AmpCalc *- Cable Ampacity Calculations for Underground & Aerial Installations*
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Program Serial Number: 203402001
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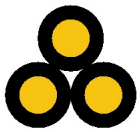
Filename: ex15a.ars
Instruction Manual Chapter 15 Example Problem
Example aerial system with isolated cable in air.



AERIAL SYSTEM DATA:

Type of Aerial System: Isolated in Air
Rep Calculation Method: NEC, S135
Cable Surface Emissivity: 0.920

Ambient Conditions:
Ambient Temperature: 40.0 Deg C
Wind Velocity: 0.00 mph
Solar Radiation Effects: None

NEHER-MCGRATH CALCULATION RESULTS:

495.9 calc amps/conductor at specified temp of 75.00 Deg

Type of Aerial System: Cable Isolated in Air
Quantity 3-1/c, 500 kcmil, 1.00 kV, Copper Conductor

NEC COMPARISON - TABLE 310.20
Adjusted NEC current = 496.0, base Table current = 496
Adjustment Factors: Ambient = 1.000, >3 cond = 1.000Copper

CABLE DATA:

Quantity 3-1/c, 500 kcmil, 1.00 kV, Copper Conductor
Cable Library: IEERUB_2, Cable Volume: IEERUB01
Cable Arrangement: Equilaterial
Cable Shielding: None
Applied System kV Line to Line: 0.48, 60 Hertz
Specified Temperature: 75.000 Deg C, (Held constant in calculation)
Specified Amps: 0.0

VOLTAGE DROP INPUTS & RESULTS:

Circuit Length: 500 Feet
Circuit Load: 495.9 Amps/conductor at 80.00 % PF Lagging
Cable Impedance: 0.0270 + j0.0304 Ohms/1000 feet
Voltage Drop: 3.568 %

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Calculation Method:
Distinct AMPACITY calculated based on user specified conductor temperature.

Summary of Results:

Cable Description	Cable Size	Sys kV	Temp	Amps	Rac	Watts/ft
3 - 1/c triplexed cables	500 kcmil	0.48	75.00	495.9	26.99	19.911

NEC Table Comparison:

			Derate Factors		
NEC Table	Table Amps	Adjusted Amps	Ambient	>3 Cond.	Tray
310.20	496	496.0	1.000	1.000	1.000

User System Input Data

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Aerial system filename	C:\Program Files (x86)\AmpCalc4\Sysfiles\ex15a.ars
Type of aerial system	Isolated in Air
Calculation Method	NEC, S135
Solar Radiation Effects	None
Ambient Temperature, (deg C)	40.0
Wind Velocity, (mph)	0.0
Cable surface coefficient of emissivity	0.92

Cable Position Input Data:

No.	Identifier	x Coord	# & Type	Cable Library	Cable Size	Shield	Sys kV	Duct Library	1/c Spc	Spec Temp
	System	y Coord	Cond.	Library Volume	Rated kV	Config	Sys Freq	Nom. Size	LF%	Spec Amps
1		0.000	3-1/c	IEERUB_2	500 kcmil	None	0.48	-	-	[75.000]
		0.000	Copper	IEERUB01	1.00	Equil.	60	-	-	0.0

Caution - Specified Temp and Amps are user input setpoints and do not necessarily represent a correct solution.
Bracketed value is user specified input variable which may be held constant in optional calculation.

Voltage Drop Calculations:

						Ohms/1000 feet/Cond.		Volt Drop (+%)	
No.	Identifier	Length (ft.)	Amps/Conductor	PF (%)		Resistance	Reactance	or Rise (-%)	
1		500	495.9	80.000	Lag	0.0270	0.0304	3.568	OK

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Load Flow Calculations:

No.	Identifier		Voltage		Current/Phase				Load Flow Power			kW Loss
	System		Mag	Deg	Amps	Deg	PF (%)		kVA	kW	kVAR	kVAR Loss
1		*Source--->*	480.0	0.00			79.6	Lag	412.2	328.0	249.7	9.956
		Load--->	462.9	-0.42	495.9	-37.29	80.0	Lag	397.5	318.0	238.5	11.223

Cable Library Volume Data:

No.	Identifier	Cable Library	Type	Temp	SIC	DF	Ins RHO	CU res	ks	3/c
	System	Lib Volume	kV	Shield?	SIC exp	DF exp	Jac RHO	AL res	kp	configuration
1		IEERUB_2	1/c	75	4.500	0.035	500	10.371	1.000	-
		IEERUB01	1.000	No	0.0000	0.0000	600	17.002	1.000	

Cable Library Size Data - Basic Cable Data Format:

