Low Intensity Infrared Heating Systems Fact Sheet

calcana.com
Calgary, Alberta, Canada | Loxley, Alabama, U.S.A

Calcana
INFRARED HEATERS

LOW INTENSITY INFRARED HEATING SYSTEM FACT SHEET

Welcome to Calcana's line of low intensity infrared heating units.

Key attributes to our system are as follows:

- Canadian made in Calgary, Alberta.
- Quiet, draft free heat.
- Fuel savings of 30% or more over conventional heating systems.
- NO OPEN FLAME, totally enclosed burner box.
- Units can be mounted on an angle.
- Low voltage thermostat control.
- Deep, heavy gauge reflectors.
- Optional 2-Stage and Modulating burner heads to better suit specific application needs.
- American made in Loxley, Alabama.
- Anti "Reflector Walk" design.
- LOW clearance to combustibles allows for installation in a wider range of applications.
- System is totally vented and does not cause building deterioration.
- Side wall or roof venting capabilities.
- Optional line voltage thermostat control.
- Four optional levels of harsh environment construction with aluminized and/or stainless steel for anti-corrosion in areas such as truck or car washes.

COMPARATIVE ADVANTAGES OF CALCANA'S LOW INTENSITY INFRARED HEATING SYSTEM

#1: FUEL SAVINGS

The CALCANA system consistently operates on 30% less fuel than conventional heating systems.

#2: HEAT STRATIFICATION

Hot air rises. With a forced air system, the hot air collects at the ceiling first then works its way down toward the floor. Often temperature levels reach 140° F at the ceiling illustrating a tremendous waste of energy. The CALCANA system uses infrared waves to heat the objects and the floor in the building which in turn heat the air. As a result, the heat is down at the floor level first. The temperature difference between the floor and the ceiling is minute with a CALCANA system. This is the way the sun heats the earth from 93,000,000 miles away.

#3: DUST

Because the CALCANA system does not blow air around the building, dust and other foreign particles are not propelled air borne.

#4: MAINTENANCE

The CALCANA system is a maintenance free system. No filters are required, no pilot lights to light, no bearings to oil or grease.

#5: COMFORT & SAFETY

Employees are very comfortable working in an environment that has warm, dry floors and tools, as well as quiet, draft free heat throughout the building.

#6: PRODUCTIVITY

In a manufacturing environment, employee welfare can be improved because of the comfort of evenly distributed heat from the floor to the ceiling, which could result in increased productivity. Also, because objects in the building absorb the heat first, curing times for any painting or stripping is reduced dramatically.

GAS FIRED INFRARED HEATING:
AN OPTION TO FORCED AIR SYSTEMS

When planning for or renovating a commercial-industrial building, choosing the right heating system could make the difference of hundreds of dollars during the building life span.

Many structures are heated with electricity, steam or forced air heating systems. Others are heated with gas-fired infrared systems.

It has been proven that the installation of infrared heating systems can save the building owner up to 50% of heating costs over a one-year period (compared with forced air heat). Successful installations include warehouses, auto sales and service agents, farm buildings, greenhouses, tennis courts, military installations and loading docks.

In addition, employee welfare can be improved because the heat is more evenly distributed from the floor up and on target. In a manufacturing environment, this could result in increased productivity.

This article reviews infrared heating technology, describes the different types of infrared systems, and differentiates between radiant infrared and forced air heat.

Infrared energy is a form of radiation that behaves similar to light energy. Both infrared and light energy is carried from a source to an object by wave motion.

The major differences between them are source temperature and the fact that the human eye cannot see low-temperature infrared energy.

Infrared energy follows the principle of electromagnetic. It forms a small portion of the electromagnetic spectrum, located between visible light and the top end of the radar and microwave portion of the spectrum.

Because infrared is similar to light energy, it follows the same law of optics, it radiates in all directions from a source point, travels in a straight line at the speed of light (186,000 miles per sec.), and can be polarized, focused or reflected. When infrared strikes an object; the energy causes the molecular particles on the surface to react. This generates heat, which is then transferred throughout the object being heated by conduction. The object becomes a radiant emitter, but at a much lower temperature and intensity.

TYPES OF INFRARED

Depending on the wave length, the infrared section of the electromagnetic spectrum can be classified in three distinct areas: near, middle and far infrared. Every object at temperatures above absolute zero will give off infrared energy; the temperature and the emitter area determine the amount given off.

It has been determined that an object heated to 1,700° F generates infrared energy in the 0.75 to 20 micron range, and peaks at 2.41 microns. Infrared energy with wave lengths of less than 0.8 microns is actually visible light. Heating an object to a higher temperature will generate more infrared energy. In the process, it also generates a greater percentage of visible light, which contributes little toward comfort heating.

