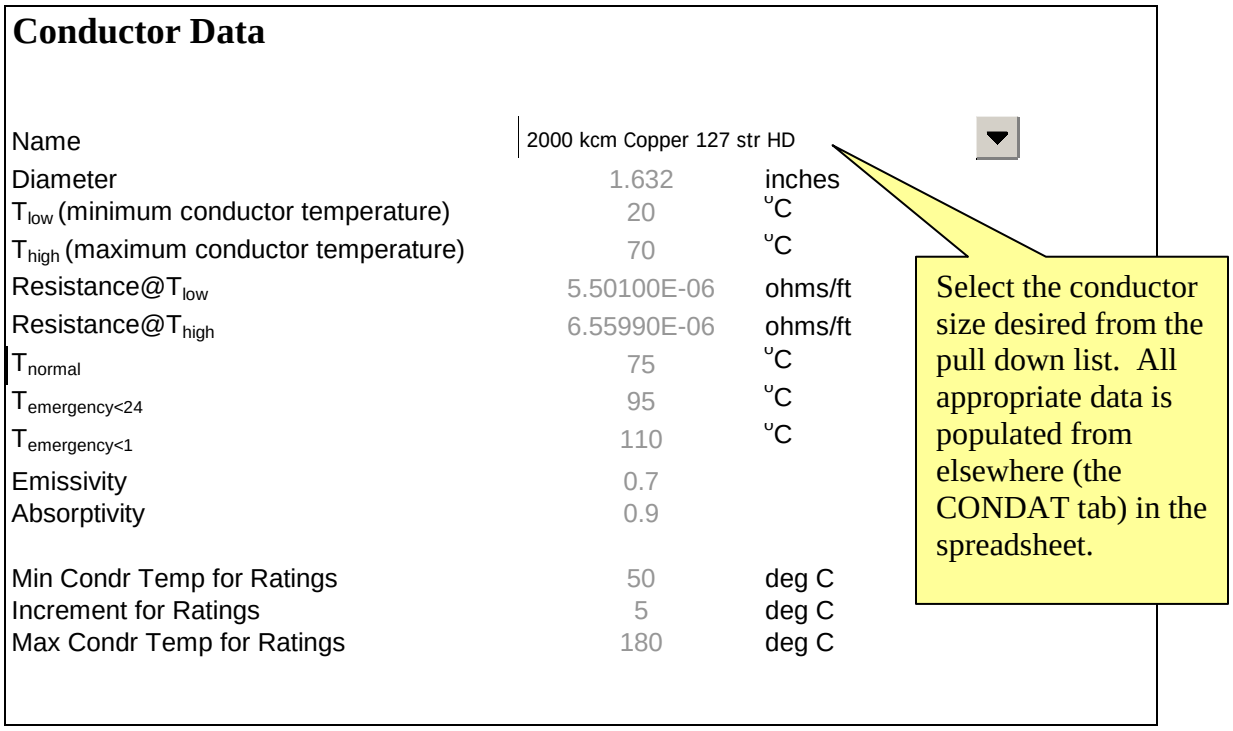
File name: PJM Bus Rating 100604.xls

Appendix B

Explanation of
Substation Bus Rating Calculation
Spreadsheet

The work group developed an Excel spreadsheet program (PJM Bus Rating 100604.xls) to perform the calculations detailed in the document as well as creating the tables of ratings that are found in the document. The spreadsheet program is included as part of this document. This appendix described the various sections or tabs of the spreadsheet software.

The Conductor data tab:



The Weather data tab:

Select weather parameters from pull down boxes, and adjust the RED entries as appropriate. PJM recommendations are shown on the right.

Weather Data

Drop Down Boxes and Red Entries a… hangeable

Suntime		14:00 Hours		*1… hours recomended by the PJM Bus Ampacity Taskforce*
Degrees North Latitude		40	o	*40° recom by the PJM Bus Ampacity T. F.*
Atmosphere		Clear		*"Clear atmosphere recommended by the PJM Bus Ampacity Taskforce*
Emissivity (□1		0.7		*(selected when chosing conductor)*
Absorptivity (□1		0.9		*(selected when chosing conductor)*
Ambient Temperature Range		-15°C to 40°C		
Elevation Above Sea Level		1000	ft	*1000 ft recomended by the PJM Bus Ampacity Taskforce*
User defined Wind speed for comparison	V1	0	(ft/sec)	*User definable comparison wind speed*
Wind speed for Published Ratings	V2	2	(ft/sec)	
Azimuth of Conductor (N-S = 0, E-W = 90)		90	o	*90° recomended by the PJM Bus Ampacity Taskforce*
Z_1 (Angle between wind and conductor)		90	o	*90° recomended by the PJM Bus Ampacity Taskforce*
K_{angle} (Wind direction factor)		1		
Hc (Altitude of the sun) at 14:00 Hours		59.73	o	
Qs (Total heat flux) at 14:00 Hours		96.09	(W/ft²)	
Z_c (Azimuth of the sun)		245.20	o	
□(Effective angle of incidence of the sun's rays)		117.23	o	
Total Heat Flux - Industrial Atmosphere		73.96	(W/ft²)	
Total Heat Flux - Clear Atmosphere		96.09	(W/ft²)	

Value used in calculations and derived from the above data

To convert from Knots or mph to fps, enter below

2.00	Knots =	3.38	(ft/sec)
5.00	miles/hr =	7.33	(ft/sec)

The Publication Table Tab:

This table has no changeable items. All values are calculated. This table was used to publish the tables in this document.

Bus Conductor: **2000 kcm Copper 127 str HD**

Assumed Wind Speed = 2 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	50	2299	2187	2068	1940	1801	1649	1480	1286	1054	750	80	#NUM!
	60	2500	2401	2296	2185	2068	1941	1804	1655	1488	1297	1071	776
	70	2680	2590	2497	2399	2296	2186	2070	1945	1810	1662	1498	1310
Normal	**75**	**2763**	**2678**	**2590**	**2497**	**2399**	**2297**	**2188**	**2072**	**1948**	**1814**	**1667**	**1503**
	80	2844	2762	2678	2590	2497	2400	2298	2190	2075	1952	1818	1672
	90	2995	2920	2843	2763	2679	2592	2500	2404	2303	2196	2082	1960
Emergency (<24 hrs)	**95**	**3067**	**2995**	**2921**	**2844**	**2764**	**2681**	**2594**	**2503**	**2407**	**2307**	**2200**	**2087**
	100	3136	3067	2996	2922	2846	2766	2683	2597	2506	2411	2311	2205
Emergency (< 1 hr)	**110**	**3269**	**3205**	**3139**	**3071**	**3000**	**2927**	**2851**	**2772**	**2690**	**2604**	**2514**	**2420**
	120	3395	3335	3274	3210	3145	3077	3007	2934	2859	2781	2699	2614
	130	3516	3460	3402	3342	3281	3218	3153	3086	3017	2944	2870	2792
							WINTER					SUMMER	

Weather Assumptions:	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90
Conductor :	2000 kcm Copper 127 str HD		Outside Diameter =	1.632 inches
	T_{low} =	20 °C	T_{high} =	70 °C
	R_{low} =	5.5E-06 ohms/ft	R_{high} =	6.6E-06 ohms/ft

The Comparison Table Tab:

This table shows a comparison in rating based on a 2 fps wind speed recommended by PJM, and another wind speed that is chosen form the Weather Data tab. Here the alternative wind speed is 0 fps or no wind.

