VALCO

Performance You Can Count On

Gas-Fired Infrared Heating for Poultry Houses





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All claims related to gas-fired, low-intensity heating are predicated on the equipment being designed, installed, maintained and serviced properly by a qualified professional.

Installation Code and Annual Inspections: All installation and service of VAL-CO® equipment must be performed by a contractor qualified in the installation and service of equipment sold and supplied by Val-Co and conform to all requirements set forth in the VAL-CO® manuals and all applicable governmental authorities pertaining to the installation, service and operation of the equipment. To help facilitate optimum performance and safety, Val-Co recommends that a qualified contractor conduct, at a minimum, annual inspections of your VAL-CO® equipment and perform service where necessary, using only replacement parts sold and supplied by Val-Co.

Further Information: Applications, engineering and detailed guidance on systems design, installation and equipment performance is available through VAL-CO® representatives. Please contact us for any further information you may require, including the Installation, Operation and Service Manual.

These products are not for residential use.

This document is intended to assist licensed professionals in the exercise of their professional judgment.

PREFACE

Energy Costs

Energy costs continue to rise and can skyrocket at an unprecedented pace. Heating fuel and electricity costs are not immune from these trends. As a result, worldwide demand for energy efficient equipment has grown.

Energy and Poultry House Operation

Since prices for the final product are set by the market, integrators and growers are continually evaluating and implementing automated technologies to produce birds more efficiently. The management of poultry houses during the early brooding stage of a chick's life largely determines whether they will reach their full potential. Every hour that a chick's environment is less than optimum reduces growth rate and increases feed conversion. Costs to both the grower and the integrator can be high if the brooding environment does not ensure that birds get off to a good, healthy start. Yet, heating and electricity costs are usually the largest expenses encountered by growers. As a result, utilization of efficient heating methods can affect the bottom line of both growers and integrators.

Gas-fired, low-intensity infrared heating is commonly used in commercial and industrial applications (e.g., warehousing, manufacturing, vehicle maintenance facilities). In recent years, gas-fired, low-intensity infrared heating has grown quickly in popularity over traditional heating systems in agricultural applications because energy savings of up to 50% can be achieved. Momentum for this technology increases as energy costs rise and integrators and growers spread the word.

Many gas-fired, low-intensity infrared heaters are listed with Canadian Standards Associations International (CSA) in North America, Europe and Asia. For a product to appear on these lists, and therefore qualify for the CSA claims, the product must meet the standards for consumer safety, health and environmental requirements and in some cases, energy saving criteria. The American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) has also acknowledged the fuel saving characteristics of gas-fired, low-intensity heating over conventional heating systems in the HVAC Applications ASHRAE Handbook (Chapter 15).

In the poultry industry, gas-fired, low-intensity infrared heating is, to some, unfamiliar or misunderstood. The purpose of this manual is to help facilitate better understanding of gas-fired, low-Intensity infrared heating and to help facilitate proper design and layout in a poultry house application. Once applied and installed properly, correctly maintained and utilized, integrators and growers can enjoy an improved growing environment and obtain significant fuel savings over traditional heating systems.

PART 1: INFRARED HEATING

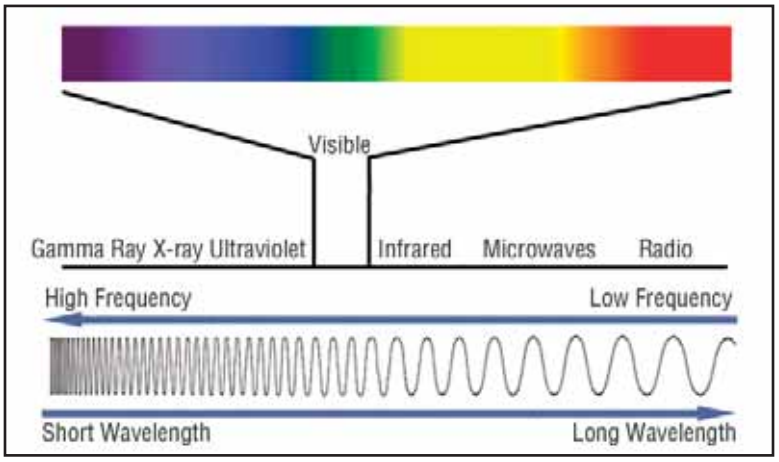
1.1 Infrared Heating: A New Concept?

Primitive people had only the sun to keep them warm before they discovered fire. Sun and fire both give off infrared heat energy. The sun's infrared energy is beamed "downward" toward Earth. Fire sends heated air, combustion gases and smoke upward, but the heat felt from fire radiates in all directions, not just upward. Thus, the popular idea that "heat rises" is not entirely true; in reality, infrared heat travels in all directions from the sun or from a fire. Rather than saying that "heat rises," it's more accurate to say that warm air rises. This means that since infrared heat travels in all directions, the popular idea of "rising heat" would apply only to heating systems which rely on air to convey warmth.

The sun is estimated to be 93 million miles (149 million kilometers) away from the Earth's surface, yet it can heat the entire earth. This is the most significant example of the effectiveness of infrared heating. While the principle is as old as the sun, the application for its use today may seem very different than the currently accepted means of heating. For those who have only been exposed to conventional methods of heating, the concept of infrared heating may open up a whole understanding of heat transfer.

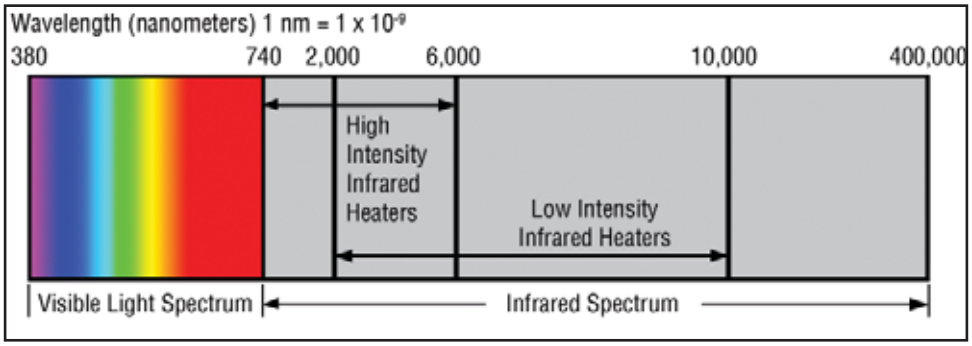
1.2 The Electromagnetic Spectrum

In the 1800's, an English astronomer named Sir William Herschel believed that the heat we feel from the sun is present in the visible spectrum. As he experimented with a prism to diffuse light into its visible color components, he discovered that violet and blue light carried the least heat. As he moved the thermometer through the spectrum of colors toward the red color, the temperature on the thermometer rose. It was actually beyond the red spectrum that the highest temperature was reached. This spectrum of longer wavelengths was named the "infrared spectrum."



Electromagnetic Spectrum[1]

The sun gives off a wide variety of electromagnetic energy. The electromagnetic spectrum differentiates all known types of electromagnetic energy by measuring the wavelength of the energy. The wavelength is measured in microns (one million microns are equal to one meter). The shortest wavelengths in the visible light spectrum are violet and blue light. Then, as the wavelengths get longer, we see green, yellow, orange, and finally red. Those rays with wavelengths longer than red are called infrared.



Infrared Spectrum[1]

1. Roberts-Gordon LLC (1994), Sir William Herschel Infrared Handbook, 1.4 pages 4-5 and 3.2.1 page 26.

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1.3 Types of Gas-Fired Infrared Heaters

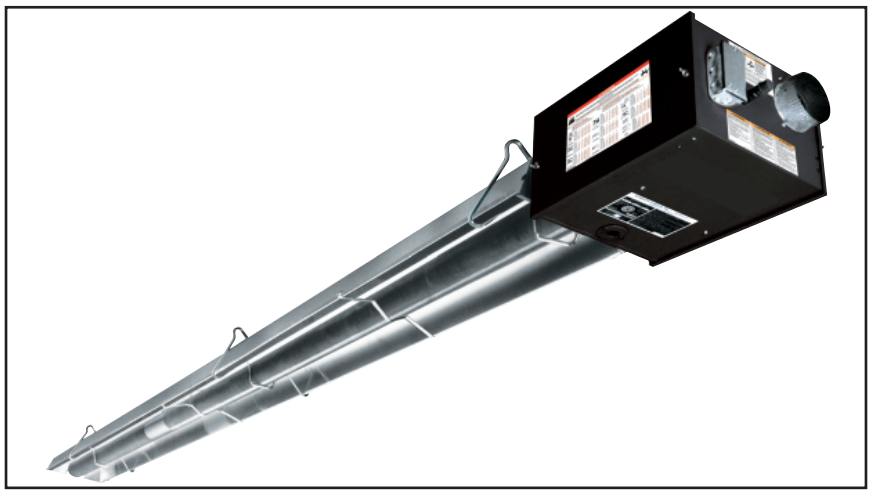
Gas-Fired, infrared heaters are usually classified into two simple groups: high-intensity, infrared heaters and low-intensity, infrared heaters.

High-Intensity infrared heaters (also known as luminous, plaque, ceramic or pancake heaters) mix gas and air behind a porous ceramic grid. The mixture of fuel and air is pushed through the small holes in the ceramic grid and burned on the grid face with an open flame, producing surface temperatures between 1600˚F (870˚C) and 1800˚F (980˚C) and an orange glow.

