



# MULTI-ZONE HEAT LOSS DESIGN ANALYSIS

Page 1

DESIGNER: Donald	DATE:	ENERGY CODE INFORMATION	JOB NAME: McGreal Farms
COMPANY: Radian		FLOOR AREA: 11,200 SQ. FT.	COMPANY: Consolidated Building Centers
ADDRESS: 1035 W		WINDOW AREA: 45 SQ. FT.	ADDRESS:
CITY, ST: Wausa		% OF GLASS TO FLOOR AREA: 0.4%	CITY, ST:
PHONE: 715-85			PHONE:

DESCRIPTION	"U"-VALUE or R-VALUE	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5	ZONE 6	UNITS	HEAT LOSS TOTALS
INSULATED WINDOW AREA (U-VALUE)	0.39	45						SQ. FT.	983 BTU/HR
INSULATED DOOR AREA (U-VALUE)	0.15	2,236						SQ. FT.	18,782 BTU/HR
INSULATED SKYLIGHTS (U-VALUE)	0.66							SQ. FT.	BTU/HR
EXTERIOR WALL HEIGHT----->		20.0						HEIGHT	
LENGTH OF UNHEATED EXTERIOR EDGE----->		440						LN. FT.	
INSULATED WALL AREA (R-VALUE)	19.00	6,519						SQ. FT.	19,214 BTU/HR
ADDITIONAL INSULATED WALL AREA	19.00							SQ. FT.	BTU/HR
TOTAL GROSS FLOOR AREA----->		11,200						SQ. FT.	
INSULATED FLOOR AREA (R-VALUE)	19.00							SQ. FT.	BTU/HR
INSULATED SLAB AREA* (R-VALUE)	10.00							SQ. FT.	BTU/HR
INSULATED CEILING AREA (R-VALUE)	30.00							SQ. FT.	BTU/HR
ADDITIONAL AIR VOLUME----->								CU. FT.	
TOTAL AIR VOLUME ----->		224,000						CU. FT.	225,792 BTU/HR
AIR CHANGES PER HOUR----->		1.00	0.09	0.09	0.50	0.50	0.50	ACH	
TOTAL HEAT LOSS PER ZONE----->		264,771						BTU/HR	264,771 BTU/HR

\*SLAB LOSS FIGURED BELOW

## KITEC® RADIANT DESIGN WORKSHEET

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INPUT VALUES	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5	ZONE 6	UNITS
To-OUTDOOR DESIGN TEMPERATURE	4	4	4	4	4	4	DEG. F
Ta-ROOM TEMPERATURE	60	70	70	70	70	70	DEG. F
Qr-RADIANT FLOOR LOAD AT DESIGN CONDITIONS	264,771						BTU/HR
A-NET RADIANT SLAB SURFACE AREA	11,200						SQ. FT.
Ua-ENERGY TRANSFER FROM RADIANT SURFACE	2	2	2	2	2	2	BTU/HR/SQ. FT./DEG. F
TYPE OF FLOOR or SURFACE COVERING	Bare Slab	Bare Slab	Bare Slab	Bare Slab	Bare Slab	Bare Slab	
Uc-U-VALUE OF FLOOR COVERING	30.00	30.00	30.00	30.00	30.00	30.00	BTU/HR/SQ. FT./DEG. F
Us-ESTIMATED U-VALUE WITHIN SLAB	1.21	1.21	1.21	1.21	1.21	1.21	BTU/HR/SQ. FT./DEG. F
De-DEPTH OF TUBING IN SLAB OR THICKNESS OF FLOOR	2.00	2.00	2.00	2.00	2.00	2.00	INCHES
Qi-INTERIOR SLAB HEAT LOSS	2.00	2.00	2.00	2.00	2.00	2.00	BTU/HR/SQ. FT.
Ue-U-VALUE AT SLAB EDGE	0.10	0.10	0.10	0.10	0.10	0.10	BTU/HR/SQ. FT./DEG. F
TYPE OF TRANSFER FLUID	25% Glycol	25% Glycol	25% Glycol	25% Glycol	25% Glycol	25% Glycol	FLUID
Df-DENSITY OF HEAT TRANSFER FLUID	8.55	8.55	8.55	8.55	8.55	8.55	LBS/GAL.
Cf-HEAT CAPACITY OF HEAT TRANSFER FLUID	0.93	0.93	0.93	0.93	0.93	0.93	BTU/LB/DEG. F
Td-FLUID TEMPERATURE DROP	20	20	20	20	20	20	DEG. F
Le-DESIRED LOOP LENGTH	250	250	250	250	250	250	FT.
Sp-AVERAGE PIPE SPACING	8	8	8	8	8	8	INCHES ON CENTER
INSTALLATION METHOD	Slab on Grade	Slab on Grade	Slab on Grade	Slab on Grade	Slab on Grade	Slab on Grade	
CALCULATED VALUES	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5	ZONE 6	
1. Tr-DESIGN TEMPERATURE DIFFERENTIAL	56	66	66	66	66	66	DEG. F
2. Qu-HEAT LOAD PER SQ. FT. OF RADIANT SURFACE	23.64						BTU/HR/SQ. FT.
3. Tc-SURFACE TEMPERATURE OF FLOOR COVERING	72						DEG. F