HEATING PRINCIPLES

Infrared directly heats people, floors, walls and other surfaces without heating the air first. Upon striking an object or a floor slab, the infrared energy is converted to heat. The floor slab then becomes a giant low-temperature radiant emitter. Machinery and equipment at the floor level are warmed by the direct radiation, as well as conduction through contact with the floor slab. The temperature differential is the driving force and determines the rate of radiant energy transfer.

In many installations, the floor slab's temperature is often 5° to 10° higher than the ambient air temperature.

Convection heat transfer from the warm floor slab and machinery to the cool air lying at floor level also plays an important role in the heating process. Cool air sweeping across the floor picks up the convected warm air and rises within the building structure.

Warm air is displaced by cooler air in a continuous cycle, gradually raising the air temperature in the building to a comfortable level.

RADIANT OUTPUT

The radiant output of a gas infrared heater is given in the equation:

$$R = SEA\,(T^4 - Ta^4)$$

Whereas:
- R = Radiant output
- S = Stefan-Boltzman constant
- E = Emissivity of the radian surface
- A = Surface area
- T = Emitter surface temperature (Degrees Rankine)
- Ta = Ambient temperature (Degrees Rankine)

The major variable affecting the heaters radiant output include the emissivity of the radiant surface and the emitter surface temperature. Materials with an emissivity factor close to 0.99 are highly desirable.

The temperature of the emitter surface also plays an important role in radiant heating. The temperature is expressed in Degrees Rankine and is raised to its fourth power. Any increase in the surface temperature greatly increases radiant output of a gas-fired infrared heater.

HEATER TYPES

Gas-fired infrared heaters are classified according to material and emitter surface temperatures.

There are basically three types of gas-fired infrared heaters: ceramic heaters, tube heaters and floor model heaters made of perforated steel emitters.

Designed to operate in the 1,650° to 1,800° ranges, ceramic heaters have a porous ceramic emitter surface. Combustion takes place on the ceramic surface, with the products of combustion released into the building.

Polished aluminum reflectors focus infrared rays on the floor level, with the reflectors spreading infrared rays to a broader area and the deeper parabolic reflectors concentrating rays into a narrow area.

The second type of gas-fired infrared heaters, tube heaters, use steel tubing where the hot gases are either pulled or pushed through the tube. The tubing is either calorized or painted to increase the emissivity of the tube material.

Tube heaters currently available operate at average emitter temperatures from as low as 450° to as high as 1,000°. They can be used in vented or unvented versions. Designs vary from ready to mount unitized systems requiring little field assembly time, to continuous systems requiring substantial field assembly time.

The third types of infrared units are the broad-area floor model heaters. These have perforated stainless steel emitters for durability and increased life.

Broad-area heaters radiate low intensity heat in a 360 degree pattern for a broad area of coverage. The perforated stainless steel emitter is conically shaped, with emitter surface temperatures ranging from 1,350° to 1,450°.

The floor-model heaters stainless steel emitters are formed into vertical cylinders. These units are designed primarily for spot heating and/or warming.

FORCED AIR COMPARISON

The major difference between a gas-fired infrared heating system and a forced hot-air system are the methods used to create a comfortable heat environment.

Gas-fired infrared units heat the floor slab and machinery before heating the air. This creates a more comfortable heat environment because personnel working in the comfort zone are blanketed by direct radiation from above, secondary radiation from below and warm air rising from the floor.

In a forced-air system, the hot air rises to the ceiling and stratifies, gradually working its way down to thermostat level. The floor slab usually never becomes warm enough to be comfortable.

In fact, in many instances, buildings heated with forced hot air have a high differential between floor and ceiling. Thus, the ceiling area of a high bay building can easily be 30° to 40° warmer than the floor area.

In the same type of building heated with an infrared system, the temperature is much more uniform. It is not uncommon to find a high-bay building heated with infrared heat where the ceiling temperature is only at a slightly lower temperature then the floor level slab.

In essence, a forced hot-air system heats from the top down, making the floor area the last and most difficult area to heat.

In a comparison, an infrared system heats from the floor up, satisfying the comfort zone first. Due to a difference in operating principles, infrared heating systems normally save from 30% to 50% over forced hot-air systems, depending on the installation and application.

