

Condensation Analysis Of Air Flow
Thru Insulated Pipe Or Duct

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DUCT WORK HEAT GAIN EXAMPLE
Project Number:
Heat Gain

Ambient Conditions on Outside of Duct

Dry Bulb Temperature=	90.00	Degrees F
Ambient Dew Point Temperature=	82.93	Degrees F
Relative Humidity=	80.0000	%
Air velocity over Pipe or Duct=	100.0000	Ft/Min
	1.1364	Miles/Hr

Pipe or Duct Data

Duct Height=	12.0000	Inches
Duct Width=	12.0000	Inches
Pipe or Duct Internal Area=	0.9867	Sq. Ft.
Pipe or Duct Material=	Aluminum Duct	
Pipe or Duct Thickness=	0.0400	Inches
Pipe or Duct Pressure=	0.0000	Inches Water
Pipe or Duct Thermal Conductivity=	1070.0000	Btu-In/Hr-Ft ² -F

Air Flow Inside Pipe or Duct

Dry Bulb Temperature=	55.00	Degrees F
Dew Point Temperature=	48.8204	Degrees F
Inside Pipe or Duct Surface Temp.=	55.3141	Degrees F
Condensation??	NO	
Relative Humidity=	80.0000	%
Mole Fraction of Water in Mix=	0.011600	
ACFM=	2,467.1345	Ft ³ /Min
Inside Air Flow Velocity=	2,500.36	Ft/Min
	41.6727	Ft/Sec
Dew Point Temperature=	48.8204	Degrees F
Dry Bulb Temp.at End of Run=	55.2282	Degrees F
Condensation???	NO	

Percentages of Gases in Mixture

	% Volume	% Mass
Nitrogen	77.1782	74.9665
Oxygen	20.7046	22.9724
Argon	0.9572	1.3258
Water	1.159973	0.724596

Air Density Inside Duct=	0.0767	Lbs/Ft ³
Thermal Conductivity of Air Mix	0.0141	Btu/Hr-Ft-F
Absolute Viscosity of Air Mix	.0000114731	lb/Ft-Sec
	170.7696	Micropoise

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Specific Heat of Air mix=	0.2403 Btu/lb - F
Reynolds #	311,875.0413
Prandtl #	0.7027
Nusselt #	496.1721
Inside Pipe or Duct air film=	6.2488 Btu/Hr-Ft ² -F
Inside Air Film Resistance=	0.1600 Hr-Ft ² -F/Btu

Insulation and Jacket Data

Insulation Type=	Fiberglass - 6.0 lb/ft ³ (450 F)
Insulation Thickness=	3.5000 Inches
Type of Jacket=	ALUMINUM JACKET - OXIDIZED
Jacket Thickness=	0.0160 Inches
Insulated Duct Height=	19.0320 Inches
Insulated Duct Width=	19.0320 Inches
Inside Duct Equiv. Diameters=	13.4503 Inches
Insulated Duct Equiv. Diameters=	24.2323 Inches
Outside Surface Temperature=	85.8083 Degrees F
Ambient Dew Point Temperature=	82.9302 Degrees F
Condensation??	NO
Average Temp Across Insulation=	70.4040 Degrees F
Insulation Thermal Conductivity=	0.2252 Btu-Inch/ Hour-Ft ² -F
Jacket Emissivity=	0.1100

Energy Data

Linear Feet of Pipe or Duct=	50.0000 Feet
Pipe or Duct Area per Linear Foot=	6.3440 SqFt./Lin Ft.
Total Outside Area=	317.2000 Sq. Ft.
Surface Shape and Orientation=	Horizontal Plate, Cooler than Air, Facing Up

Free Convection 'C' Value=	0.8900
Convection Heat Loss Coefficient (HCV)=	0.3444 Btu/Hr-Ft ² -F
Radiant Heat Loss Coefficient (HR)=	0.1237 Btu/Hr-Ft ² -F
Inside Air Film Resistance=	0.1600 Hour-Ft ² -F/Btu
Outside Air Film Resistance=	2.1359 Hour-Ft ² -F/Btu
Pipe or Duct Resistance=	0.0000 Hour-Ft ² -F/Btu
Insulation Resistance=	15.5386 Hour-Ft ² -F/Btu
Total Resistance=	17.8346 Hour-Ft ² -F/Btu
Heat Flow FT ² =	1.9625 Btu/Hr/Ft ²
Heat Flow Linear Foot=	12.4500 Btu/Hr/Lin Ft
Total Heat Flow per Hour=	622.4985 Btu/Hr.

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