Bus Conductor: **2000 kcm Copper 127 str HD**

Assumed Wind Speed = 0 fps

Rating	Rated Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	50	1814	1694	1566	1428	1277	1108	910	659	214	#NUM!	#NUM!	#NUM!
	60	2032	1927	1816	1699	1574	1440	1293	1128	937	699	323	#NUM!
	70	2227	2132	2033	1930	1822	1707	1585	1454	1311	1151	966	739
Normal	**75**	**2318**	**2227**	**2133**	**2035**	**1933**	**1826**	**1713**	**1592**	**1462**	**1320**	**1162**	**981**
	80	2404	2317	2228	2135	2038	1937	1831	1719	1599	1471	1331	1175
	90	2567	2487	2405	2320	2232	2141	2046	1947	1843	1733	1616	1490
Emergency (<24 hrs)	**95**	**2644**	**2567**	**2488**	**2407**	**2323**	**2236**	**2145**	**2052**	**1953**	**1850**	**1741**	**1625**
	100	2719	2645	2568	2490	2409	2326	2240	2151	2058	1960	1858	1750
Emergency (< 1 hr)	**110**	**2862**	**2792**	**2721**	**2648**	**2574**	**2497**	**2418**	**2336**	**2251**	**2164**	**2072**	**1976**
	120	2997	2932	2865	2797	2728	2656	2583	2507	2429	2349	2266	2179
	130	3126	3065	3002	2938	2873	2806	2737	2667	2595	2521	2444	2365
							WINTER					SUMMER	

Assumed Wind Speed = 2 fps

Rating	Operating Temperature	Ambient Temperature (°C) -15	-10	-5	0	5	10	15	20	25	30	35	40
	50	2299	2187	2068	1940	1801	1649	1480	1286	1054	750	80	#NUM!
	60	2500	2401	2296	2185	2068	1941	1804	1655	1488	1297	1071	776
	70	2680	2590	2497	2399	2296	2186	2070	1945	1810	1662	1498	1310
Normal	**75**	**2763**	**2678**	**2590**	**2497**	**2399**	**2297**	**2188**	**2072**	**1948**	**1814**	**1667**	**1503**
	80	2844	2762	2678	2590	2497	2400	2298	2190	2075	1952	1818	1672
	90	2995	2920	2843	2763	2679	2592	2500	2404	2303	2196	2082	1960
Emergency (<24 hrs)	**95**	**3067**	**2995**	**2921**	**2844**	**2764**	**2681**	**2594**	**2503**	**2407**	**2307**	**2200**	**2087**
	100	3136	3067	2996	2922	2846	2766	2683	2597	2506	2411	2311	2205
Emergency (< 1 hr)	**110**	**3269**	**3205**	**3139**	**3071**	**3000**	**2927**	**2851**	**2772**	**2690**	**2604**	**2514**	**2420**
	120	3395	3335	3274	3210	3145	3077	3007	2934	2859	2781	2699	2614
	130	3516	3460	3402	3342	3281	3218	3153	3086	3017	2944	2870	2792
							WINTER					SUMMER	

Weather Assumptions:				
	Emissivity =	0.7	Suntime =	14
	Absorptivity =	0.9	Degrees North Latitude=	40
	Atmosphere =	Clear	Elevation Above Sea Level=	1000
	Azimuth of Conductor (N-S = 0, E-W = 90) =	90	Z_1 (Angle between wind and conductor)	90

The Ratings with Sun Tab:

This table is one of the results tables and shows conductor ratings for the range of operating temperatures, ambient temperatures for each of the two different wind speeds. This table is for daytime since it is based upon solar exposure.

Steady State Thermal Rating with SUN (Ampacity), Amperes

2000 kcm Copper 127 str HD — Clear — □1 0.7 — □1 0.9

Rating Condition: V1
Wind Speed (ft/sec): 0

Condr Max Temp Deg C	-15	-10	-5	0	5	10	15	20	25	30	35	40
50	1814	1694	1566	1428	1277	1108	910	659	214	#NUM!	#NUM!	#NUM!
55	1927	1815	1696	1570	1434	1285	1118	923	679	274	#NUM!	#NUM!
60	2032	1927	1816	1699	1574	1440	1293	1128	937	699	323	#NUM!
65	2132	2032	1928	1819	1703	1579	1446	1301	1139	952	719	366
70	2227	2132	2033	1930	1822	1707	1585	1454	1311	1151	966	739
75	2318	2227	2133	2035	1933	1826	1713	1592	1462	1320	1162	981
80	2404	2317	2228	2135	2038	1937	1831	1719	1599	1471	1331	1175
85	2487	2404	2318	2229	2137	2042	1942	1837	1726	1607	1480	1341
90	2567	2487	2405	2320	2232	2141	2046	1947	1843	1733	1616	1490
95	2644	2567	2488	2407	2323	2236	2145	2052	1953	1850	1741	1625
100	2719	2645	2568	2490	2409	2326	2240	2151	2058	1960	1858	1750
105	2791	2720	2646	2571	2493	2413	2331	2245	2157	2064	1968	1866
110	2862	2792	2721	2648	2574	2497	2418	2336	2251	2164	2072	1976
115	2930	2863	2794	2724	2652	2578	2502	2423	2342	2258	2171	2080
120	2997	2932	2865	2797	2728	2656	2583	2507	2429	2349	2266	2179
125	3063	2999	2935	2869	2801	2732	2661	2589	2514	2436	2357	2274
130	3126	3065	3002	2938	2873	2806	2737	2667	2595	2521	2444	2365
135	3189	3129	3068	3006	2943	2878	2812	2744	2674	2602	2529	2453
140	3250	3192	3133	3072	3011	2948	2884	2818	2751	2682	2611	2537
145	3311	3254	3196	3137	3078	3017	2954	2891	2826	2759	2690	2619
150	3370	3315	3258	3201	3143	3084	3023	2962	2898	2834	2767	2699
155	3428	3374	3319	3264	3207	3150	3091	3031	2970	2907	2843	2777
160	3486	3433	3380	3325	3270	3214	3157	3099	3039	2978	2916	2852
165	3542	3491	3439	3386	3332	3278	3222	3165	3107	3048	2988	2926
170	3598	3548	3497	3445	3393	3340	3286	3231	3174	3117	3058	2998
175	3653	3604	3555	3504	3453	3401	3348	3295	3240	3184	3127	3069
180	3708	3660	3611	3562	3512	3462	3410	3358	3305	3250	3195	3138