Since high-intensity infrared heaters utilize an open flame, the products of combustion (i.e. carbon dioxide and water vapor) remain, reducing the oxygen and increasing the humidity in the house environment. Thus, more ventilation is required to restore oxygen and remove water vapor from the house. The extra ventilation also tends to cool the environment, requiring the heaters to cycle on more often, raising heating costs. In addition, although high-intensity infrared heaters produce intense heat, they are generally compact in size and the heat from the unit is localized in a small area, producing a wide range of temperatures within the house. The intense heat and combustion products produced by high-intensity, infrared heaters can create a house environment that is difficult to manage.

Gas-fired, low-intensity infrared heaters mix gas and air and then burn it inside a heat exchanger tube. Heat exchanger tubes are usually made of aluminized steel. The heat exchanger tube surface temperatures of gas-fired, low-intensity infrared heaters reach maximum temperatures generally between 900° F (480° C) and 1100° F (595° C).

Gas-fired, low-intensity infrared heaters have a long heat exchanger tube which allows the heat to be spread over a much larger area as compared to the more localized heat from a high-intensity heater. In addition, the infrared energy emitted from a gas-fired, low-intensity infrared heater has a lower frequency and longer wavelength than high-intensity infrared heaters. This allows surrounding objects, such as concrete, animals, walls, etc. to more easily absorb the heat.



Gas-Fired, Low-Intensity Infrared Heater

Unitary, gas-fired, low-intensity infrared heaters are typically used in poultry house applications. Unitary, gas-fired, low-intensity infrared heaters have a single burner located at one end of the heat exchanger tube. The combustion takes place at the burner end, and the products of combustion are exhausted or vented at the opposite end. As a result, one end of the heat exchanger tube is warmer and gives off more heat than the other end. Overlapping the heat patterns helps create a nice, even heat. If the heater is mounted correctly, the end-to-end heat difference is minimized. The most common installations are straight tube heaters, but U-configurations are also available.

The heat exchanger tube is covered by an aluminum reflector that serves two purposes. First, the design of the reflector directs the infrared heat emitted from the tube to a 90° downward radiation pattern. This allows the system to evenly distribute the infrared energy over a floor area two times as wide as the system is high. For example, a system hanging 10’ – 11’ (3 m – 3.3 m) above the poultry house floor can evenly heat across a 21' (6.4 m) area. Second, the shape of the reflector minimizes heated air, which surrounds the heat exchanger tube, from escaping. Retaining the heated air helps keep the heat exchanger tube warmer, thus allowing it to more effectively emit infrared energy to the objects below. (Different steel alloys and/or coatings on the heat exchanger tube have different emissivity, resulting in different outputs).

Val-C0 offers heat-treated, aluminized tubing with its gas-fired, low-intensity infrared heaters*. Heat-treated aluminized steel tubing rates high on the emissivity scale and is preferred in poultry applications due to the corrosion resistant properties. Val-C0 offers .024 gauge aluminum reflectors with its gas-fired, low-intensity infrared heaters. The shiny aluminum surface helps reflect and direct infrared heat away from the ceiling.

** On all models, the first 10' (3 m) of tubing is ALUMI-THERM® steel and the remaining tubing is heat treated aluminized steel.*

Emissivity: Measurement of a material's ability to give off infrared energy.

Emissivity Scale[1]:
Materials and emissivities generally available in the industry.
Key: 1.00 = A perfect emitter.

Material	Emissivity	@Temperature °C / °F	(wavelength µ)
Plain Steel	0.79 to 0.81	538 / 1000	(3.6)
Aluminized Steel (Type 1)	0.20 to 0.50	538 / 1000	(3.6)
Aluminized Steel (Heat Treated)	0.80	538 / 1000	(3.6)
Porcelainized Steel	0.92 to 0.96	38 / 100	(9.3)
Cast Iron	0.95	538 / 1000	(3.6)
Stainless Steel (Type 304)	0.44 to 0.62	538 / 1000	(3.6)
Stainless Steel (Type 430 Polished)	0.10 to 0.20	38 / 100	(9.2)
Pyromark® Paint	0.80	538 / 1000	(3.6)

Reflectivity: Measurement of a material's ability to reflect energy or light.

Reflectivity Scale:
Materials and reflectivities generally available in the industry.
Key: 1.00 = A perfect reflector.

Material	Reflectivity
Tin	0.94
Chrome	0.92
Aluminum (Mill finish)	0.91 to 0.95
Aluminum (Polished)	0.91 to 0.95
Nickel	0.90
Aluminized Steel (Type 1)	0.50 to 0.80
Galvanized Steel	0.72
Stainless Steel (Type 304)	0.48 to 0.66
Stainless Steel (Type 430 Polished)	0.80 to 0.90

1. Roberts-Gordon LLC (1994), Sir William Herschel Infrared Handbook, 1.4 pages 4-5 and 3.2.1 page 26.

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Val-Co sells unitary gas-fired, low-intensity infrared heaters under the trade name HEATRITE™. The heater is comprised of a burner, heat exchanger tubes, reflectors and a fan. The fan, located in or on the burner box, pushes an ignited gas/air mixture down the tube, creating heat. Growers find these systems to be very effective for heating above brood sections and grow out sections. The most common heater installations in poultry houses are straight and u-tube heaters. In some instances, both configurations are used in the same building.

1.4 Heater Description

1.4.1 Description of Infrared Tube Heaters

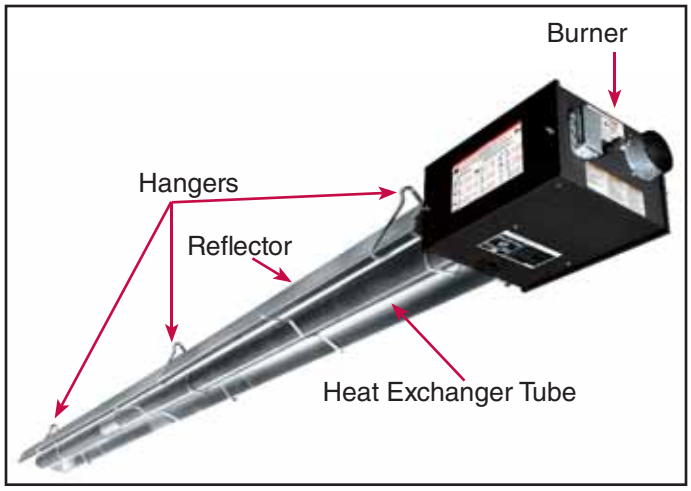
Gas-fired, low-intensity, infrared tube heaters are suspended overhead, generally, within 1' (.3 m) from the ceiling. In poultry houses, the common length of a low-intensity, infrared tube heater is between 20' (6 m) and 50' (15 m).

Each heater consists of a burner, a 20'-50' (6 m -15 m) length of 4"(10 cm) O.D. heat exchanger tube, and a highly efficient reflector hung above the entire length of the heat exchanger tubing.

Burners are available in btu/h (kW) output ratings from 40,000 Btu/h (15 kW) to 200,000 Btu/h (50 kW) depending on the model of the heater. Because of height, length and heat requirements, mid-range Btu/h (kW) outputs are most frequently used.

Inside or mounted on the burner, a blower pulls combustion air into the burner. The combustion air and either natural gas or propane are mixed and ignited to produce a flame. The flame and hot combustion gases flow through the heat exchanger tube, heating it up to about 1000° F (540° C). The hot tube emits infrared energy in all directions from the tube surface. All of the infrared energy emitted from the top portion of the tube is reflected down toward the floor by the reflector. At the end of the heat exchanger (opposite end of the burner), the products of combustion (exhaust gases) have cooled enough to be vented into the space or to the outdoors.

The heaters are controlled by either a thermostat or poultry house controller to maintain the desired space temperature.



VAL-CO® Gas-Fired, Low-Intensity, Infrared Tube Heater.



Straight and U-tube gas-fired, low-intensity infrared heaters in the same building.

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PART 2: CONVENTIONAL POULTRY HOUSE HEATING

2.1 History of Poultry House Heating

The purpose of brooding chicks is to provide growing birds a comfortable and healthy environment, efficiently and economically. Temperature (particularly of the floor), ventilation rates, humidity, litter conditions, dust, ammonia or carbon dioxide levels should all be monitored and managed by growers. Failure to properly manage these factors during the brooding period will likely mean lower economic returns. Newly hatched chicks have little or no ability to regulate their own body temperature and depend on the grower to provide an ideal growing environment. Exposing chicks to temperatures too high or too low will result in energy and nutrients being expended to cool the bird by panting or to warm the bird by heat production. Chicks will also expend energy and nutrients dealing with poor ventilation, high humidity, inadequate litter conditions, dust and elevated ammonia or carbon dioxide levels. Once expended, the energy and nutrients that might have been used by the bird for growth are lost.

Over the years, the method of adding heat to the chicken house has taken many forms. The pancake brooder was developed in the 1960's and has remained a popular form of chicken house heating. The 1970's saw the advent of the poultry house warm air heater. In the late 1980's, the high intensity, infrared brooder was introduced to the marketplace. The gas-fired, low-intensity infrared heater has been used in the Canadian poultry market for the past 20 years. However, only recently has the poultry market, at large, begun to take a closer look at the many advantages gas-fired, low-intensity infrared tube heaters offer modern poultry house heating.