***GAS-FIRED INFRARED HEATING: AN OPTION TO FORCED-AIR SYSTEMS**.
Bob Genisol, Air Conditioning, Heating & Refrigeration News, May 15th, 1989

HEAT LOSS CALCULATIONS

TO BE USED AS A GUIDE ONLY

The following charts are sample calculations of heat losses for different sizes of buildings. They are to be used as a guide only. The variables that they are designed under are:

Insulation Factor: R-20 Walls and Roof
Infiltration Rate: 1 Air Change Per Hour
Temperature Rise: 105 degree F

We recommend that a detailed heat loss calculation be completed on any building to determine the proper size, input and number of heating units required to heat the space properly prior to design layout, pricing and installation of heating equipment.

WARNING: Undersizing of heating systems can cause building damage due to freezing. Oversizing can lead to short cycling causing condensation buildup and premature corrosion of radiant tubes.

If unsure or unable to calculate a proper heat loss prior to design layout, pricing and installation, call Calcana. We will make suggestions and assist you with the design and layout of Calcana equipment.

EXAMPLE OF HOW TO USE GUIDE

Building:

40’ x 60’ x 16’ Height
R-20 Insulation Walls and Roof
1 Overhead Door
1 Walk-in Door
Average Building usage: for example, a farm shop (1 Air Change Per Hour)

Go to Matrix and select intersecting point of width and length. The number at this point is input of heat required (then multiplied by 1,000) to heat building as a rule of thumb. If in doubt, please give our office a call for a full computerized heat loss of the building.

WIDTH	LENGTH	16' HIGH		1 - AIR CHANGE		1 - 12' x 16' DOOR		1 - 3' x 7' DOOR	
	40'	60'	80'	100'	120'	140'	160'	180'	200'
40' x	84.4	114.3	144.1	174	230.9	233.8	263.1	293.5	323.4
50' x	99.3	135.2	171.1	207.1	243	278.9	314.8	350.7	386.6

114.3 x 1,000 = 114,300 BTU/Hr Input

Select Model with Input of 125,000 BTU/Hr

WIDTH	LENGTH	12' HIGH		1 - AIR CHANGE		1 - 12' x 16' DOOR		1 - 3' x 7' DOOR	
	40'	**60'**	**80'**	**100'**	**120'**	**140'**	**160'**	**180'**	**200'**
40' x	69.5	93.6	117.6	141.6	165.6	189.7	213.7	237.7	261.7
50' x	81.5	110.3	139.0	167.9	196.6	225.4	254.2	283.0	311.7
60' x	93.6	127.1	160.6	194.1	227.6	261.2	294.1	328.2	361.7
70' x	105.6	143.8	182.1	220.4	258.6	296.9	335.2	373.5	411.7
80' x	117.6	160.6	203.6	246.6	289.7	332.7	375.7	418.7	461.7
90' x	129.6	177.4	225.1	272.9	320.7	368.4	416.2	464.0	511.7
100' x	141.6	194.1	246.6	299.1	351.7	404.2	456.7	509.2	561.7
120' x	165.6	227.6	289.7	351.7	413.7	475.7	537.7	594.7	661.7

WIDTH	LENGTH	16' HIGH		1 - AIR CHANGE		1 - 12' x 16' DOOR		1 - 3' x 7' DOOR	
	40'	**60'**	**80'**	**100'**	**120'**	**140'**	**160'**	**180'**	**200'**
40' x	84.4	114.3	144.1	174.0	203.9	233.8	263.1	293.5	323.4
50' x	99.3	135.2	171.1	207.1	243.0	278.9	314.8	350.7	386.6
60' x	114.3	156.2	198.2	240.1	282.0	324.0	365.9	407.4	449.8
70' x	129.2	177.2	225.2	273.1	321.1	369.1	417.1	465.1	513.0
80' x	144.1	198.2	252.2	306.2	360.2	414.2	468.2	522.2	576.3
90' x	159.1	219.1	279.2	339.2	399.3	459.3	519.4	579.4	639.5
100' x	174.0	240.1	306.2	372.3	438.3	504.4	570.5	636.6	702.7
120' x	203.9	282.0	360.2	438.3	516.5	594.6	672.8	750.1	829.0

WIDTH	LENGTH	20' HIGH		1 - AIR CHANGE		1 - 12' x 16' DOOR		1 - 3' x 7' DOOR	
	40'	**60'**	**80'**	**100'**	**120'**	**140'**	**160'**	**180'**	**200'**
40' x	102.5	138.5	174.5	210.5	246.5	279.6	315.4	351.1	386.8
50' x	120.5	163.8	207.2	250.6	294.0	337.3	380.7	424.1	467.5
60' x	138.5	189.2	239.9	290.7	341.4	392.1	442.9	493.6	554.3
70' x	156.5	214.6	272.7	330.7	388.8	446.9	505.0	563.1	621.2
80' x	174.5	239.9	305.4	370.8	436.3	501.7	567.1	632.6	698.0
90' x	192.5	265.3	338.1	410.9	483.7	556.5	629.3	702.1	774.8
100' x	210.5	290.7	370.8	451.0	531.1	611.3	691.4	771.5	851.7
120' x	246.5	341.4	436.3	531.1	626.0	720.8	815.7	910.5	1005.4

CALCANA INDUSTRIES LTD.