4. Ts-SURFACE TEMPERATURE OF RADIANT SURFACE	73						DEG. F		
5. Tf-AVERAGE TEMPERATURE OF TRANSFER FLUID	93						DEG. F		
6. Ti-SUPPLY TEMPERATURE OF TRANSFER FLUID	103						DEG. F		
7. Te-TEMPERATURE DIFFERENCE AT SLAB EDGE	69						DEG. F		
8. Qi-INTERIOR SLAB HEAT LOSS TO GROUND							BTU/HR		
9. Qe-EDGE SLAB HEAT LOSS TO GROUND							BTU/HR		
10. Qg-TOTAL SLAB HEAT LOSS TO GROUND							BTU/HR		
11. Qt-TOTAL HEAT LOAD AT DESIGN CONDITIONS	264,771						BTU/HR		
12. Qut-TOTAL HEAT LOAD PER SQ. FT.	23.64						BTU/HR/SQ. FT.		
13. V-HEAT TRANSFER FLUID FLOW RATE	27.75						GPM		
14. Pd-PRESSURE DROP ACROSS KITEC® PIPING	0.76						PSI		
SELECTED KITEC® PIPE SIZE†	1/2" KITEC®						SIZE		
TOTAL NUMBER OF LOOPS	67						LOOPS		
ESTIMATED TOTAL FEET OF KITEC® RADIANT PIPING	16,750						LN. FT.		
REQUIRED AUXILIARY HEAT OUTPUT AT DESIGN							BTU/HR		
HYDRONIC BASEBOARD (580 BTU/FT. @180 DEG. F)							LN. FT.		
OPTIONALLY INCREASE RADIANT SURFACE AREA							SQ. FT.		
ENTER ACTUAL SUPPLIED AUXILIARY HEAT OUTPUT---->							BTU/HR		
†For Larger Size Consult IPEX, Inc. St. Louis Weather Data Information							Data Summary Table No. 1		
FUEL TYPE	LOCAL FUEL COST	UNITS	COST PER MILLION BTU BASED ON 100% EFFICIENCY		Deg. Day Base	TOTAL Deg. Days	TOTAL RADIANT SURFACE: 11,200 SQ. FT. REVISED HEAT LOSS: 264,771 BTU/HR		
NATURAL GAS	\$0.95	THERM	\$9.50		65 DEG. F	4,900	TOTAL FLOW RATE: 27.75 GPM		
ELECTRICITY	\$0.08	PER KWH	\$23.44		60 DEG. F	3,626	AVERAGE SUPPLY TEMP: 103 DEG. F		
OIL		PER GAL.			55 DEG. F	2,429	TOTAL NUMBER OF LOOPS: 67 LOOPS		
PROPANE	\$2.05	PER GAL.	\$22.41		50 DEG. F	1,482	TOTAL KITEC® FOOTAGE: 16,750 LN. FT.		
FUEL/ EFFICIENCY		TYPE	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5	ZONE 6	ZONE COST TOTAL
NATURAL GAS	90%	CENTRAL FORCED AIR	\$5,869.09						\$5,869.09
	90%	ZONED HYDRO-AIR™ HEAT	\$4,994.60						\$4,994.60
	90%	ZONED RADIANT FLOOR	\$4,343.13						\$4,343.13
ELECTRICITY	100%	CENTRAL FORCED AIR	\$13,033.09						\$13,033.09
	100%	ZONED HYDRO-AIR™ HEAT	\$11,091.16						\$11,091.16
	100%	ZONED RADIANT FLOOR	\$9,644.48						\$9,644.48
OIL	90%	CENTRAL FORCED AIR							
	90%	ZONED HYDRO-AIR™ HEAT							
	90%	ZONED RADIANT FLOOR							
PROPANE	90%	CENTRAL FORCED AIR	\$13,844.88						\$13,844.88
	90%	ZONED HYDRO-AIR™ HEAT	\$11,781.99						\$11,781.99
	90%	ZONED RADIANT FLOOR	\$10,245.21						\$10,245.21
NOTE-These calculated annual cost estimates are based on 20 year average weather data and do not represent a guarantee of performance. Estimates are for space heating only and do not include the effects of passive solar or other internal gains as these factors are impossible to predict or control. These estimates should be used for comparative purposes only! All area measurements and "U"-Values are supplied by the Builder and/or the Architect. IPEX, Inc. assumes no responsibility for the accuracy of these measurements. All calculations are based upon these figures. Local fuel cost are estimated as closely as possible from local sources. It is the responsibility of the owner to obtain a quote for the cost of these fuels from the various suppliers. Your actual cost will vary from these figures, based on lifestyle, meter charges, connection fees and other additional charges. These annual cost comparisons are for space heating only, and <u>do not</u> include the cost of Domestic Hot Water, lighting and other energy uses.									
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**Worksheet No. 1**

Provides total Heat Loss for each area in BTU/HR.