Although the gas-fired, low-intensity infrared tube heater has been widely used in industrial heating applications, its application in poultry house heating is new and unfamiliar to some in the poultry industry. Gas-fired, low-intensity infrared tube heat has proved itself to be an incredibly efficient means of transferring heat into the floor of the poultry house where the birds are located.



Gas-Fired, Low-intensity Infrared Tube Heater

2.2 Air Heating with Warm Air Heaters

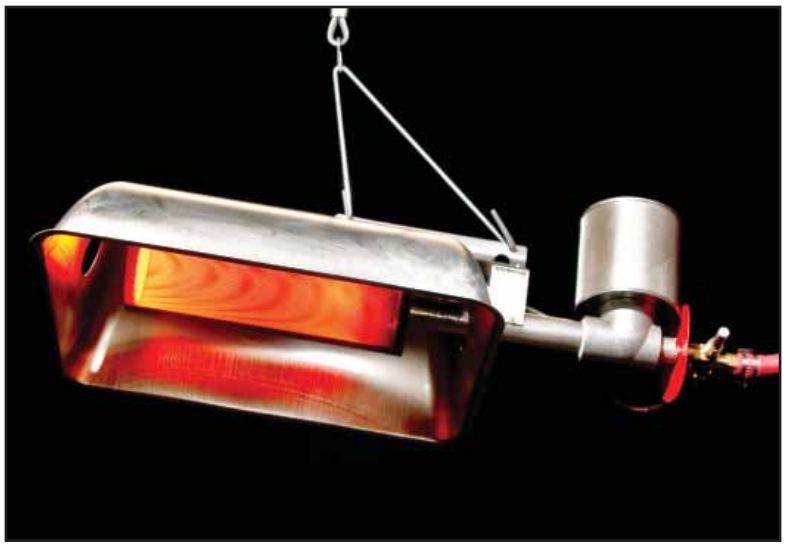
Growers consider the gas or oil fired warm air heater to be a compact, stand alone, inexpensive and acceptable method of heating. Warm air heaters certainly provide less uniform heat than could be achieved with boiler systems or other heating methods. They are often placed at the end of the poultry house with the heated air directed toward the middle of the house. Consequently, there tends to be an area in the middle of the house that is warmer than the sides and ends. Since the fan pushing air across the heat exchanger to the center of the house is drawing cold air from behind and below, the floor at the end of the house is cooler.



Warm Air Heater

2.3 High-Intensity Infrared Heaters

High-intensity, infrared heaters use an open flame to combust a mix of gas and air on a porous ceramic or metal grid, producing an orange glow. The combustion products are released directly into the house environment. Since the physical size of the heater is small, the heat felt from the unit is localized in a small area and has higher intensity. These heaters are more appropriate for spot heating applications. However, the open flame, high oxygen consumption, localized intense heat and increased humidity make high-intensity infrared heaters difficult to manage in poultry house heating.



High-Intensity Infrared Heater

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2.4 Pancake Brooder Heaters

The pancake brooder type heater (also called gas radiators or jet brooders) is widely used in the United States and other parts of the world. Pancake brooder heaters have an umbrella or pancake shape and are relatively small, as a result, heat output is very low. Consequently, more pancake heaters are required to uniformly heat a large space. Pancake brooders are often located about 3' (1 m) above the floor and heat the floor beneath it somewhat uniformly. These heaters, generally, transfer about 40% of their energy as infrared heat to the floor and 60% to the air as convective heat. This means that there will be some heat loss through the roof due to stratification. Since they are mounted at a low level, they have to be raised or moved when the poultry house is loaded out. In addition, since pancake heaters involve an open flame (like high-intensity infrared heaters). These types of heaters consume valuable amounts of oxygen and add moisture to the house environment, requiring extra ventilation and can cause the heaters to cycle on more frequently, resulting in increased energy costs.



Pancake Brooder Heater

2.5 Central Wet Systems (Boilers)

Wet systems are among the most expensive poultry house heating systems. Despite the cost, boiler systems have gained widespread acceptance and popularity due to their multi-functionality and good heat distribution. The pipes radiate heat in all directions. Convective heat also rises from the pipes. However, much of the heat needed by the brood is directed upward and is transmitted through the roof of the poultry house. Wet systems are also particularly slow to adjust to outside climate changes.

Although boiler efficiencies have improved, this heating system still possesses high operating and maintenance costs that growers have come to accept. A single, large boiler correctly sized for the heat loss of a poultry house at outdoor design temperature conditions, can be grossly oversized when temperatures are mild or few zones are calling for heat. This oversized condition can lead to short cycling, which is inherently inefficient, but the use of staged boiler systems can reduce short cycling. In addition to prohibitive initial costs, growers must have a standby boiler in case the main one fails.



Central Wet System (Boilers)

2.6 Cabinet Heaters

Growers consider LPG gas or oil-fired cabinet heaters to be a stand alone, acceptable method of heating. Cabinet heaters certainly provide less uniform heat than gas-fired, low-intensity, infrared heaters. They are often placed in a room separate to the main building to keep the units clean from debris. The cabinet heater is then ducted into the main building and often times, the exhaust flue gases are ducted in for extra heat. With air being forced into the space, there tends to be an area in the middle of the house that is warmer than the sides and ends. Louvers on the ducts can be positioned to direct some of the heated air downward to try to reduce immediate heat stratification and cold spots. Typically, however, the ends of the house and the floor remain cooler, while the cost of the additional fan adds to the cost of electricity.



*Example of a Cabinet Heater**

**All installation and service of VAL-CO® equipment must be performed by a contractor qualified in the installation and service of equipment sold and supplied by Val-Co and conform to all requirements set forth in the VAL-CO® manuals and all applicable governmental authorities pertaining to the installation, service and operation of the equipment. To help facilitate optimum performance and safety, Val-Co recommends that a qualified contractor conduct, at a minimum, annual inspections of your VAL-CO® equipment and perform service where necessary, using only replacement parts sold and supplied by Val-Co.*
Applications, engineering and detailed guidance on systems design, installation and equipment performance is available through VAL-CO® representatives. Please contact us for any further information you may require, including the Installation, Operation and Service Manual.

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PART 3: WHY INFRARED HEATING?

3.1 Understanding Infrared Heat Transfer

The concept of gas-fired, low-intensity infrared heating (also called radiant or tube heating) is new to many poultry growers. As a result, infrared heating may not be completely understood. Three types of heat transfer exist; radiation (transfer of energy by electromagnetic waves), convection (transfer of energy through a fluid) and conduction (transfer of energy through a solid).

Overall, people are most familiar with convective heat transfer. When a heater blows warm air into a space, the transfer of heat through the fluid (the air) in the space is a form of convection. Conduction is also commonly understood. When a frying pan is placed on the burner of an electric range, the transfer of heat from the hot burner surface through the metal pan is a form of conduction.

Both convection and conduction require a medium (a solid or fluid) through which the energy is transferred. Radiation, on the other hand, does not require any medium to transfer heat. Infrared heat (in the form of electromagnetic waves) is emitted from a warm object and passes through either air or the vacuum of space at the speed of light before the energy strikes an object. Once the electromagnetic waves strike an object, heat transfer to that object occurs. Therefore, infrared heat heats objects, not air.

The ability to heat objects without heating the air is the concept that some people do not understand initially. However, the fact that infrared heat does not need a medium to transfer heat is a tremendous advantage over air heating. With air heating, objects cannot be any warmer than the existing air temperature. Large volume spaces or spaces with rapid air changes can be problematic for air heating systems. But chickens, floors, walls and other objects absorb electromagnetic waves from infrared heaters, warming them before the air is heated. Infrared heat can create a comfortable environment, even when the air temperature is quite low. The heated objects then transfer heat to the atmosphere allowing convective air heating to take place. As convection continues, the air temperature warms.

Equivalent comfort can be achieved at lower air temperatures when infrared heat is used. Lower air temperatures translate into fuel savings and less air stratification (hot air rising to the ceiling). When the roof is warm, heat transfer through the roof increases since the temperature difference between the inside and outside is elevated. Stratification is reduced with infrared heating compared to warm air heating.

With air heating, if the warm air is lost during ventilation, the objects in the space have not stored extra heat energy from the air. So once warm air is lost, the heat is lost until the air is reheated. Infrared heating puts energy into objects, such as the floor, which hold and store the heat. This stored energy is released to the air and surrounding objects, helping to recover the air temperature in the building, even if some of the warm air is lost due to ventilation.

3.2 The Benefits of Low-Intensity Infrared Heating

When the differences between air heating and infrared heating are understood, one can begin to identify the potential advantages of gas-fired, low-intensity infrared heating in poultry houses.

3.2.1 Quick, Fuel-Efficient Operation:

Installing gas-fired, low-intensity infrared tube heaters in a poultry house can produce fuel savings of up to 50% over traditional, furnace type, warm air heating. With warm air heaters, in order to warm the floor, first the air must be warmed to an even higher temperature. Since warm air rises, it then has to be redirected back towards the floor where it can begin warming the surface. This results in pre-flock heating times of around 36 hours or more.

Pancake brooder and high-intensity heaters produce 40% infrared heat and 60% convection heat (that warms air). While this method is an improvement as compared to warm air heaters, the majority of heat is still as a result of convection. Gas-fired, low-intensity tube heaters (when properly installed and maintained in accordance with the installation, operation and service manual) generate 90% infrared heat towards the floor of the house resulting in an increase in floor temperatures in as little as 3 hours.