Rating Condition: V2
Wind Speed (ft/sec): 2

Condr Max Temp Deg C	-15	-10	-5	0	5	10	15	20	25	30	35	40
50	2299	2187	2068	1940	1801	1649	1480	1286	1054	750	80	#NUM!
55	2403	2297	2186	2067	1940	1802	1652	1484	1291	1062	763	169
60	2500	2401	2296	2185	2068	1941	1804	1655	1488	1297	1071	776
65	2592	2498	2400	2296	2186	2069	1943	1807	1658	1493	1304	1079
70	2680	2590	2497	2399	2296	2186	2070	1945	1810	1662	1498	1310
75	2763	2678	2590	2497	2399	2297	2188	2072	1948	1814	1667	1503
80	2844	2762	2678	2590	2497	2400	2298	2190	2075	1952	1818	1672
85	2921	2843	2762	2678	2590	2499	2402	2301	2193	2078	1955	1823
90	2995	2920	2843	2763	2679	2592	2500	2404	2303	2196	2082	1960
95	3067	2995	2921	2844	2764	2681	2594	2503	2407	2307	2200	2087
100	3136	3067	2996	2922	2846	2766	2683	2597	2506	2411	2311	2205
105	3204	3137	3069	2998	2924	2848	2769	2686	2600	2510	2415	2315
110	3269	3205	3139	3071	3000	2927	2851	2772	2690	2604	2514	2420
115	3333	3271	3207	3141	3073	3003	2930	2855	2776	2694	2609	2519
120	3395	3335	3274	3210	3145	3077	3007	2934	2859	2781	2699	2614
125	3456	3398	3339	3277	3214	3149	3081	3011	2939	2864	2786	2705
130	3516	3460	3402	3342	3281	3218	3153	3086	3017	2944	2870	2792
135	3574	3520	3464	3406	3347	3286	3223	3159	3092	3022	2950	2876
140	3632	3579	3524	3469	3411	3352	3292	3229	3164	3098	3029	2957
145	3688	3637	3584	3530	3474	3417	3358	3298	3235	3171	3105	3036
150	3743	3693	3642	3590	3536	3480	3424	3365	3305	3243	3178	3112
155	3798	3749	3700	3649	3596	3543	3487	3431	3372	3312	3250	3186
160	3852	3804	3756	3706	3656	3603	3550	3495	3438	3380	3320	3258
165	3905	3859	3812	3763	3714	3663	3611	3558	3503	3447	3389	3329
170	3957	3912	3867	3820	3772	3722	3672	3620	3567	3512	3456	3398
175	4009	3965	3921	3875	3828	3780	3731	3681	3629	3576	3522	3465
180	4061	4018	3974	3930	3884	3837	3790	3741	3691	3639	3586	3532

The Ratings without Sun Tab:

This table is another of the results tables and shows conductor ratings for the range of operating temperatures, ambient temperatures for each of the two different wind speeds. This table is for night time since it is absent solar exposure.

Steady State Thermal Rating without SUN (Ampacity), Amperes

2000 kcm Copper 127 str HD ☐ 0.7 ☐ 0.9

Rating Condition: V1
Wind Speed (ft/sec): 0

Condr Max Temp Deg C	-15	-10	-5	0	5	10	15	20	25	30	35	40
50	2235	2139	2039	1935	1826	1712	1591	1462	1323	1170	999	800
55	2321	2229	2134	2035	1931	1824	1710	1590	1462	1323	1171	1000
60	2404	2315	2224	2129	2031	1929	1822	1709	1589	1462	1324	1172
65	2483	2398	2310	2220	2126	2028	1927	1820	1708	1589	1462	1325
70	2560	2478	2394	2306	2217	2123	2027	1926	1820	1708	1590	1463
75	2634	2555	2474	2390	2304	2214	2122	2026	1925	1820	1709	1591
80	2706	2630	2551	2470	2387	2301	2213	2121	2025	1926	1821	1710
85	2776	2702	2626	2548	2468	2385	2300	2212	2121	2026	1926	1822
90	2844	2772	2698	2623	2546	2466	2384	2300	2212	2122	2027	1928
95	2910	2840	2769	2696	2621	2544	2465	2384	2300	2213	2123	2029
100	2974	2906	2837	2767	2694	2620	2544	2466	2385	2301	2215	2125
105	3037	2971	2904	2836	2765	2694	2620	2544	2467	2386	2303	2217
110	3099	3035	2969	2903	2835	2765	2694	2621	2546	2468	2388	2306
115	3159	3097	3033	2968	2902	2835	2766	2695	2623	2548	2471	2391
120	3218	3157	3096	3033	2969	2903	2836	2767	2697	2625	2551	2474
125	3276	3217	3157	3096	3033	2970	2904	2838	2770	2700	2628	2554
130	3333	3275	3217	3157	3096	3035	2971	2907	2841	2773	2704	2632
135	3389	3333	3276	3218	3159	3098	3037	2974	2910	2844	2777	2708
140	3445	3390	3334	3277	3220	3161	3101	3040	2978	2914	2849	2782
145	3499	3445	3391	3336	3280	3222	3164	3105	3044	2982	2919	2854
150	3553	3500	3447	3393	3339	3283	3226	3168	3109	3049	2988	2925
155	3606	3555	3503	3450	3397	3342	3287	3231	3173	3115	3055	2994
160	3658	3608	3558	3506	3454	3401	3347	3292	3236	3179	3121	3061
165	3710	3661	3612	3561	3510	3459	3406	3352	3298	3242	3186	3128
170	3762	3714	3665	3616	3566	3516	3464	3412	3359	3305	3249	3193
175	3813	3766	3718	3670	3621	3572	3522	3471	3419	3366	3312	3257
180	3863	3817	3771	3724	3676	3628	3579	3529	3478	3427	3374	3320

Rating Condition: V2
Wind Speed (ft/sec): 2

Condr Max Temp Deg C	-15	-10	-5	0	5	10	15	20	25	30	35	40
50	2644	2547	2445	2338	2224	2103	1973	1832	1678	1505	1308	1071
55	2729	2637	2540	2439	2332	2219	2098	1969	1828	1674	1502	1305
60	2810	2722	2631	2534	2434	2327	2214	2094	1965	1825	1671	1500
65	2888	2804	2716	2625	2529	2429	2323	2210	2091	1962	1822	1669
70	2962	2882	2798	2711	2620	2525	2425	2319	2207	2088	1959	1820
75	3034	2957	2877	2793	2707	2616	2521	2421	2316	2204	2085	1957
80	3103	3029	2952	2872	2789	2703	2613	2518	2419	2314	2202	2083
85	3170	3099	3025	2948	2869	2786	2700	2610	2516	2417	2312	2201
90	3235	3166	3095	3022	2945	2866	2784	2698	2608	2514	2415	2311
95	3299	3232	3163	3092	3019	2943	2864	2782	2697	2607	2513	2414
100	3360	3296	3229	3161	3090	3017	2942	2863	2781	2696	2606	2513
105	3420	3358	3294	3228	3160	3089	3016	2941	2862	2781	2695	2606
110	3479	3418	3356	3292	3227	3159	3089	3016	2941	2862	2781	2696
115	3536	3477	3417	3356	3292	3227	3159	3089	3016	2941	2863	2782
120	3592	3535	3477	3417	3356	3292	3227	3160	3090	3018	2943	2865
125	3647	3592	3535	3478	3418	3357	3294	3228	3161	3091	3019	2944
130	3701	3648	3593	3537	3479	3419	3358	3295	3230	3163	3094	3022
135	3754	3702	3649	3594	3538	3481	3422	3361	3298	3233	3166	3097
140	3807	3756	3704	3651	3597	3541	3484	3425	3364	3301	3236	3169
145	3858	3809	3759	3707	3654	3600	3544	3487	3428	3367	3305	3240
150	3909	3861	3812	3762	3711	3658	3604	3548	3491	3432	3372	3309
155	3959	3913	3865	3816	3766	3715	3662	3608	3553	3496	3437	3377
160	4009	3964	3917	3869	3821	3771	3720	3667	3614	3558	3501	3443
165	4058	4014	3968	3922	3875	3826	3777	3726	3673	3620	3564	3507
170	4107	4064	4019	3974	3928	3881	3832	3783	3732	3680	3626	3571
175	4155	4113	4070	4026	3981	3935	3887	3839	3790	3739	3687	3633
180	4203	4162	4120	4077	4033	3988	3942	3895	3847	3797	3747	3694

The CONDAT Tab:

This table is the source data for all of the wire and bus sizes available in the spreadsheet. 40 rows are available at the bottom for user additions.