No.	Identifier	Cable Size	Cable OD	1/c OD	Insulation thickness	Jacket thickness	Conductor		CU lay F	Shield Th.	Shield Rdc
	System						kcmil	Diameter	AL lay F	Shield Dia.	Calc Yse?
1		500 kcmil	1.189	-	0.1880	0.000	500.00	0.813	1.0200	-	-
									1.0200	-	-

CALCULATION RESULTS - Table 1 of 2

No.	Identifier	System	Temp	Amps	# Cond.	Loss Fac.	Watts/ft	Rac	Rdc	Wd	Dtd
1			75.000	495.9	3	0.000	19.911	26.994	25.729	0.0002	0.001

CALCULATION RESULTS - Table 2 of 2

No.	Yp	Qp	Spacing	GF1	GF2	Ri	Rj	Rsd	Rd	Rep	Rcap	Sun Tp
1	-	1.0000	1.189	-	-	0.9905	0.0000	-	-	4.2827	5.2733	0.00

Variable Definitions and Units:

Variable Label	Description	Units
# Cond	Number of conductors (not cables) at position	
1/c OD	For 3/c Cable, outside diameter of 1/c portion	Inches
1/c Spacing	Equivalent phase spacing for 1/c cables at different positions	Inches
3/c Configuration	Type of 3/c cable, round or sector	
Actual Fill %	Actual conduit fill	%

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Variable Definitions and Units:

Variable Label	Description	Units
AL lay F	Lay factor for aluminum conductor	
AL Res	Aluminum electrical resistivity	Cir mils ohms/ft
Allowable Fill %	Allowable conduit fill according to limits set by user or NEC defaults	%
Amps	Calculated or specified current on a per conductor basis	Amperes
Cable Lib	Cable data library descriptor	
Cable OD	Cable overall outside diameter	Inches
Cable Size	Cable size designation	
Cable Type	Cable type,1/c or 3/c	
Concrete thermal resistivity (RHO)	Concrete thermal resistivity	Deg C-cm/watt
Cond.	Conductor Material, Copper or Aluminum	
Conductor Diameter	Conductor diameter	Inches
Config	Cable configuration, non-applicable, equilateral, cradled or mixed	
CU lay F	Lay factor for copper conductor	
CU Res	Copper electrical resistivity	Cir mils ohms/ft
Current Mag	Magnitude of current used in load flow calculations	Amps
Current Deg	Phase angle of current used in load flow calculations	Degrees
Dissipation Factor	Insulation dissipation factor, (DF), overall DF = DF x e^(DF Exp x Temp)	
Dissipation Factor Exponent	Insulation dissipation factor exponent, overall DF = DF x e^(DF Exp x Temp)	
Distance from earth's surface to origin	Vertical distance from earth's surface to origin of coordinate system	Inches
Dist. top of ductbank to earth's surface	Vertical distance from top of ductbank concrete envelope to earth's surface	Inches
Dtd	Increment of conductor temperature rise due to dielectric losses	Deg C
Duct ID	Duct Inner diameter	Inches
Duct Library	Duct data library descriptor	
Duct RHO	Duct material thermal resistivity	Deg C-cm/watt
Duct Thickness	Duct wall thickness	Inches
Duct Type	Whether duct material is Non-magnetic, Steel or Iron	
Ductbank Geometric Factor	Calculated ductbank geometric factor	
Ductbank Height	Height of ductbank concrete envelope	Inches
Ductbank Width	Width of ductbank concrete envelope	Inches
dx	Ficticious diameter at which the effect of loss factor commences	Inches
Earth temperature	Earth ambient temperature	Deg C
Earth thermal resistivity (RHO)	Earth thermal resistivity	Deg C-cm/watt
GF1	Geometric factor for 3/c cable applying to insulation resistance	
GF2	Geometric factor for 3/c cable applying to dielectric loss	
Grd OD	Overall outer diameter of ground cables at position	Inches
Grd Qty	Quantity of ground cables at position (needed only for conduit fill calculations)	
Grd Size	Size of ground cables at position	
Grd Type	Whether ground cables are Insulated or bare	
Identifier	Cable position identifier assigned by user	
Ins RHO	Thermal resistivity of insulation	Deg C-cm/watt
Insulation Thickness	Cable insulation thickness	Inches
Ipf	Insulation power factor, overall Ipf = Ipf x e^(Ipf Exp x Temp)	
Ipf Exp	Insulation power factor exponent, overall Ipf = Ipf x e^(Ipf Exp x Temp)	
Jac RHO	Cable jacket thermal resistivity	Deg C-cm/watt
Jacket Thickness	Cable jacket thickness	Inches
Jam Ratio	Ratio of duct ID to cable OD, to be OK for 3 cables must be < 2.8 or > 3.2	
kcmil	Conductor area	Thou. circ mils
kp	Conductor proximity effect factor	
ks	Conductor skin effect factor	