Being able to warm the floor and litter directly will help reduce pre-flock warm up time and also allow operation at a lower ambient temperature, which can result in further energy savings.

3.2.2 Efficient, Even Floor Temperatures

Pre-flock warm up time is important because it provides a warm, comfortable, healthy environment for the birds. Gas-fired, low-intensity infrared tube heaters in a house can provide warm, even floor temperatures in a short amount of time, compared to other types of heating. The results of different heating types vary. The FLIR infrared camera pictures on the next page show the degree of heating on the poultry house floor.

The first picture demonstrates a brood chamber heated with warm air box heaters after 20 minutes. As you can tell, the floor is evenly warm after 20 minutes at about the 65° F (18° C) range. The second picture depicts high intensity brooder heaters after 10 minutes. The results show a quicker warm up time, but a wide range of temperatures across the floor ranging from 70° F (21° C) – 90° F (32° C), with more hot spots than warm spots. The third picture exhibits the gas-fired, low-intensity, tube heaters after 10 minutes. This picture illustrates how quickly and efficiently tube heaters can place uniform heat on the floor of a poultry house. The temperatures on the floor are even, ranging from 70° F (21° C) –

80°F (26° C), with a few warm spots accounting for the burner head placement. This slight range in temperatures allows the birds to move around to areas where they feel most comfortable.

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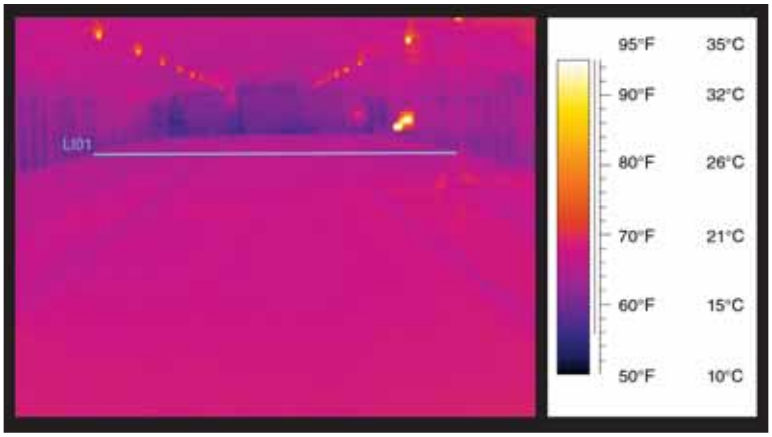
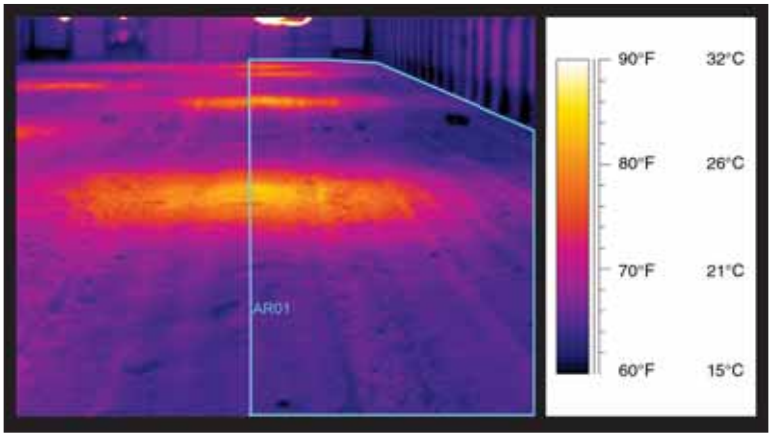
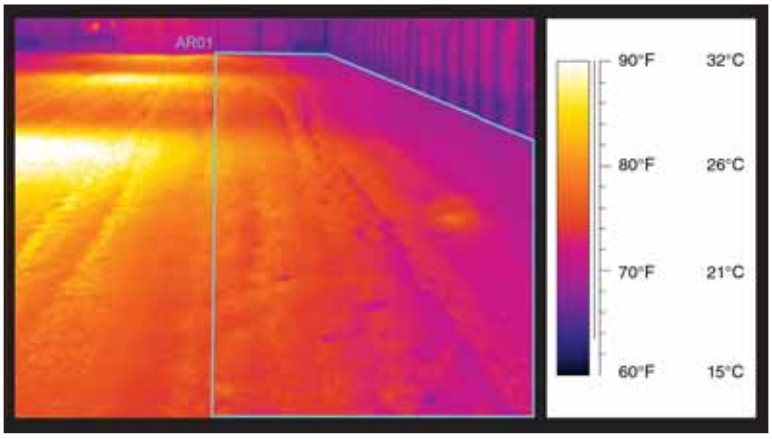


*Floor temperatures after 20 minutes of air heating.[2] **



*Floor temperatures after 10 minutes of high-intensity heating.[2] **



*Floor temperatures after 10 minutes of heating with gas-fired, low-intensity infrared tube heaters.[2] **

**Results may vary*

2. Czarick, M. (2005), Infrared Tube Heater Floor Heating Patterns, The University of Georgia Cooperative Extension Service: Poultry Housing Tips, 17, 5, pp. 1-10

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This poultry house relies on high-intensity heaters for heat. You can see the chicks are spaced out around the hot spots, confirming the test results found regarding uneven floor temperatures with pancake brooder heaters, as shown on pages 11 and 12.

3.2.3 Easy Installation and Maintenance:

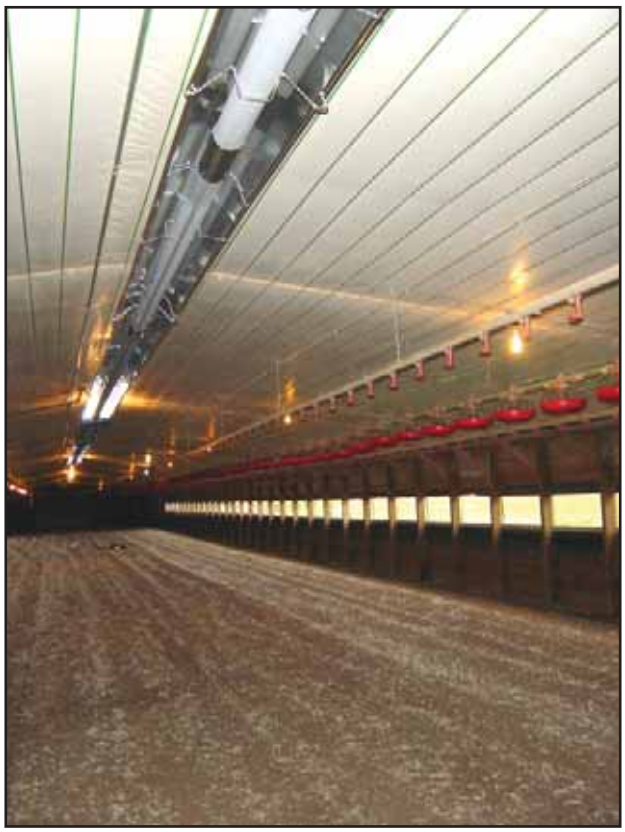
Gas-fired, low-intensity, infrared tube heaters can be easy to install and service. Typically, no special equipment is needed for the installation.* VAL-CO® installation, operation and service manuals illustrate installation, control wiring, maintenance and repair considerations.

Gas-fired, low-intensity, infrared tube heaters are mounted overhead so there is little interference with ventilation airflow. Typically, there is also no need to adjust heater mounting height throughout the growing cycle. Gas-fired, low-intensity, infrared tube heaters are mounted close to the ceiling, creating minimal obstruction of the chicken house and improving the spread of infrared heat.

Unlike pancake brooder heating equipment, gas-fired, low-intensity infrared heaters can remain in the house during cleanout. Gas-fired, low-intensity, infrared tube heaters are mounted near the ceiling and are well out of the way during house clean out and poultry removal.

Gas-fired, low-intensity, infrared tube heaters use fresh air as combustion air. When heaters are properly installed and maintained in accordance with the installation, operation and service manual and applicable government regulations, the amount of contaminants that the internal components of the burner are exposed to is reduced. This helps result in years of trouble free operation. Brooder heaters require more maintenance than gas-fired, low-intensity infrared tube heaters. Since they use air from the house, pancake brooder heaters must be maintained after every flock.

It is recommended that the reflectors and tubes be cleaned periodically in order to continue to operate at optimal efficiency. By comparison, it can be more efficient and cost effective to maintain five or six gas-fired, low-intensity, infrared tube heaters versus twenty to thirty pancake brooder heaters.



Gas-fired, low-intensity, infrared heaters are overhead and out of the way for house cleaning.

3.2.4 Environmental Benefits - Warmer Floors and Drier Litter:

Gas-fired, low-intensity, infrared heat is directed to objects below the heater, including the floor where the birds reside. In addition to creating a warm, comfortable temperature for the birds, the litter on the floor absorbs the energy and is heated, evaporating moisture from the litter. A drier litter improves the house environment by reducing ammonia generation. Drier litter can also help lower mortality rates, as wet litter is an ideal breeding ground for many diseases and bacteria.