Conductor Data Table

Note: FOR COPPER TUBES: R70c = 1.1925*R20c

Name	Outside Diam. inches	Rlow u ohm/ft	Tlow deg C	Rhigh u ohm/ft	Thigh deg C	Rated Operating Temperatures T_{normal} deg C	$T_{emergency<24}$ deg C	$T_{emergency<1}$ deg C	Emissivity	Absorptivity
1" Alum, Sched 40, 6061 Alloy	1.315	41.210	20	46.680	70	90	115	130	0.5	0.5
1-1/2" Alum, Sched 40, 6061 Alloy	1.900	25.450	20	28.820	70	90	115	130	0.5	0.5
2" Alum, Sched 40, 6061 Alloy	2.375	18.940	20	21.450	70	90	115	130	0.5	0.5
2-1/2" Alum, Sched 40, 6061 Alloy	2.875	11.950	20	13.530	70	90	115	130	0.5	0.5
3" Alum, Sched 40, 6061 Alloy	3.500	9.138	20	10.350	70	90	115	130	0.5	0.5
3-1/2" Alum, Sched 40, 6061 Alloy	4.000	7.957	20	8.613	70	90	115	130	0.5	0.5
4" Alum, Sched 40, 6061 Alloy	4.500	6.415	20	7.280	70	90	115	130	0.5	0.5
5" Alum, Sched 40, 6061 Alloy	5.563	4.735	20	5.373	70	90	115	130	0.5	0.5
6" Alum, Sched 40, 6061 Alloy	6.625	3.648	20	4.140	70	90	115	130	0.5	0.5
1" Alum, Sched 80, 6061 Alloy	1.315	31.860	20	36.080	70	90	115	130	0.5	0.5
1-1/2" Alum, Sched 80, 6061 Alloy	1.900	19.060	20	21.590	70	90	115	130	0.5	0.5
2" Alum, Sched 80, 6061 Alloy	2.375	13.780	20	15.610	70	90	115	130	0.5	0.5
2-1/2" Alum, Sched 80, 6061 Alloy	2.875	9.033	20	10.270	70	90	115	130	0.5	0.5
3" Alum, Sched 80, 6061 Alloy	3.500	6.751	20	7.683	70	90	115	130	0.5	0.5
3-1/2" Alum, Sched 80, 6061 Alloy	4.000	5.536	20	6.313	70	90	115	130	0.5	0.5
4" Alum, Sched 80, 6061 Alloy	4.500	4.620	20	5.284	70	90	115	130	0.5	0.5
5" Alum, Sched 80, 6061 Alloy	5.563	3.361	20	3.833	70	90	115	130	0.5	0.5
6" Alum, Sched 80, 6061 Alloy	6.625	2.425	20	2.790	70	90	115	130	0.5	0.5
1" Alum, Sched 40, 6063 Alloy	1.315	31.120	20	36.570	70	90	115	130	0.5	0.5
1-1/2" Alum, Sched 40, 6063 Alloy	1.900	19.220	20	22.590	70	90	115	130	0.5	0.5
2" Alum, Sched 40, 6063 Alloy	2.375	14.300	20	16.820	70	90	115	130	0.5	0.5
2-1/2" Alum, Sched 40, 6063 Alloy	2.875	9.020	20	10.610	70	90	115	130	0.5	0.5
3" Alum, Sched 40, 6063 Alloy	3.500	6.896	20	8.122	70	90	115	130	0.5	0.5
3-1/2" Alum, Sched 40, 6063 Alloy	4.000	5.735	20	6.759	70	90	115	130	0.5	0.5
4" Alum, Sched 40, 6063 Alloy	4.500	4.842	20	5.713	70	90	115	130	0.5	0.5
4-1/2" Alum, Sched 40, 6063 Alloy	5.000	4.167	20	4.920	70	90	115	130	0.5	0.5
5" Alum, Sched 40, 6063 Alloy	5.563	3.574	20	4.221	70	90	115	130	0.5	0.5
6" Alum, Sched 40, 6063 Alloy	6.625	2.754	20	3.257	70	90	115	130	0.5	0.5
1" Alum, Sched 80, 6063 Alloy	1.315	24.06	20	28.270	70	90	115	130	0.5	0.5
1-1/2" Alum, Sched 80, 6063 Alloy	1.900	14.39	20	16.910	70	90	115	130	0.5	0.5
2" Alum, Sched 80, 6063 Alloy	2.375	10.41	20	12.300	70	90	115	130	0.5	0.5
2-1/2" Alum, Sched 80, 6063 Alloy	2.875	6.819	20	8.068	70	90	115	130	0.5	0.5
3" Alum, Sched 80, 6063 Alloy	3.500	5.096	20	6.048	70	90	115	130	0.5	0.5
3-1/2" Alum, Sched 80, 6063 Alloy	4.000	4.179	20	4.974	70	90	115	130	0.5	0.5
4" Alum, Sched 80, 6063 Alloy	4.500	3.488	20	4.172	80	90	115	130	0.5	0.5
4-1/2" Alum, Sched 80, 6063 Alloy	5.000	2.967	20	3.559	70	90	115	130	0.5	0.5
5" Alum, Sched 80, 6063 Alloy	5.563	2.515	20	3.032	70	90	115	130	0.5	0.5
6" Alum, Sched 80, 6063 Alloy	6.625	1.829	20	2.248	70	90	115	130	0.5	0.5
3/4" Copper, Schedule 40, 98% ICAS	1.050	24.79	20	29.562	70	90	115	130	0.85	0.85
1" Copper, Schedule 40, 98% ICAS	1.315	17.600	20	20.988	70	90	115	130	0.85	0.85
1-1/4" Copper, Schedule 40, 98% ICAS	1.660	11.970	20	14.274	70	90	115	130	0.85	0.85
1-1/2" Copper, Schedule 40, 98% ICAS	1.900	10.080	20	12.020	70	90	115	130	0.85	0.85
2" Copper, Schedule 40, 98% ICAS	2.375	7.620	20	9.087	70	90	115	130	0.85	0.85
2-1/2" Copper, Schedule 40, 98% ICAS	2.875	5.250	20	6.261	70	90	115	130	0.85	0.85
3" Copper, Schedule 40, 98% ICAS	3.500	3.682	20	4.391	70	90	115	130	0.85	0.85
3-1/2" Copper, Schedule 40, 98% ICAS	4.000	2.822	20	3.365	70	90	115	130	0.85	0.85
4" Copper, Schedule 40, 98% ICAS	4.500	2.490	20	2.969	70	90	115	130	0.85	0.85
1" Copper, Schedule 80, 98% ICAS	1.315	12.830	20	15.300	70	90	115	130	0.85	0.85
1-1/2" Copper, Schedule 80, 98% ICAS	1.900	7.680	20	9.158	70	90	115	130	0.85	0.85
2" Copper, Schedule 80, 98% ICAS	2.375	5.558	20	6.628	70	90	115	130	0.85	0.85
2-1/2"Copper, Schedule 80, 98% ICAS	2.875	3.641	20	4.342	70	90	115	130	0.85	0.85
3" Copper, Schedule 80, 98% ICAS	3.500	2.723	20	3.247	70	90	115	130	0.85	0.85
3-1/2" Copper, Schedule 80, 98% ICAS	4.000	2.240	20	2.671	70	90	115	130	0.85	0.85
4" Copper, Schedule 80, 98% ICAS	4.500	1.866	20	2.225	70	90	115	130	0.85	0.85
1/0 ACSR 6/1	0.398	169.508	25	216.856	75	105	130	140	0.7	0.9
2/0 ACSR 6/1	0.447	128.977	25	176.515	75	105	130	140	0.7	0.9
3/0 ACSR 6/1	0.502	102.462	25	144.318	75	105	130	140	0.7	0.9
4/0 ACSR 6/1	0.563	81.250	25	118.939	75	105	130	140	0.7	0.9
159 kcm ACSR 12/7	0.756	103.409	25	181.439	75	105	130	140	0.7	0.9
203.2 kcm ACSR 16/19	0.714	77.841	25	155.303	75	105	130	140	0.7	0.9
266.8 kcm ACSR 26/7	0.642	65.095	25	77.898	75	105	130	140	0.7	0.9
266.8 kcm ACSR 30/7	0.660	64.640	25	77.330	75	105	130	140	0.7	0.9
336.4 kcm ACSR 18/1	0.684	52.197	25	62.462	75	105	130	140	0.7	0.9
336.4 kcm ACSR 26/7	0.720	51.667	25	61.818	75	105	130	140	0.7	0.9
336.4 kcm ACSR 30/7	0.741	51.288	25	61.364	75	105	130	140	0.7	0.9

