Heat Load + Airflow Calculation Equations Listed Below are Applied to Each Room and Each Duct Section of the Building

	GENERAL EQUATION	FORMULA		DESCRIPTION
8.10	Net Roof Area	NRA=GRA-SA	square feet	net roof area = gross roof area - skylight area
8.20	Net Wall Area	NWA=GWA-(DA+VGA)	square feet	net wall area = gross wall area - (door area + vertical glass area)
8.30	Converting Air Changes per Hour to Ventilation CFM	CFMV=(ACHxTVOL)/60	cubic feet	cubic feet per minute ventilation = (air change per hour x total volume) / 60
8.40	Converting Air Changes per Hour to Infiltration CFM	CFMI=(ACHxTVOL)/60	cubic feet	cubic feet per minute infiltration = (air change per hour x total volume) / 60
	HEAT LOSS EQUATION	**FORMULA**		**DESCRIPTION**
8.5	Heat Loss at Wall, Partitions, Doors, Glass, Roofs, Floors	Qh=UxWTDxA	sbtuh	sensible heat loss btuh out of surface = Uvalue x winter temperature difference x area square feet
8.6	Heat Loss at Envelope Componets Per Room	Qhs=Qhw+Qhd+Qhg+Qhr+Qhf	sbtuh	sensible heat loss for room = heat loss wall + heat loss door + heat loss glass + heat loss roof + heat loss floor
8.7	Heat Loss at Ductwork	Qhdu=(Qhs+Qhi)xFx	sbtuh	sensible heat loss duct = (heat loss structural + heat loss infiltration) x duct heat loss factor
8.8	Heat Loss from Infiltration	Qhi=1.1xACFxCFMixWDT	sbtuh	sensible heat loss infiltration = 1.1 x altitude correction factor x cubic feet minute infiltration x winter temperature difference
8.8	Heat Loss from Ventilation	Qhv=1.1xACFxCFMvxWDT	sbtuh	sensible heat loss ventilation = 1.1 x altitude correction factor x cubic feet minute ventilation x winter temperature difference
8.9	Heat Loss at Slab Edge	Qslab=FvaluexWTDh+Lexp	sbtuh	sensible heat loss slab edge = slab f value x winter temperature difference + running feet of exposed slab edge
8.10	Heat Loss at Below Grade Walls	Qb=UxWTDhxA	sbtuh	sensible heat loss below grade wall = Uvalue x winter temperature difference below grade x area square feet
8.11	Heat Loss per Room	Qhr=Qhs+Qhdu+Qhi	sbtuh	sensible heat loss room = heat loss of structural components + heat loss ductwork + heat loss infiltration
8.12	Heat Loss Entire Building	Qh=Qhs+Qhdu+Qhi+Qhv	sbtuh	sensible heat loss entire building = heat loss of structural components + heat loss ductwork + heat loss infiltration + heat loss ventilation
	HEAT GAIN EQUATION	**FORMULA**		**DESCRIPTION**
8.13	Heat Gain at Walls, Partitions, Doors, Roofs, and Floors	Qs=UxSTDsxA	sbtuh	sensible heat gain = Uvalue x summer temperature difference sensible x area square feet
8.14	Heat Gain at Glass at Un Shaded by Exterior Overhang	Qsg=HTMsxA	sbtuh	sensible heat gain un shaded glass = heat transfer multiplier x area square feet including frame
8.15	Height of Un Shaded Portion of Glass	Hu=Ht-[(OhpxSLM)-Ho]	feet	height of un shaded glass = glass height - [(overhang projection x shade line multiplier) - height of overhang]
8.16	Heat Gain for Glass Shaded by Exterior Overhang	Qsgs=(HuxWxHTMng)+[(Ht-Hu)xWxHTMs]	sbtuh	sensible heat gain shaded glass = (un shaded glass height x width of glass x heat transfer multiplier north glass) + [(glass total height - glass un shaded height) x width of glass x heat transfer multiplier for actual glass direction]
8.17	Heat Gain of Room Envelope Components	Qss=Qsw+Qsd+Qsgu+Qsgs+Qsr+Qsf	sbtuh	sensible heat gain for room components = sensible heat gain wall + sensible heat gain doors + sensible heat gain un shaded glass + sensible heat gain shaded glass + sensible heat gain roof + sensible heat gain floor
8.18	Heat Gain from People	Qsp=QpxNP	sbtuh	sensible heat gain for people = sensible btuh per person x number of people with same activity level
8.19	Heat Gain from People	QLp=QlpxNP	lbtuh	latent heat gain for people = latent btuh per person x number of people with same activity level
8.20	Heat Gain from Appliances	Qse=NAppxQaxIUFxPUF	sbtuh	sensible heat gain for appliances = number of appliances x sensible heat output per appliance x average in use output factor x percent used per hour
8.21	Heat Gain from Appliances	QLe=NAppxQLaxIUFxPUF	lbtuh	latent heat gain for appliances = number of appliances x latent heat output per appliance x average in use output factor x percent used per hour
8.22	Heat Gain at Ductwork	Qsdu=(Qss+Qsi+Qse+Qsp+QsL)xFx	sbtuh	sensible heat gain ductwork = (heat gain structural + heat gain infiltration + heat gain appliances + heat gain people + heat gain lights) x duct load factor