**All installation and service of VAL-CO® equipment must be performed by a contractor qualified in the installation and service of equipment sold and supplied by Val-Co and conform to all requirements set forth in the VAL-CO® manuals and all applicable governmental authorities pertaining to the installation, service and operation of the equipment. To help facilitate optimum performance and safety, Val-Co recommends that a qualified contractor conduct, at a minimum, annual inspections of your VAL-CO® equipment and perform service where necessary, using only replacement parts sold and supplied by Val-Co.*

Applications, engineering and detailed guidance on systems design, installation and equipment performance is available through VAL-CO® representatives. Please contact us for any further information you may require, including the Installation, Operation and Service Manual.

This document is intended to assist licensed professionals in the exercise of their professional judgment.

3.2.5 Environmental Benefits – Improved Poultry Production:

Comfortable and consistent temperatures along feed and water lines, reduced moisture on the floor and better air quality all create a healthier environment to promote reduced mortality rates. The long, linear design of gas-fired, low-intensity, infrared tube heaters create warm temperatures to invite birds along the length of water and feed lines.

Gas-fired, low-intensity, infrared tube heaters do not blow warm air around the space. The heater emits infrared heat from the heat exchanger tube without blowing air, dirt and dust, which can help facilitate better air quality.

The gentle warmth that is emitted from the tube surface is reflected and redirected toward the floor where the heat is needed for the comfort of the birds. Plaque and pancake brooders produce convection heat and radiation heat in the following proportions: 60%-40%, thus 40% of the heat can't be directed toward the floor where it is needed.

3.2.6 Environmental Benefits – Save Valuable Oxygen:

When connected to a flue and properly installed, used and serviced, gas-fired, low-intensity infrared heaters take fresh air for combustion from outside the house saving valuable oxygen. In contrast, unflued high-intensity heaters and warm air heaters can consume important volumes of oxygen from inside the house. This can create condensation and humidity, resulting in water on the litter. This can be critical in poorly insulated or static houses.

3.3 Low-Intensity Infrared Heating vs. Air Heating (Gas and Oil Direct-Fired Warm Air Heaters)

Air heating systems usually cost less to install than a gas-fired, low-intensity infrared heating system. However, these systems usually cost the grower considerably more to operate. Air heating systems are deficient in two basic laws of heat transfer. First, due to natural convection, warm air in the presence of cold air rises. Infrared energy does not rise when properly directed to the floor.

Infrared heaters heat objects, not air, so stratification of air does not occur to nearly the same extent. The reflector over the system helps ensure that the energy is directed downward where it is most useful. Second, moving warm air over objects (poultry) cools objects that contain moisture. Evaporation of water has a cooling effect. Properly designed, installed and used, gas-fired, low-intensity infrared heating systems should provide a much more uniform heat distribution compared to air heating systems.

3.4 Low-Intensity Infrared Heating vs. Wet Systems

Steam and hot water boilers have been used for generations and have been accepted for heating poultry houses. That view is changing, as growers realize boilers and piping systems are expensive to install. Separate equipment areas or buildings are required to house boilers, adding to construction costs and using valuable floor space. On the other hand, gas-fired, low-intensity infrared heating systems do not take up floor space, and additional systems can be added as additional poultry houses are built.

While efficiency is being improved, wet systems are still a long way from being as fuel efficient and effective as gas-fired, low-intensity infrared heating systems. The recommended maintenance schedule for boilers can be expensive. If a boiler is shut down for repair, there is no heat source for the poultry house unless a second expensive standby boiler can be put into operation. There is solid economic justification for replacing older boilers with new gas-fired, low-intensity infrared heating systems, as the payback and return on investment can occur in just a few years.

3.5 Low-Intensity Infrared Heating vs. Pancake Brooder Heaters

The pancake heater is relatively small and as a result, heat output is very low. Consequently, more pancake heaters are required to uniformly heat a large space. Pancake brooders are located about 3' (1 m) above the floor. Because they are mounted at a low level, they have to be raised or moved when the poultry house is emptied and adjusted during flock cycles.

Gas-fired, low-intensity infrared heaters, generally heat a larger area, so less heaters are required than brooder heaters. They are also mounted closer to the ceiling, so they do not need to be moved when the poultry house is emptied*.

3.6 Infrared Heating as the Energy-Saving Option of Choice

Many solutions to enhance energy savings have been offered to integrators and growers. As discussed earlier, these proposed energy-saving solutions commonly create other problems, which need more solutions, and so on. With gas-fired, low-intensity infrared heating, the energy-saving problem is solved with energy savings up to 50% over conventional heating systems. On top of energy savings, an objective grower must consider the additional intrinsic benefits that may help enhance the grower's profits. Low maintenance costs, improved poultry production, as well as an improved healthy environment, all add up to the overall profitability of the poultry house.

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PART 4: TYPES OF GAS-FIRED, LOW-INTENSITY, INFRARED HEATERS

There are several models of gas-fired, low-intensity, unitary, infrared heaters. The most commonly used for poultry houses are:

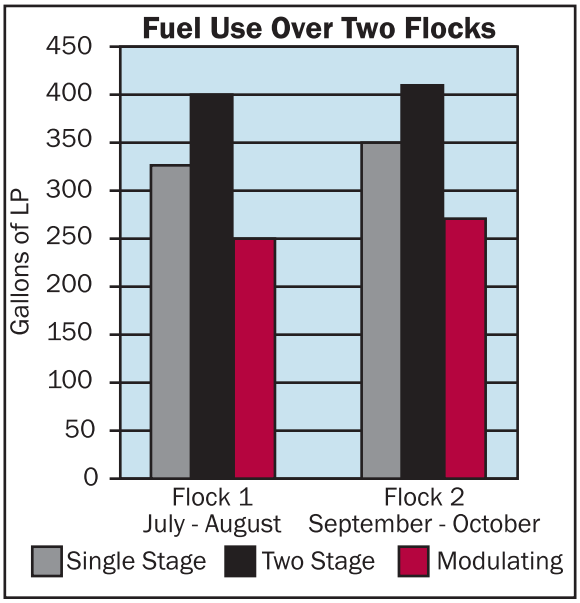
- Modulating
- Single-Stage
- Two-Stage

4.1 VAL-CO® North American Products

4.1.1 Modulating Low-Intensity, Infrared Tube Heaters

Gas-fired, low-intensity, modulating infrared tube heaters offer an enhanced control option. The heater is capable of operating not only at low and high fire, but also at any input in between the high and low inputs. This improved control technology allows the heater to deliver the amount of heat needed to more precisely maintain temperatures without temperature overshoot. The precise control of the heater helps facilitate longer, more efficient run times and reduces inefficient heater cycling. In addition, through gas-air linkage technology, the heater is able to vary not only the fuel supplied to the burner, but can also vary the combustion air supplied. This technology allows the heater to maintain efficient operation at various firing rates.

Fuel savings differences between the several styles of tube heaters were measured by a large integrator in three identical chicken houses on the same farm. The first house used single stage (fixed firing rate) tube heaters, the second house used two-stage (dual firing rate) tube heaters, and the third house used the new modulating tube heaters. In the study fuel useage was as expected with the two-stage house being the least efficient, followed by the single stage house, with the most fuel efficient house using the modulating heaters. There was no significant difference in bird performance between these houses.



*Study of fuel use between modulating infrared heaters vs. two stage heaters.**

**Results may vary*

Benefits of Modulating Gas-Fired, Low-Intensity, Infrared Tube Heaters

- Help to provide more accurate control to meet heating demands by allowing even the slightest change in heater firing rate anywhere within the 60-100% range.
- Help to provide real energy savings by matching the heating system's input to the building's heat load requirement. The precise heater controls remember the last heating cycle, starting the new heating cycle at the optimum rate, resulting in longer heater run times, as opposed to frequent heater cycling.

This document is intended to assist licensed professionals in the exercise of their professional judgment.

4.1.2 Single-Stage Gas-Fired, Low-Intensity, Infrared Tube Heaters

A standard gas-fired, low-intensity infrared tube heater operates at a single input rate. For most poultry house applications, the heater input is between 80,000 BTU/h (23kW) and 150,000 BTU/h (45 kW) depending on the length of the heater and mounting height. When there is a call for heat, the heater fires at the rated input until the temperature setpoint is satisfied, then turns off until the next call for heat.

With single stage heaters, a blower pushes air and gas through the heat exchanger tube, expelling it outside the building at the end of the unit. These units have a single burner on one end of the heat exchanger tube. Growers also find these systems to be very effective for heating brood sections and grow out sections. Positive pressure, unitary heaters may be installed so that the heat exchanger tube is laid out in one of a variety of shapes. The most common heater installation is straight tube; U-shaped or L-configurations are also available.



VAL-CO® Single Stage Gas-Fired, Low-Intensity, Infrared Tube Heater.

4.1.3 Twin-Fire Gas-Fired, Low-Intensity, Infrared Tube Heaters

A variation on the single-stage gas-fired, low-intensity infrared tube heater is the twin-fire (or twin-tube) design. The twin-fire design operates at a single input, but each burner unit offers two infrared heat exchanger tubes and reflectors that extend from opposite sides of the burner unit.

Each side of the twin fire heater operates at an input that is half of the full rated input of the heater. For instance, if the rated input of a twin fire heater is 250,000 BTU/h (70kW), each side of the heater operates at 125,000 BTU/h (35kW). The twin heat exchangers allow a single heater to heat twice the area of a tube heater with one heat exchanger, therefore taking the place of two heaters. An advantage of the twin fire design is that only one electrical and gas connection are needed. This can result in lowering the gas piping and electrical installation costs.

Although not recommended for brooding sections of a house, a twin fire heater can be successfully employed in the grow out section of the house.