The DeltaT Tab:

This tab is used for intermediate steps in the calculation. No user inputs are required. The table shows the difference in temperature between the conductor temperature and ambient temperature.

***DELTA t* (degrees C) = (T_c - T_a)**

2000 kcm Copper 127 str HD

Rating Condition	Wind Speed (ft/sec)	Condr Max Temp Deg C	-15	-10	-5	0	5	10	15	20	25	30	35	40
V1	0	50	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0	20.0	15.0	10.0
V2	2	50	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0	20.0	15.0	10.0
V1	0	55	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0	20.0	15.0
V2	2	55	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0	20.0	15.0
V1	0	60	75.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0	20.0
V2	2	60	75.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0	20.0
V1	0	65	80.0	75.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0
V2	2	65	80.0	75.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0	25.0
V1	0	70	85.0	80.0	75.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0
V2	2	70	85.0	80.0	75.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0	30.0
V1	0	75	90.0	85.0	80.0	75.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0
V2	2	75	90.0	85.0	80.0	75.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0	35.0
V1	0	80	95.0	90.0	85.0	80.0	75.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0
V2	2	80	95.0	90.0	85.0	80.0	75.0	70.0	65.0	60.0	55.0	50.0	45.0	40.0
V1	0	85	100.0	95.0	90.0	85.0	80.0	75.0	70.0	65.0	60.0	55.0	50.0	45.0
V2	2	85	100.0	95.0	90.0	85.0	80.0	75.0	70.0	65.0	60.0	55.0	50.0	45.0
V1	0	90	105.0	100.0	95.0	90.0	85.0	80.0	75.0	70.0	65.0	60.0	55.0	50.0
V2	2	90	105.0	100.0	95.0	90.0	85.0	80.0	75.0	70.0	65.0	60.0	55.0	50.0
V1	0	95	110.0	105.0	100.0	95.0	90.0	85.0	80.0	75.0	70.0	65.0	60.0	55.0
V2	2	95	110.0	105.0	100.0	95.0	90.0	85.0	80.0	75.0	70.0	65.0	60.0	55.0
V1	0	100	115.0	110.0	105.0	100.0	95.0	90.0	85.0	80.0	75.0	70.0	65.0	60.0
V2	2	100	115.0	110.0	105.0	100.0	95.0	90.0	85.0	80.0	75.0	70.0	65.0	60.0
V1	0	105	120.0	115.0	110.0	105.0	100.0	95.0	90.0	85.0	80.0	75.0	70.0	65.0
V2	2	105	120.0	115.0	110.0	105.0	100.0	95.0	90.0	85.0	80.0	75.0	70.0	65.0
V1	0	110	125.0	120.0	115.0	110.0	105.0	100.0	95.0	90.0	85.0	80.0	75.0	70.0
V2	2	110	125.0	120.0	115.0	110.0	105.0	100.0	95.0	90.0	85.0	80.0	75.0	70.0
V1	0	115	130.0	125.0	120.0	115.0	110.0	105.0	100.0	95.0	90.0	85.0	80.0	75.0
V2	2	115	130.0	125.0	120.0	115.0	110.0	105.0	100.0	95.0	90.0	85.0	80.0	75.0
V1	0	120	135.0	130.0	125.0	120.0	115.0	110.0	105.0	100.0	95.0	90.0	85.0	80.0
V2	2	120	135.0	130.0	125.0	120.0	115.0	110.0	105.0	100.0	95.0	90.0	85.0	80.0
V1	0	125	140.0	135.0	130.0	125.0	120.0	115.0	110.0	105.0	100.0	95.0	90.0	85.0
V2	2	125	140.0	135.0	130.0	125.0	120.0	115.0	110.0	105.0	100.0	95.0	90.0	85.0
V1	0	130	145.0	140.0	135.0	130.0	125.0	120.0	115.0	110.0	105.0	100.0	95.0	90.0
V2	2	130	145.0	140.0	135.0	130.0	125.0	120.0	115.0	110.0	105.0	100.0	95.0	90.0
V1	0	135	150.0	145.0	140.0	135.0	130.0	125.0	120.0	115.0	110.0	105.0	100.0	95.0
V2	2	135	150.0	145.0	140.0	135.0	130.0	125.0	120.0	115.0	110.0	105.0	100.0	95.0
V1	0	140	155.0	150.0	145.0	140.0	135.0	130.0	125.0	120.0	115.0	110.0	105.0	100.0
V2	2	140	155.0	150.0	145.0	140.0	135.0	130.0	125.0	120.0	115.0	110.0	105.0	100.0
V1	0	145	160.0	155.0	150.0	145.0	140.0	135.0	130.0	125.0	120.0	115.0	110.0	105.0
V2	2	145	160.0	155.0	150.0	145.0	140.0	135.0	130.0	125.0	120.0	115.0	110.0	105.0
V1	0	150	165.0	160.0	155.0	150.0	145.0	140.0	135.0	130.0	125.0	120.0	115.0	110.0
V2	2	150	165.0	160.0	155.0	150.0	145.0	140.0	135.0	130.0	125.0	120.0	115.0	110.0
V1	0	155	170.0	165.0	160.0	155.0	150.0	145.0	140.0	135.0	130.0	125.0	120.0	115.0
V2	2	155	170.0	165.0	160.0	155.0	150.0	145.0	140.0	135.0	130.0	125.0	120.0	115.0

The TFilm tab:

This tab is used for intermediate steps in the calculation. No user inputs are required. The table shows the temperature of the air film between the conductor and ambient environment.