AREA	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5	ZONE 6
WINDOW	983					
DOOR	18,782					
SKYLIGHT						
WALL 1	19,214					
WALL 2						
FLOOR						
SLAB						
CEILING						
AIR INFILTRATE	225,792					
TOTAL----->	264,771					

**Notes:**
**Window Area**

Triple Glazed ▼

**Door Area**

Insulated Core ▼

**Skylight Area**

Double Glazed ▼

**Wall Area No. 1**

6" Insulation ▼

**Wall Area No. 2**

6" Insulation ▼

**Floor Loss Area**

6" Insulation ▼

**Slab Loss Area**

2" Insulation ▼

**Ceiling Loss Area**

10" Fiberglass ▼

☐

CANAD

Calgary ▼

☒

U.S.A.

St. Louis ▼

**Your project contains one or more of the following elements:**

- |   |  |                                       |
|---|--|---------------------------------------|
| <input type="checkbox"/> Commercial     | <input type="checkbox"/> New Construction  | <input type="checkbox"/> Natural Gas  |
| <input type="checkbox"/> Residential    | <input type="checkbox"/> Retrofit/Remodel  | <input type="checkbox"/> Electricity  |
| <input type="checkbox"/> Industrial     | <input type="checkbox"/> System Upgrade    | <input type="checkbox"/> Fuel Oil     |
| <input type="checkbox"/> Radiant Floor  | <input type="checkbox"/> Multi-Zone        | <input type="checkbox"/> Propane      |
| <input type="checkbox"/> Domestic Hot   | <input type="checkbox"/> Hydro-Air Heat    | <input type="checkbox"/> Wood Heat    |
| <input type="checkbox"/> Domestic Cold  | <input type="checkbox"/> Hydro-Air Cool    | <input type="checkbox"/> Coal Heat    |
| <input type="checkbox"/> Ground Loop    | <input type="checkbox"/> Hydro-Baseboard   | <input type="checkbox"/> Solar Heat   |
| <input type="checkbox"/> Root Bed Heat  | <input type="checkbox"/> Spa/Pool Heating  | <input type="checkbox"/> Ice Storage  |
| <input type="checkbox"/> Sports Field   | <input type="checkbox"/> Sauna/Jacuzzi     | <input type="checkbox"/> Heat Storage |
| <input type="checkbox"/> Sterilize Soil | <input type="checkbox"/> Outdoor Controls  | <input type="checkbox"/> Waste Heat   |
| <input type="checkbox"/> Eave Melting   | <input type="checkbox"/> Heat Distribution | <input type="checkbox"/> Heat Pump    |
| <input type="checkbox"/> Compressed Air | <input type="checkbox"/> Cool Distribution | <input type="checkbox"/> Chiller      |

**Floor Covering**
**Fluid Type**
**Installation Type**
**Desired Pipe Size**
**Notes:**

ZONE 1	Bare Slab ▼	25% Glycol ▼	Slab on Grade ▼	1/2" KITEC® ▼
ZONE 2	Bare Slab ▼	25% Glycol ▼	Slab on Grade ▼	1/2" KITEC® ▼
ZONE 3	Bare Slab ▼	25% Glycol ▼	Slab on Grade ▼	1/2" KITEC® ▼
ZONE 4	Bare Slab ▼	25% Glycol ▼	Slab on Grade ▼	1/2" KITEC® ▼
ZONE 5	Bare Slab ▼	25% Glycol ▼	Slab on Grade ▼	1/2" KITEC® ▼
ZONE 6	Bare Slab ▼	25% Glycol ▼	Slab on Grade ▼	1/2" KITEC® ▼

**RADIANT SELECTION CHART**

## Data Summary Table No. 2

Kitec® Summary for Multiple Unit projects.

ZONE OR AREA DESCRIPTION	RADIANT AREA (SQ.FT.)	HEAT LOAD (BTU/HR)	FLOW RATE (US GPM)	SUPPLY TEMP. (DEG. F)	NUMBER OF LOOPS	TOTAL FOOTAGE (LN. FT.)
ZONE 1	11,200	264,771	27.75	103	67	16,750
ZONE 2						
ZONE 3						
ZONE 4						
ZONE 5						
ZONE 6						
TOTAL OF PAGES	11,200	264,771	27.75		67	16,750

**Notes:**