VAL-CO® Twin Fire Gas-Fired, Low-Intensity, Infrared Tube Heater.

4.1.4 VAL-CO® Gas-Fired, Low-intensity, Infrared Tube Heater Input Rates

VAL-CO® Single Input Infrared Heater		
Rated Input, btu/h (kW)	Minimum Heat Exchanger Length ft (m)	Maximum Heat Exchanger Length ft (m)
80,000 (15)	20 (6)	30 (9)
100,000 (20 or 25)	30 (9)	40 (12)
125,000 (30, 35 or 40)	40 (12)	50 (15)
150,000 (45 or 50)	50 (15)	60 (18)

VAL-CO® Modulating Infrared Heater (For North America Only)			
Maximum Rated Input Btu/h (kW)	Minimum Rated Input Btu/h (kW)	Minimum Heat Exchanger Length ft (m)	Maximum Heat Exchanger Length ft (m)
80,000 (15)	48,000	20 (6)	30 (9)
115,000 (34)	75,000 (22)	30 (9)	40 (12)
150,000 (44)	100,000 (29)	40 (12)	50 (15)

VAL-CO® Twin-Fire Infrared Heater (For North America Only)			
Total Rated Input, Btu/h (kW)	Rated Input Each Side, Btu/h (kW)	Minimum Total Heat Exchanger Length ft (m)	Minimum Heat Exchanger Length Each Side ft (m)
160,000 (47)	80,000 (23)	40 (12)	20 (6)
200,000 (59)	100,000 (29)	60 (18)	30 (9)
250,000 (73)	125,000 (37)	80 (24)	40 (12)
300,000 (88)	150,000 (44)	100 (30)	50 (15)

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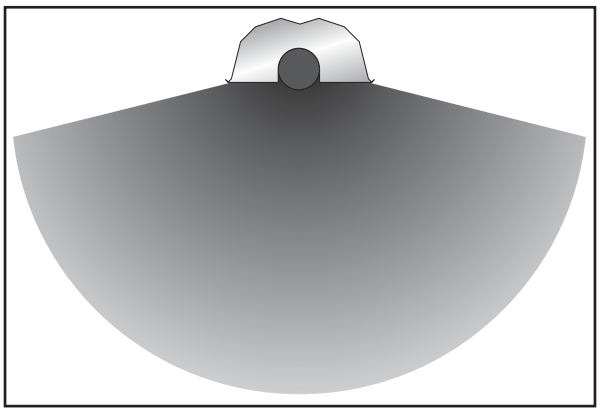
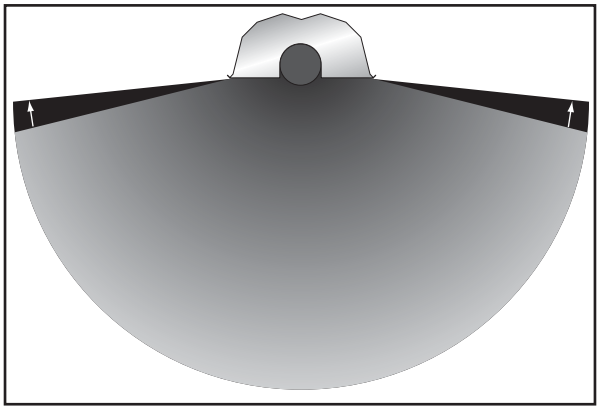
4.2 VAL-CO® Wide Pattern Hangers

For agricultural applications, Val-Co supplies a wide pattern hanger. The wide pattern hangers increase the radiant spread by 24° compared to the normal hanger. This allows for a wider heat pattern for those extra wide poultry houses. The wide pattern hanger can be hung at the normal 90° (level) angle for center mounting. This hanger does not have a 45° angle (tilted) option. Val-Co supplies wide pattern hangers as standard with their heaters. If you prefer regular hangers with a 45° option, please contact Val-Co.



Traditional pattern hangers radiant spread.



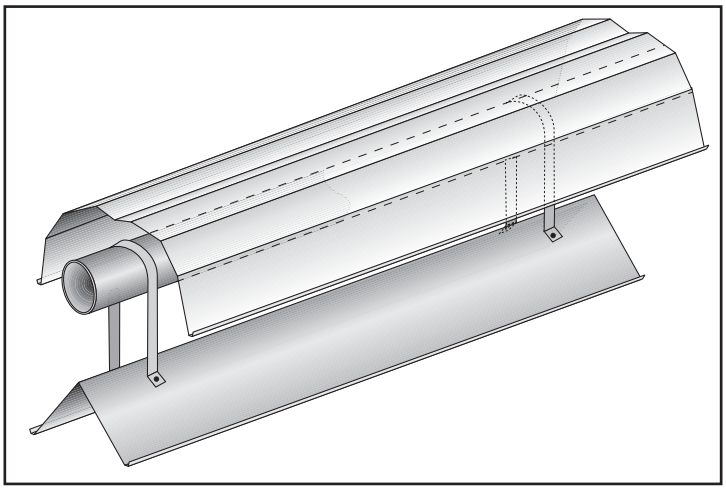
Wide pattern hangers increase radiant spread by 24° compared to traditional hangers offered by Roberts-Gordon.

PART 5: DESIGN CONSIDERATIONS FOR POULTRY APPLICATIONS

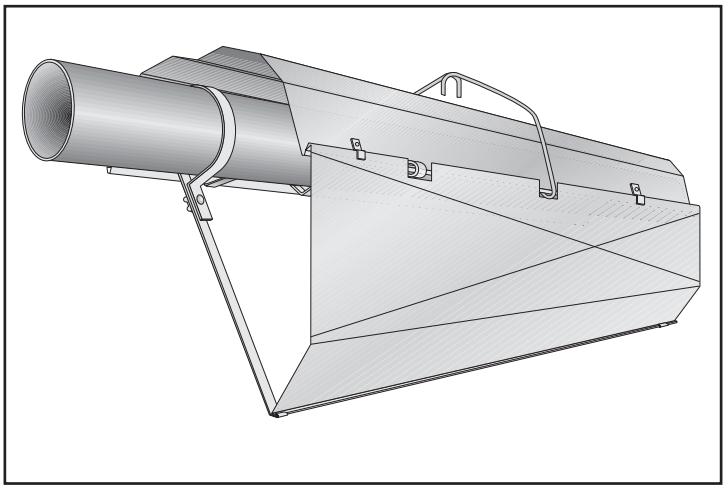
5.1 Typical Building Size and Shape

A typical poultry house can be 40'-50' (12 m-15 m) wide and 200'-500' feet (60 m-152 m) long. Wider houses can be 66' (20 m) and beyond. The width of the house is a large determining factor in the planned layout of the heaters in the building. Houses 40'-50' (12 m-15 m) wide can, generally, have a single row of heaters along the length of the house. This row is usually run down the center, but can also be mounted along a sidewall with the reflector tilted 45° toward the middle of the house. As broiler houses change in size, special considerations need to be taken to assure adequate heat is supplied throughout the building. As houses become wider (60' [18 m] and wider), it may be necessary to have two rows of heaters, unlike the most commonly used layout of one. Val-Co offers a wide range of BTUs, lengths and special accessories that can be used to accomplish this.

With the ever changing equipment that can be used in a broiler house, Val-Co offers several accessories that can be used to protect components below and near the heat exchanger tube. Below is an example of a lower clearance shield and a side reflector. These accessories can be used to protect drop cords, feed supply tubes and water lines if it is necessary.



Lower Clearance Shield



Side Reflector

This document is intended to assist licensed professionals in the exercise of their professional judgment.

The majority of poultry houses are single story buildings, but in some areas of North America, two story houses are common. Design layout parameters for these two-story buildings are typically the same as a single story application. The heater layout from the first floor would be repeated on the second floor. One of the benefits of gas-fired, low-intensity, infrared heat is minimal stratification. The heat on the first floor is absorbed by the flooring, litter, birds and other objects, instead of rising into the second story space.

New poultry houses are being built wider to accommodate larger flocks. As a select number of integrators choose to utilize wider houses for increased floor space and larger flocks, additional feed and water lines are usually required. The same consideration is applied to the heating equipment. Gas-fired, low-intensity, infrared heaters offer a wide variety of Btu/hour and tube lengths to accommodate these new broiler houses. Val-Co can assist in the design and layout of its heating equipment to insure adequate coverage and comfort in these wider houses.



Gas-fired, low-intensity heaters configured for large houses over 75.5' (23 m).

5.2 Heater Placement

Proper placement of gas-fired, low-intensity, infrared heaters is extremely important in producing the highest comfort levels, avoiding hot or cold spots and obtaining the utmost in fuel efficiency. It is important to have the design and layout of your agricultural building performed by a representative qualified in the design, layout, installation and service of equipment sold and supplied by Val-Co.

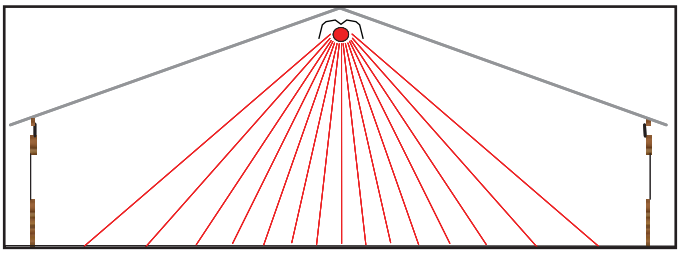
5.2.1 Center Mounting

Gas-fired, low-intensity infrared tube heaters are, typically, installed close to ceiling height (in accordance with the appropriate clearances to combustibles). Multiple heaters are placed in a single line down the center along the entire length of a poultry house (or in multiple lines depending on the house width). This is the most efficient way to mount the heaters. The center downward mounting offers:

Even Heat - This layout creates a nice even heat throughout the entire space.