8.23	Total Heat Gain Infiltration	Qsi=1.1xACFxCFMixSTD	sbtuh	sensible heat gain infiltration = 1.1 x altitude correction factor x cubic feet minute infiltration x summer temperature difference
8.23	Total Heat Gain Ventilation	Qsi=1.1xACFxCFMvxSTD	sbtuh	sensible heat gain ventilation = 1.1 x altitude correction factor x cubic feet minute ventilation x summer temperature difference
8.24	Total Heat Gain Infiltration	Qli=.068xACFxCFMixGrDiff	lbtuh	latent heat gain infiltration = .68 x altitude correction factor x cubic feet minute infiltration x grains of moisture difference
8.24	Total Heat Gain Ventilation	Qli=.068xACFxCFMvxGrDiff	lbtuh	latent heat gain ventilation = .68 x altitude correction factor x cubic feet minute ventilation x grains of moisture difference
8.25	Heat Gain per Room	Qsr=(Qss+Qsdu+Qsi+Qsp+Qse+QsL)xTSM	sbtuh	sensible heat gain room = (heat gain components + heat gain ducts + heat gain infiltration + heat gain people + heat gain appliances + heat gain lights) x temperature swing multiplier
8.26	Heat Gain for Entire Building	Qs=(Qss+Qsdu+Qsi+Qsv+Qsp+Qse+QsI)xTSM	sbtuh	sensible heat gain entire building = (heat gain components + heat gain ducts + heat gain infiltration + heat gain people + heat gain appliances + heat gain lights) x temperature swing multiplier
8.27	Heat Gain for Entire Building	QL=Qlp+Qle+Qli+Qlv	lbtuh	latent heat gain of entire building = heat gain people + heat gain appliances + heat gain infiltration + heat gain ventilation
8.28	Total Cooling Tons Required	Tons=(Qs+Ql)/12000	tons	cooling tons = (sensible heat gain entire building + latent heat gain entire building) / 12000
8.33	Sensible Heat Gain from Lights	QsL=QLx3.413	sbtuh	sensible heat gain lights = lighting watts x 3.413
	AIRFLOW EQUATION	**FORMULA**		**DESCRIPTION**
8.29	Total Heating Supply Air Cubic Feet Per Minute	CFMh=Qh/(1.1xAFxCTD)	cubic feet	cubic feet minute heating = heat loss entire building / (1.1 x altitude factor x heating coil temperature difference) Altitude Factor = [(1-6.8745 x 10_6 x E{elevation in feet})_5.2561] x 14.696 x 2.036 / 29.921
8.30	Total Cooling Supply Air Cubic Feet Per Minute	CFMs=Qs/(1.1xAFxCTD)	cubic feet	cubic feet minute cooling = sensible heat gain entire building / (1.1 x altitude factor x cooling coil temperature difference) Altitude Factor = [(1-6.8745 x 10_6 x E{elevation in feet})_5.2561] x 14.696 x 2.036 / 29.921
8.31	Room Heating Supply Air Cubic Feet Per Minute	CFMroom=CFMtotalx(Qhr/Qs)	cubic feet	cubic feet minute heating room = cubic feet minute heating entire building x (heat loss per room / heat loss of entire building)
8.32	Room Cooling Supply Air Cubic Feet Per Minute	CFMroom=CFMtotalx(Qsr/Qs)	cubic feet	cubic feet minute cooling room = cubic feet minute cooling entire building x (sensible heat gain per room / sensible heat gain of entire building)
8.34	Grains of Moisture Difference	GrDiff=GrainsOD-GrainsID	grains	moisture grains difference = grains of moisture outdoors - grains of moisture indoors
8.35	Barometric Pressure	BP=Kx[1-(6.8745x10_6xAlt)]_5.02561	bar press	barometric pressure = (K = 29.921) x [1 - (6.8745 x 10_6 x Altitude in feet)] _5.02561
8.36	Air Density	Den=BP/[(T+460)x10.26563]	lbs cu ft	air density = w.g. barometric pressure / [(air temperature + 460) x 10.26563]
8.37	Velocity	Vel=(CFMx183.35)/D_2	feet minute	feet per minute velocity = (cubic feet per minute x 183.35) / duct diameter squared)
8.38	Velocity Pressure	VP=(Vel_2xDen)/1096.5_2	feet minute	velocity pressure = (velocity feet per minute squared x air density pound per cubic feet) / 1096.5 squared
8.39	Equivalent Circular Diameter for Rectangular Conversion	De=1.3x(LenxWid)_.625/(Len+Wid)_.250	dec feet	duct diameter equivalence = 1.3 x (length of duct x width of duct)_.625 / (length of duct x width of duct)_.250
8.40	Reynolds Number	Re=(5xDiaxDenxVel)/.0438	Rn	reynolds number = (5 x duct diameter x air density pound per cubic foot x air velocity fpm) / .0438
8.41	Friction Factor	FF=PressDropxDia/(VPx1200)	Ffactor	friction factor = design pressure drop per square inch x duct diameter / (velocity pressure in wg x 1200)
8.42	Colebrook Equation	FF=[1/(-2LOG((12RF/(3.7xDia))+2.51/(RexFF_.5)))]_2	Colebrook	friction factor = [1 / (-2 log to the base 10 ((12 roughness factor / (3.7 x duct diameter)) +2 .51 / (reynold number x friction factor .5)))]_2