QUICK HEAT LOSS CALCULATION FOR RESIDENTIAL GARAGES

WARNING: Undersizing of heating systems can cause building damage due to freezing. Oversizing can lead to short cycling causing condensation buildup and premature corrosion of radiant tubes.

For the following scenarios, the general assumption that they are designed under are:

Insulation Factor: R-12 Walls and Roof
Temperature: -40° F Outside, 65° F Inside

Scenario A: Attached garage, 8' wall height

Input Heating Requirements are 54 BTU/Hr per Square Foot of Floor Space

Scenario B: Detached garage, 8' wall height

Input Heating Requirements are 62 BTU/Hr per Square Foot of Floor Space

Scenario C: Detached garage, 10' wall height

Input Heating Requirements are 66.5 BTU/Hr per Square Foot of Floor Space

Scenario D: Detached garage, 12' wall height

Input Heating Requirements are 70 BTU/Hr per Square Foot of Floor Space

EXAMPLE: Detached Garage, 24' x 26' x 8', R-12 Insulation

24' x 26' = 624 Square Feet

624 Square Feet x 62 BTU/Hr (Scenario B) = **38,688 BTU/Hr Input**

USE MODEL CAL-40A

Rule of Thumb:

AREA TO BE HEATED*			MODEL SIZE
Type:	**From:**	**To:**	
1-2 Car	14' x 12' or 168 sq. ft.	24' x 26' or 624 sq.ft.	CAL-40A-10' / CAL-40AM-10'
3 Car	25' x 26' or 650 sq. ft.	27' x 32' or 864 sq.ft.	CAL-50A-15' / CAL-50AM-15'
4 Car	27' x 36' or 972 sq. ft.	40' x 40' or 1600 sq.ft.	CAL-75A-20' / CAL-75AM-20'

*Note: The assumption is made that the garage is insulated with a minimum of an R-12 rating in the walls and roof. If garage is not insulated utilize next larger model. Please note that a non-insulated garage will consume more fuel and will feel cooler than an insulated garage.

Canada: 5507 6 Street SE, Calgary, AB T2H 1L6
United States: 30201 County Road 49, Loxley, AL 36551

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BUILDING DATA FOR INFRARED HEATING SYSTEM

JOB NAME:	DATE:	JOB/REF #:
CONTRACTOR:	CITY/TOWN:	
WHOLESALER:	PROVINCE/STATE:	

TYPE OF FACILITY: ____

LENGTH: ___________ WIDTH: ___________ HEIGHT: ___________

INSULATION: WALL: R-VALUE: ___________ CEILING: R-VALUE: ___________

OVERHEAD DOORS DIMENSIONS & QUANTITY:

LENGTH: ___________ WIDTH: ___________ QUANTITY: ___________

LENGTH: ___________ WIDTH: ___________ QUANTITY: ___________

EXHAUST VENTILATION: □ YES □ NO IF YES, C.F.M. _______ # OF UNITS _______

MAKE-UP AIR UNITS: □ YES □ NO HEATED: □ YES □ NO

FUEL AVAILABLE: □ NATURAL GAS □ PROPANE

SKETCH: (USE ADDITIONAL SHEET IF NECESSARY)

Canada: 5507 6 Street SE, Calgary, AB T2H 1L6
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BUILDING DATA FOR INFRARED HEATING SYSTEM

JOB NAME:	DATE:	JOB/REF #:
CONTRACTOR:	CITY/TOWN:	
WHOLESALER:	PROVINCE/STATE:	

TYPE OF FACILITY: ____

LENGTH: ___________ WIDTH: ___________ HEIGHT: ___________

INSULATION: WALL: R-VALUE: ___________ CEILING: R-VALUE: ___________

OVERHEAD DOORS DIMENSIONS & QUANTITY:

LENGTH: ___________ WIDTH: ___________ QUANTITY: ___________

LENGTH: ___________ WIDTH: ___________ QUANTITY: ___________

EXHAUST VENTILATION: □ YES □ NO IF YES, C.F.M. _______ # OF UNITS _______

MAKE-UP AIR UNITS: □ YES □ NO HEATED: □ YES □ NO

FUEL AVAILABLE: □ NATURAL GAS □ PROPANE

SKETCH: (USE ADDITIONAL SHEET IF NECESSARY)