Multiple Heat Zones - With single unit heating systems if the unit breaks down, the poultry house will be without heat, unless there is a back up heat system. With gas-fired, low-intensity, infrared heaters, if one heater breaks down, the other heaters are still working, keeping the space at a consistent comfort level until the broken unit is fixed.

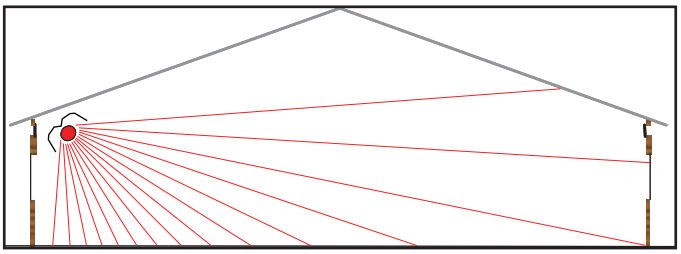
Fuel Savings - Often brooder areas are sectioned off early in the grow cycles. Gas-fired, low-intensity, infrared heater layouts demonstrate the entire house does not have to be heated during this cycle. Only the specific sections being used can be heated



Open Ceiling House

5.2.2 45° Side Wall Installations

In Canada, a common installation configuration is the 45° sidewall. The heater is mounted at the ceiling, but against the sidewall (in accordance with the appropriate clearances to combustibles) at a 45° (tilted) angle. Despite some heat loss through convection, this method has been successful.



45° Side Wall Installation

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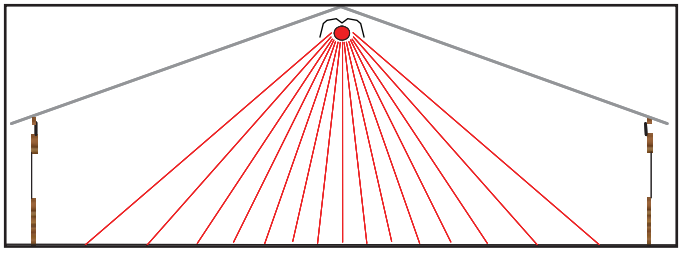
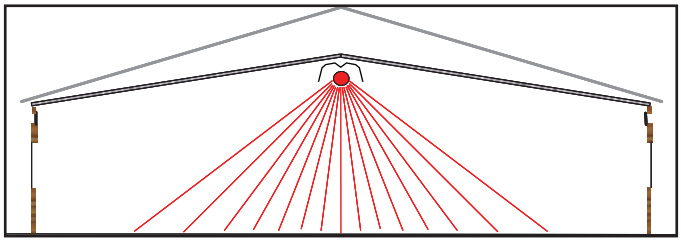
5.3 Low Ceilings

Poultry houses, generally, have low roof profiles and low peak heights. Inside the house there may not be open access to mount the heater just below the peak if a drop ceiling is in place. Typically, the hanging height of the heater in poultry houses will be between 9'-14' (2.75 m - 4.25 m) from the floor, higher if space permits. Each heater has certified clearances to combustibles which must be adhered. The clearance between the top of the heater and the ceiling or ceiling liner material must be maintained at all times for safety. This distance is less than 1' (0.3 m) and varies slightly depending on model and input. Since some poultry houses have fabric liners along the ceiling, care must be taken so that liners above the heaters do not sag into a clearances to combustibles area. It may be necessary to put a protective shield above the first length of tube to protect the ceiling from high temperatures.



Open Ceiling House



Dropped Ceiling House

5.4 Building Use Throughout Brood Cycle / Dividers

It is common for poultry houses to be sectioned off so that the birds are contained in a small area (brood area) early in the grow cycle. As the birds grow, a secondary brooder area and grow-out area are opened up for the birds. This use of the building should be considered during the heater layout design. Ideally, each heater will be entirely inside one section or another and not located such that the partition is positioned across the heater. If a floor to ceiling partition is located across the heaters, the partition must have a hole for the heater that is equal or greater in size than the heater's clearances to combustible area. Some partitions are just on the floor and wouldn't need to be cut. The clearances below and to the sides of the heater are always greater than the clearances above the heater.

5.5 Temperature Sensor Location

Most growers prefer to create a separate heat zone with each heater, so one sensor or thermostat is used with every heater. The location of the sensor should be at bird level, or as close to the floor as practical. If there is one central line of heaters, growers may initially locate the sensor somewhere between the outer water and feed lines and halfway between the burner and exhaust ends of the heater, to ensure adequate temperature and comfort for the birds in this area.



Heat Sensor

5.6 Combustion Air Supply and Venting

Contaminants such as feathers, dust, water, etc., may collect on the ceramic surface of pancake heaters, lowering their efficiency. These heaters also cannot be vented, so combustion products are exhausted into the space and mix with the air the chickens breathe. With gas-fired, low-intensity infrared heaters, corrosion resistant metal or flexible duct is used to deliver outside air to the burner. Isolating the combustion air inlet from indoor environment ensures that contaminants, which would shorten the heater's service life, do not enter the burner. Gas-fired, low-intensity infrared heaters have either 4" (10 cm) or 5" (13 cm) combustion air adapter diameter.

Most low-intensity, gas-fired tube heaters are approved for vented or unvented operation, dependent upon local codes and regulations. Unvented heaters require extra ventilation. Some heat will be lost due to extra ventilation.



Fresh Air Intake

This document is intended to assist licensed professionals in the exercise of their professional judgment.

5.7 Control Systems

It is common for poultry growers around the world to use a single control system for all equipment in the entire house. Many manufacturers offer “whole house” controllers to operate and monitor:

- Heating
- Lighting
- Natural Ventilation
- Forced Ventilation
- Feeding
- Watering

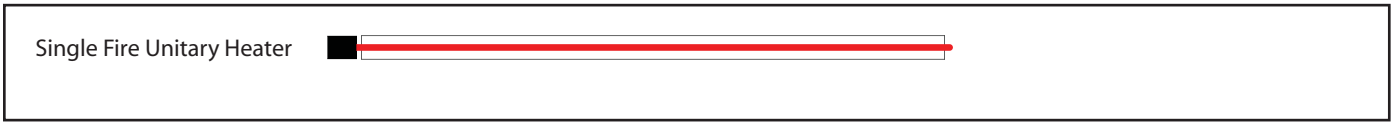
The majority of “whole house” controllers are capable of operating gas-fired, low-intensity, infrared heaters. Some control systems used with high-intensity infrared heaters, fluctuate gas pressure through electro-valves. Systems that fluctuate gas pressure cannot be used with low-intensity, infrared tube heaters. However, poultry house controller manufacturers sell all the accessories needed to control gas-fired, low-intensity, infrared tube heaters. If a poultry house

controller is not used, the heaters can be controlled by thermostat, or they can easily be tied into existing controls.

5.8 Typical Layouts for Various House Shapes and Sizes

The next few pages show some widely used layouts in both the brooder and grow-out sections of broiler houses. It is important to have the design and layout for all your agricultural buildings and houses performed by a representative qualified in the design, installation and service of poultry equipment sold and supplied by Val-Co.