T_{film} (degrees C) = $(T_c + T_a)/2$

2000 kcm Copper 127 str HD

Rating Con	Wind Speed (ft/sec)	Condr Max Temp Deg C	-15	-10	-5	0	5	10	15	20	25	30	35	40
V1	0	50	17.5	20.0	22.5	25.0	27.5	30.0	32.5	35.0	37.5	40.0	42.5	45.0
V2	2	50	17.5	20.0	22.5	25.0	27.5	30.0	32.5	35.0	37.5	40.0	42.5	45.0
V1	0	55	20.0	22.5	25.0	27.5	30.0	32.5	35.0	37.5	40.0	42.5	45.0	47.5
V2	2	55	20.0	22.5	25.0	27.5	30.0	32.5	35.0	37.5	40.0	42.5	45.0	47.5
V1	0	60	22.5	25.0	27.5	30.0	32.5	35.0	37.5	40.0	42.5	45.0	47.5	50.0
V2	2	60	22.5	25.0	27.5	30.0	32.5	35.0	37.5	40.0	42.5	45.0	47.5	50.0
V1	0	65	25.0	27.5	30.0	32.5	35.0	37.5	40.0	42.5	45.0	47.5	50.0	52.5
V2	2	65	25.0	27.5	30.0	32.5	35.0	37.5	40.0	42.5	45.0	47.5	50.0	52.5
V1	0	70	27.5	30.0	32.5	35.0	37.5	40.0	42.5	45.0	47.5	50.0	52.5	55.0
V2	2	70	27.5	30.0	32.5	35.0	37.5	40.0	42.5	45.0	47.5	50.0	52.5	55.0
V1	0	75	30.0	32.5	35.0	37.5	40.0	42.5	45.0	47.5	50.0	52.5	55.0	57.5
V2	2	75	30.0	32.5	35.0	37.5	40.0	42.5	45.0	47.5	50.0	52.5	55.0	57.5
V1	0	80	32.5	35.0	37.5	40.0	42.5	45.0	47.5	50.0	52.5	55.0	57.5	60.0
V2	2	80	32.5	35.0	37.5	40.0	42.5	45.0	47.5	50.0	52.5	55.0	57.5	60.0

The Air Density tab:

This tab is used for intermediate steps in the calculation. No user inputs are required. The table shows the air density around the conductor based on temperature.

Air Density (ρ_f), (lb/ft^3)

2000 kcm Copper 127 str HD

Rating Con	Wind Speed (ft/sec)	Condr Max Temp Deg C	-15	-10	-5	0	5	10	15	20	25	30	35	40
V1	0	50	0.073134	0.072509	0.071894	0.07129	0.070696	0.070112	0.069537	0.068972	0.068415	0.067868	0.067329	0.066799
V2	2	50	0.073134	0.072509	0.071894	0.07129	0.070696	0.070112	0.069537	0.068972	0.068415	0.067868	0.067329	0.066799
V1	0	55	0.072509	0.071894	0.07129	0.070696	0.070112	0.069537	0.068972	0.068415	0.067868	0.067329	0.066799	0.066277
V2	2	55	0.072509	0.071894	0.07129	0.070696	0.070112	0.069537	0.068972	0.068415	0.067868	0.067329	0.066799	0.066277
V1	0	60	0.071894	0.07129	0.070696	0.070112	0.069537	0.068972	0.068415	0.067868	0.067329	0.066799	0.066277	0.065763
V2	2	60	0.071894	0.07129	0.070696	0.070112	0.069537	0.068972	0.068415	0.067868	0.067329	0.066799	0.066277	0.065763
V1	0	65	0.07129	0.070696	0.070112	0.069537	0.068972	0.068415	0.067868	0.067329	0.066799	0.066277	0.065763	0.065258
V2	2	65	0.07129	0.070696	0.070112	0.069537	0.068972	0.068415	0.067868	0.067329	0.066799	0.066277	0.065763	0.065258
V1	0	70	0.070696	0.070112	0.069537	0.068972	0.068415	0.067868	0.067329	0.066799	0.066277	0.065763	0.065258	0.064759
V2	2	70	0.070696	0.070112	0.069537	0.068972	0.068415	0.067868	0.067329	0.066799	0.066277	0.065763	0.065258	0.064759
V1	0	75	0.070112	0.069537	0.068972	0.068415	0.067868	0.067329	0.066799	0.066277	0.065763	0.065258	0.064759	0.064269
V2	2	75	0.070112	0.069537	0.068972	0.068415	0.067868	0.067329	0.066799	0.066277	0.065763	0.065258	0.064759	0.064269
V1	0	80	0.069537	0.068972	0.068415	0.067868	0.067329	0.066799	0.066277	0.065763	0.065258	0.064759	0.064269	0.063785
V2	2	80	0.069537	0.068972	0.068415	0.067868	0.067329	0.066799	0.066277	0.065763	0.065258	0.064759	0.064269	0.063785

The Air Viscosity tab:

This tab is used for intermediate steps in the calculation. No user inputs are required. The table shows the viscosity of the air around the conductor.

Absolute Viscosity of Air (μ_f), (lb/ft*h)

2000 kcm Copper 127 str HD

Rating Con	Wind Speed (ft/sec)	Condr Max Temp Deg C	-15	-10	-5	0	5	10	15	20	25	30	35	40
V1	0	50	0.043572	0.043863	0.044152	0.04444	0.044727	0.045012	0.045297	0.04558	0.045862	0.046143	0.046423	0.046701
V2	2	50	0.043572	0.043863	0.044152	0.04444	0.044727	0.045012	0.045297	0.04558	0.045862	0.046143	0.046423	0.046701
V1	0	55	0.043863	0.044152	0.04444	0.044727	0.045012	0.045297	0.04558	0.045862	0.046143	0.046423	0.046701	0.046979
V2	2	55	0.043863	0.044152	0.04444	0.044727	0.045012	0.045297	0.04558	0.045862	0.046143	0.046423	0.046701	0.046979
V1	0	60	0.044152	0.04444	0.044727	0.045012	0.045297	0.04558	0.045862	0.046143	0.046423	0.046701	0.046979	0.047255
V2	2	60	0.044152	0.04444	0.044727	0.045012	0.045297	0.04558	0.045862	0.046143	0.046423	0.046701	0.046979	0.047255
V1	0	65	0.04444	0.044727	0.045012	0.045297	0.04558	0.045862	0.046143	0.046423	0.046701	0.046979	0.047255	0.047531
V2	2	65	0.04444	0.044727	0.045012	0.045297	0.04558	0.045862	0.046143	0.046423	0.046701	0.046979	0.047255	0.047531
V1	0	70	0.044727	0.045012	0.045297	0.04558	0.045862	0.046143	0.046423	0.046701	0.046979	0.047255	0.047531	0.047805
V2	2	70	0.044727	0.045012	0.045297	0.04558	0.045862	0.046143	0.046423	0.046701	0.046979	0.047255	0.047531	0.047805
V1	0	75	0.045012	0.045297	0.04558	0.045862	0.046143	0.046423	0.046701	0.046979	0.047255	0.047531	0.047805	0.048078
V2	2	75	0.045012	0.045297	0.04558	0.045862	0.046143	0.046423	0.046701	0.046979	0.047255	0.047531	0.047805	0.048078
V1	0	80	0.045297	0.04558	0.045862	0.046143	0.046423	0.046701	0.046979	0.047255	0.047531	0.047805	0.048078	0.04835
V2	2	80	0.045297	0.04558	0.045862	0.046143	0.046423	0.046701	0.046979	0.047255	0.047531	0.047805	0.048078	0.04835