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Variable Label	Description	Units
kV	Rated cable line-to-line kilovolts	kilovolts
kVA	Circuit three phase load flow kilovoltamperes for all cables at position	kVA
kVAR	Circuit three phase load flow kilovars for all cables at position	kVAR
kVAR Loss	Total Circuit three phase kilovars losses for all cables at position	kVAR
kW	Circuit three phase load flow kilowatt for all cables at position	kW
kW Loss	Total Circuit three phase kilowatt losses for all cables at position	kW
Length	Circuit length, (one-way distance for dc as well as ac)	Feet
LF%	Load factor	%
Lib Volume	Cable Library data volume tag	
LOG10(Fd)	Log (base 10) of distance product factor	
Loss Fac	Loss factor	
Neut OD	Overall outer diameter of neutral cables at position	Inches
Neut Qty	Quantity of neutral cables at position (needed only for conduit fill calculations)	
Neut Size	Size of neutral cables at position	
No.	Cable position number not including inactive positions	
Nom. Size	Nominal duct size	Inches
Number of cable positions in system	Number of active cable positions in system calculation	
PF %	Load Power Factor, (for voltage drop calcs)	%
Ph OD	Overall outer diameter of phase cables at position	Inches
Ph Qty	Quantity of phase cables at position	
Ph Size	Size of phase cables at position	
Qp	Loss ratio = Losses in (Conductor + Shield + Duct) / Conductor	
Qs	Loss ratio = Losses in (Conductor + Shield) / Conductor	
Qty-Type	Quantity and type (1/c or 3/c) of cables at position	
Rac	Conductor ac resistance at conductor specified or rated temperature	microhms/foot
Rated kV	Cable line-to-line kilovolt rating	kilovolts
Rcap	Overall thermal resistance between conductor & ambient	Thermal ohm-ft
Rd	Duct thermal resistance	Thermal ohm-ft
Rdc	Conductor dc resistance at conductor specified or rated temperature	microhms/foot
Reactance	Conductor ac reactance used for voltage drop calcs	ohms/1000 feet
Rep	Thermal resistance at interface zone between cable or conduit surface & ambient air	Thermal ohm-ft
Resistance	Conductor ac resistance used for voltage drop calcs	ohms/1000 feet
Ri	Insulation thermal resistance	Thermal ohm-ft
Rj	Cable Jacket thermal resistance	Thermal ohm-ft
Rsd	Thermal resistance between cable exterior and duct interior	Thermal ohm-ft
Shield	Cable shielded? Yes or No	
Shield	Shield grounding, No shield, Shield w/1 end grd or Shield w/2 end grd	
Shield Dia	Shield mean diameter	Inches
Shield Rdc	Shield dc resistance	microhms/foot
Shield Th	Shield thickness	Inches
Shld X	Mutual reactance conductor to shield	Microhms/foot
SIC	Insulation Specific Inductive capacitance (SIC), SIC = SIC x e^(SIC exp x Temp)	
SIC Exp	Insulation SIC exponent, overall SIC = SIC x e^(SIC exp Temp)	
Size	Cable size designation	
Spacing	Spacing between conductors in the same phase group	Inches
Specified Amps	Specified conductor current	Amperes
Specified Temp	Specified conductor temperature	Deg C
Sys Freq	Applied power frequency in cable	Hertz
Sys kV	Applied cable line-to-line kilovolts	kilovolts

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Variable Label	Description	Units
System	Number of system (assigned in order entered)	
Temp	Calculated or specified total conductor temperature	Deg C
Thermal Factor	Factor specifying relative heating at each cable position	
Type of underground system	Type of underground system, ductbank or direct buried	
Underground system filename	Path and *.ugs filename where underground system data stored	
Voltage Mag	Source or load voltage magnitude in load flow calcs	Volts
Voltage Deg	Source or load voltage phase angle in load flow calcs	Degrees
Volt Drop (+%) or Rise (-%)	Voltage drop or rise across circuit length, = 100 x (Vsource-Vload) / Vsource	%
Watts/ft	Total cable watts loss per foot	Watts/foot
Wd	Cable dielectric loss	Watts/foot
x Coord	Position x coordinate	Inches
y Coord	Position y coordinate	Inches
Yc	Increment of Rac/Rdc ratio due to conductor effects = Ycs+Ycp	
Ycp	Increment of Rac/Rdc ratio due to conductor proximity effect	
Ycs	Increment of Rac/Rdc ratio due to conductor skin effect	
Yp	Increment of Rac/Rdc ratio due to pipe or conduit losses	
Ys	Increment of Rac/Rdc ratio due to total shield losses = Ysc + Yse	
Ysc	Increment of Rac/Rdc ratio due to circulating currents in shield	
Yse	Increment of Rac/Rdc ratio due to eddy currents in the shield	