The q_c tab:

This tab is used for intermediate steps in the calculation. No user inputs are required. The table shows the convection heat loss from a 1 foot length of conductor.

Convected Heat Loss (q_c), Watts Per Foot of Conductor (max of qc0, kqc1, or kqc2)

2000 kcm Copper 127 str HD

Rating Condition	Wind Speed (ft/sec)	Condr Max Temp Deg C	-15	-10	-5	0	5	10	15	20	25	30	35	40
V1	0	50	20.40	18.37	16.41	14.51	12.66	10.88	9.17	7.53	5.97	4.50	3.13	1.88
V2	2	50	32.65	30.12	27.60	25.08	22.56	20.04	17.53	15.02	12.51	10.01	7.50	5.00
V1	0	55	22.28	20.22	18.22	16.27	14.39	12.56	10.80	9.10	7.47	5.93	4.47	3.11
V2	2	55	35.14	32.61	30.09	27.57	25.05	22.54	20.03	17.52	15.01	12.50	10.00	7.50
V1	0	60	24.18	22.09	20.05	18.07	16.14	14.27	12.46	10.71	9.03	7.42	5.88	4.43
V2	2	60	37.63	35.11	32.58	30.06	27.55	25.03	22.52	20.01	17.50	15.00	12.49	9.99
V1	0	65	26.10	23.98	21.91	19.89	17.92	16.01	14.15	12.36	10.62	8.96	7.36	5.84
V2	2	65	40.12	37.60	35.08	32.56	30.04	27.53	25.01	22.50	20.00	17.49	14.99	12.49
V1	0	70	28.04	25.89	23.78	21.73	19.73	17.78	15.88	14.04	12.26	10.54	8.89	7.30
V2	2	70	42.61	40.09	37.56	35.05	32.53	30.02	27.51	25.00	22.49	19.98	17.48	14.98
V1	0	75	29.99	27.81	25.68	23.59	21.55	19.57	17.64	15.76	13.93	12.17	10.46	8.82
V2	2	75	45.10	42.57	40.05	37.53	35.02	32.51	30.00	27.49	24.98	22.48	19.97	17.47
V1	0	80	31.96	29.75	27.59	25.47	23.40	21.38	19.42	17.50	15.63	13.83	12.07	10.38
V2	2	80	47.58	45.06	42.54	40.02	37.51	35.00	32.49	29.98	27.47	24.97	22.46	19.96

The μ_r tab:

This tab is used for intermediate steps in the calculation. No user inputs are required. The table shows the thermal conductivity of the air around the conductor.

Thermal Conductivity of Air (k_f) at Temperature , T_{film} W/ft (degrees C)

2000 kcm Copper 127 str HD

Rating Con	Wind Speed (ft/sec)	Condr Max Temp Deg C	-15	-10	-5	0	5	10	15	20	25	30	35	40
V1	0	50	0.007786	0.007843	0.0079	0.007957	0.008014	0.00807	0.008127	0.008184	0.008241	0.008297	0.008354	0.008411
V2	2	50	0.007786	0.007843	0.0079	0.007957	0.008014	0.00807	0.008127	0.008184	0.008241	0.008297	0.008354	0.008411
V1	0	55	0.007843	0.0079	0.007957	0.008014	0.00807	0.008127	0.008184	0.008241	0.008297	0.008354	0.008411	0.008467
V2	2	55	0.007843	0.0079	0.007957	0.008014	0.00807	0.008127	0.008184	0.008241	0.008297	0.008354	0.008411	0.008467
V1	0	60	0.0079	0.007957	0.008014	0.00807	0.008127	0.008184	0.008241	0.008297	0.008354	0.008411	0.008467	0.008524
V2	2	60	0.0079	0.007957	0.008014	0.00807	0.008127	0.008184	0.008241	0.008297	0.008354	0.008411	0.008467	0.008524
V1	0	65	0.007957	0.008014	0.00807	0.008127	0.008184	0.008241	0.008297	0.008354	0.008411	0.008467	0.008524	0.008581
V2	2	65	0.007957	0.008014	0.00807	0.008127	0.008184	0.008241	0.008297	0.008354	0.008411	0.008467	0.008524	0.008581
V1	0	70	0.008014	0.00807	0.008127	0.008184	0.008241	0.008297	0.008354	0.008411	0.008467	0.008524	0.008581	0.008637
V2	2	70	0.008014	0.00807	0.008127	0.008184	0.008241	0.008297	0.008354	0.008411	0.008467	0.008524	0.008581	0.008637
V1	0	75	0.00807	0.008127	0.008184	0.008241	0.008297	0.008354	0.008411	0.008467	0.008524	0.008581	0.008637	0.008694
V2	2	75	0.00807	0.008127	0.008184	0.008241	0.008297	0.008354	0.008411	0.008467	0.008524	0.008581	0.008637	0.008694
V1	0	80	0.008127	0.008184	0.008241	0.008297	0.008354	0.008411	0.008467	0.008524	0.008581	0.008637	0.008694	0.00875
V2	2	80	0.008127	0.008184	0.008241	0.008297	0.008354	0.008411	0.008467	0.008524	0.008581	0.008637	0.008694	0.00875

The q_s tab:

This tab is used for intermediate steps in the calculation. No user inputs are required. The table shows the heat gain to the conductor due to solar heat input. This is only used for day time ratings.

Solar Heat Gain (q_s), Watts Per Foot of Conductor

2000 kcm Copper 127 str HD **Clear** □[0.7 □[0.9

Rating Condition	Wind Speed (ft/sec)	Condr Max Temp Deg C	-15	-10	-5	0	5	10	15	20	25	30	35	40
V1	0	50	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458
V2	2	50	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458
V1	0	55	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458
V2	2	55	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458
V1	0	60	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458
V2	2	60	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458
V1	0	65	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458
V2	2	65	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458
V1	0	70	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458
V2	2	70	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458
V1	0	75	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458
V2	2	75	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458
V1	0	80	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458
V2	2	80	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458	10.458

The q_r tab:

This tab is used for intermediate steps in the calculation. No user inputs are required. The table shows the heat loss due to radiation from the hot conductor.

Radiated Heat Loss (q_r), Watts Per Foot of Conductor

2000 kcm Copper 127 str HD □[0.7 □[0.9

Rating Condition	Wind Speed (ft/sec)	Condr Max Temp Deg C	-15	-10	-5	0	5	10	15	20	25	30	35	40
V1	0	50	10.2563	9.6944	9.0995	8.4703	7.8057	7.1041	6.3644	5.5852	4.7650	3.9025	2.9962	2.0447
V2	2	50	10.2563	9.6944	9.0995	8.4703	7.8057	7.1041	6.3644	5.5852	4.7650	3.9025	2.9962	2.0447
V1	0	55	11.3525	10.7905	10.1957	9.5665	8.9018	8.2003	7.4606	6.6814	5.8612	4.9987	4.0924	3.1409
V2	2	55	11.3525	10.7905	10.1957	9.5665	8.9018	8.2003	7.4606	6.6814	5.8612	4.9987	4.0924	3.1409
V1	0	60	12.4999	11.9380	11.3431	10.7140	10.0493	9.3478	8.6081	7.8289	7.0087	6.1462	5.2399	4.2883
V2	2	60	12.4999	11.9380	11.3431	10.7140	10.0493	9.3478	8.6081	7.8289	7.0087	6.1462	5.2399	4.2883
V1	0	65	13.7003	13.1384	12.5435	11.9143	11.2497	10.5482	9.8085	9.0292	8.2090	7.3465	6.4402	5.4887
V2	2	65	13.7003	13.1384	12.5435	11.9143	11.2497	10.5482	9.8085	9.0292	8.2090	7.3465	6.4402	5.4887
V1	0	70	14.9551	14.3932	13.7983	13.1692	12.5045	11.8030	11.0633	10.2840	9.4638	8.6013	7.6950	6.7435
V2	2	70	14.9551	14.3932	13.7983	13.1692	12.5045	11.8030	11.0633	10.2840	9.4638	8.6013	7.6950	6.7435
V1	0	75	16.2660	15.7041	15.1092	14.4801	13.8154	13.1139	12.3742	11.5949	10.7747	9.9122	9.0059	8.0544
V2	2	75	16.2660	15.7041	15.1092	14.4801	13.8154	13.1139	12.3742	11.5949	10.7747	9.9122	9.0059	8.0544
V1	0	80	17.6347	17.0727	16.4779	15.8487	15.1840	14.4825	13.7428	12.9636	12.1434	11.2809	10.3746	9.4231
V2	2	80	17.6347	17.0727	16.4779	15.8487	15.1840	14.4825	13.7428	12.9636	12.1434	11.2809	10.3746	9.4231

The Resistance tab:

This tab is used for intermediate steps in the calculation. No user inputs are required. The table shows the resistance of the conductor based upon the conductor temperature.

Conductor Electrical Resistance (R), (Ohms/ft.)

2000 kcm Copper 127 str HD

Rating Condition	Wind Speed (ft/sec)	Condr Max Temp Deg C	-15	-10	-5	0	5	10	15	20	25	30	35	40
V1	0	50	6.1E-06	6.1E-06	6.1E-06	6.1E-06	6.1E-06	6.1E-06	6.1E-06	6.1E-06	6.1E-06	6.1E-06	6.1E-06	6.1E-06
V2	2	50	6.1E-06	6.1E-06	6.1E-06	6.1E-06	6.1E-06	6.1E-06	6.1E-06	6.1E-06	6.1E-06	6.1E-06	6.1E-06	6.1E-06
V1	0	55	6.2E-06	6.2E-06	6.2E-06	6.2E-06	6.2E-06	6.2E-06	6.2E-06	6.2E-06	6.2E-06	6.2E-06	6.2E-06	6.2E-06
V2	2	55	6.2E-06	6.2E-06	6.2E-06	6.2E-06	6.2E-06	6.2E-06	6.2E-06	6.2E-06	6.2E-06	6.2E-06	6.2E-06	6.2E-06
V1	0	60	6.3E-06	6.3E-06	6.3E-06	6.3E-06	6.3E-06	6.3E-06	6.3E-06	6.3E-06	6.3E-06	6.3E-06	6.3E-06	6.3E-06
V2	2	60	6.3E-06	6.3E-06	6.3E-06	6.3E-06	6.3E-06	6.3E-06	6.3E-06	6.3E-06	6.3E-06	6.3E-06	6.3E-06	6.3E-06
V1	0	65	6.5E-06	6.5E-06	6.5E-06	6.5E-06	6.5E-06	6.5E-06	6.5E-06	6.5E-06	6.5E-06	6.5E-06	6.5E-06	6.5E-06
V2	2	65	6.5E-06	6.5E-06	6.5E-06	6.5E-06	6.5E-06	6.5E-06	6.5E-06	6.5E-06	6.5E-06	6.5E-06	6.5E-06	6.5E-06
V1	0	70	6.6E-06	6.6E-06	6.6E-06	6.6E-06	6.6E-06	6.6E-06	6.6E-06	6.6E-06	6.6E-06	6.6E-06	6.6E-06	6.6E-06
V2	2	70	6.6E-06	6.6E-06	6.6E-06	6.6E-06	6.6E-06	6.6E-06	6.6E-06	6.6E-06	6.6E-06	6.6E-06	6.6E-06	6.6E-06
V1	0	75	6.7E-06	6.7E-06	6.7E-06	6.7E-06	6.7E-06	6.7E-06	6.7E-06	6.7E-06	6.7E-06	6.7E-06	6.7E-06	6.7E-06
V2	2	75	6.7E-06	6.7E-06	6.7E-06	6.7E-06	6.7E-06	6.7E-06	6.7E-06	6.7E-06	6.7E-06	6.7E-06	6.7E-06	6.7E-06
V1	0	80	6.8E-06	6.8E-06	6.8E-06	6.8E-06	6.8E-06	6.8E-06	6.8E-06	6.8E-06	6.8E-06	6.8E-06	6.8E-06	6.8E-06
V2	2	80	6.8E-06	6.8E-06	6.8E-06	6.8E-06	6.8E-06	6.8E-06	6.8E-06	6.8E-06	6.8E-06	6.8E-06	6.8E-06	6.8E-06

Appendix C

References

This PJM Substation Conductor Rating document was prepared using various industry standards as guides and references. These referenced documents are:

1. *IEEE Standard for Calculating the Current-Temperature Relationship of Bare Overhead Conductors*, IEEE Std 738-1993
2. *IEEE Guide for Design of Substation Rigid-Bus Structures*, IEEE Std 605-1998
3. *A Uniform Method for the determination of load capability of line terminal equipment*, ECAR 74-EEP-42, revised June 1974.
4. *ECAR Transmission Conductors Loss of Strength Due to Elevated Temperature, ECAR 74-TFP-37*, May 1974.
5. *Determining the Loadability of Line Terminal Equipment*, ECAR 88-EEP-42, July 1988
6. *Transmission Conductor Thermal Ratings*, ECAR 89-TFP-28, October 1989
7. *Bare Overhead Transmission Conductor Ratings*, PJM Interconnection, November 2000.