Types of Gas-Fired, Low-Intensity Infrared Heaters



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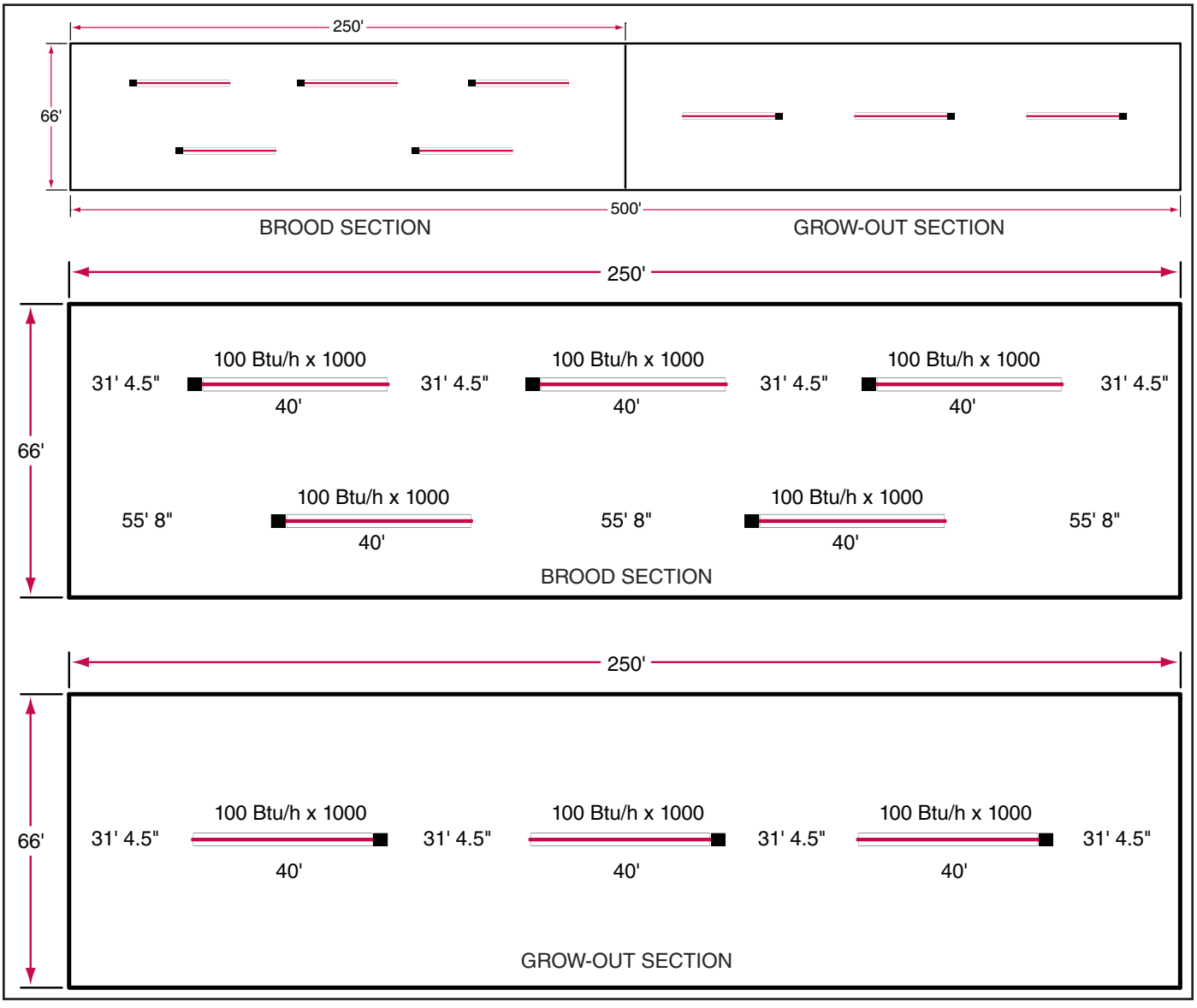
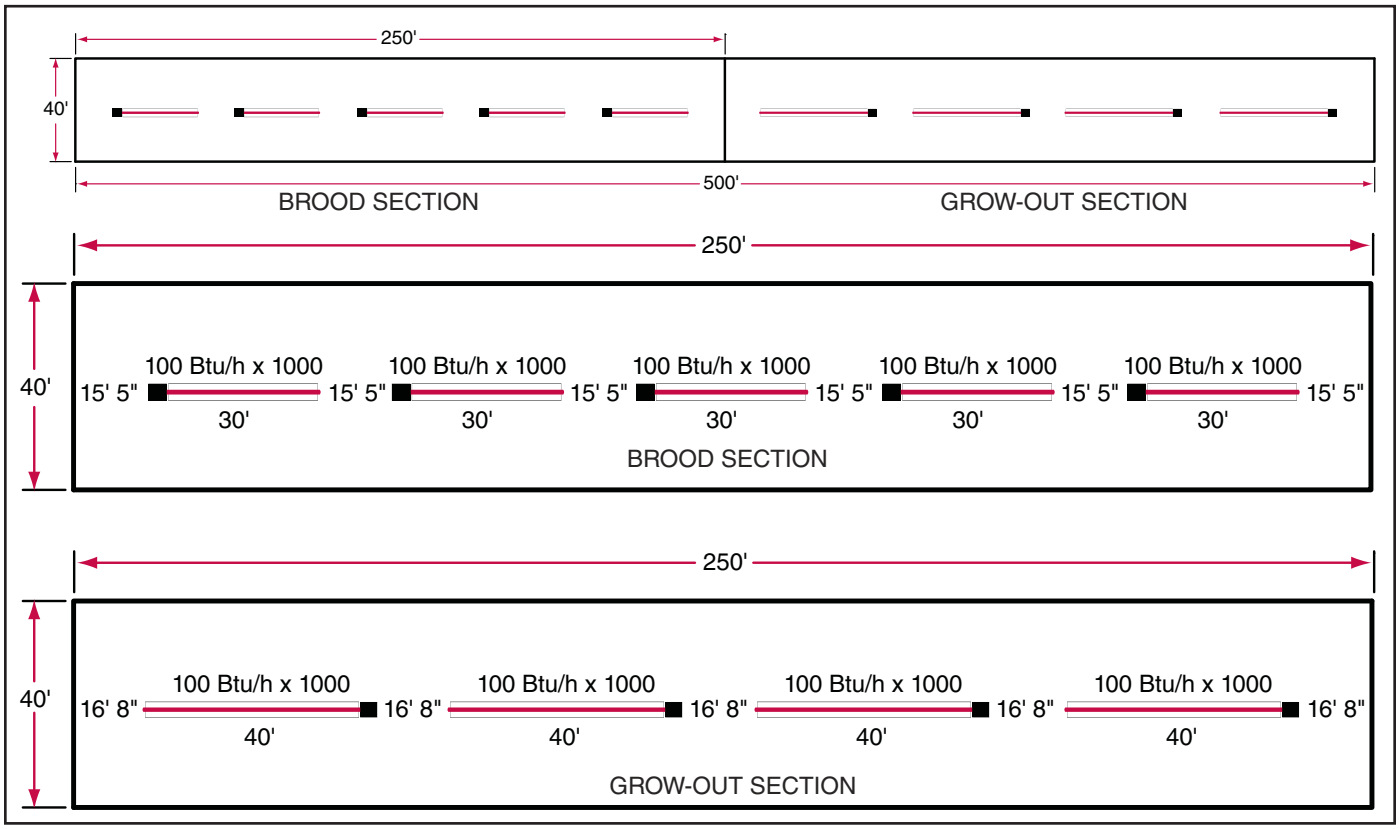


*Layout 2**

**drawings not to scale*

This document is intended to assist licensed professionals in the exercise of their professional judgment.



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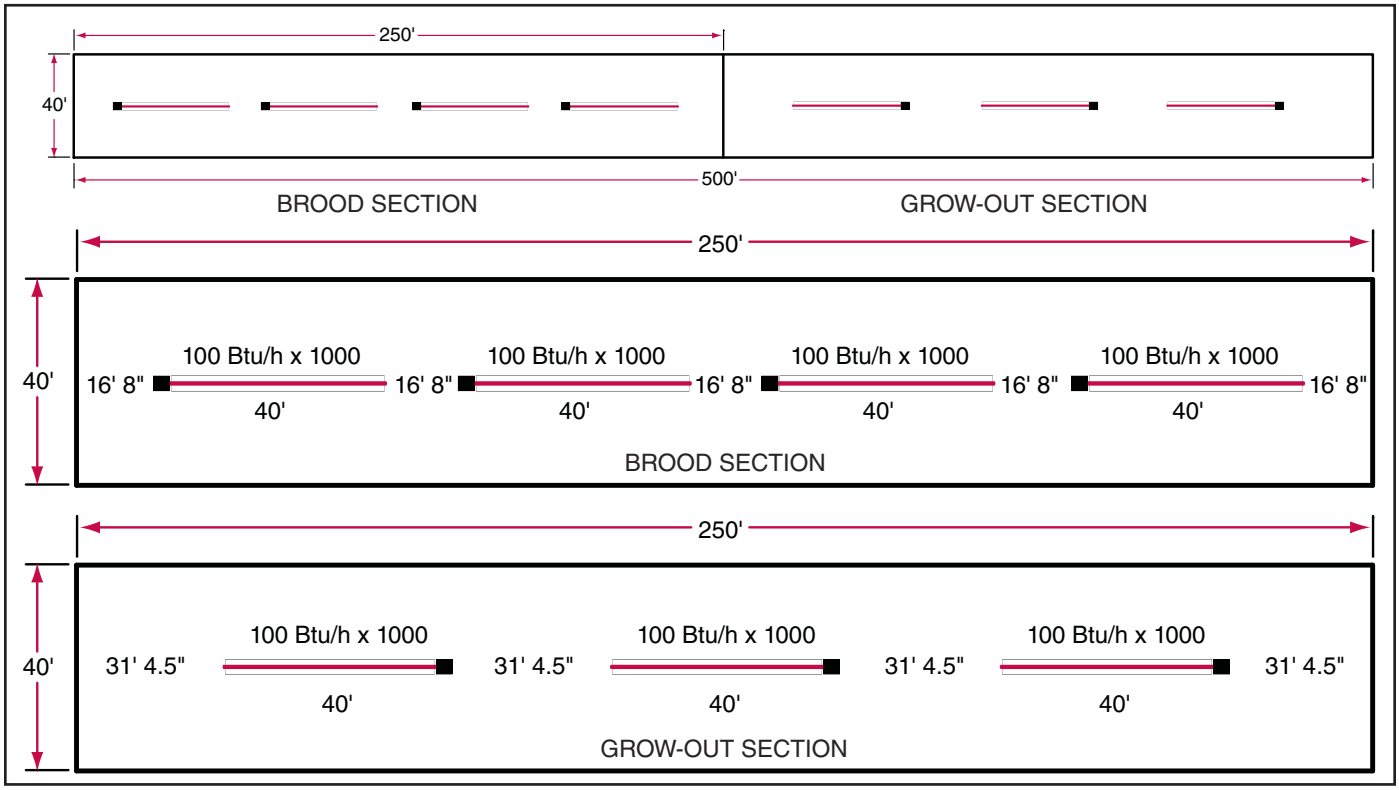

*Layout 4**

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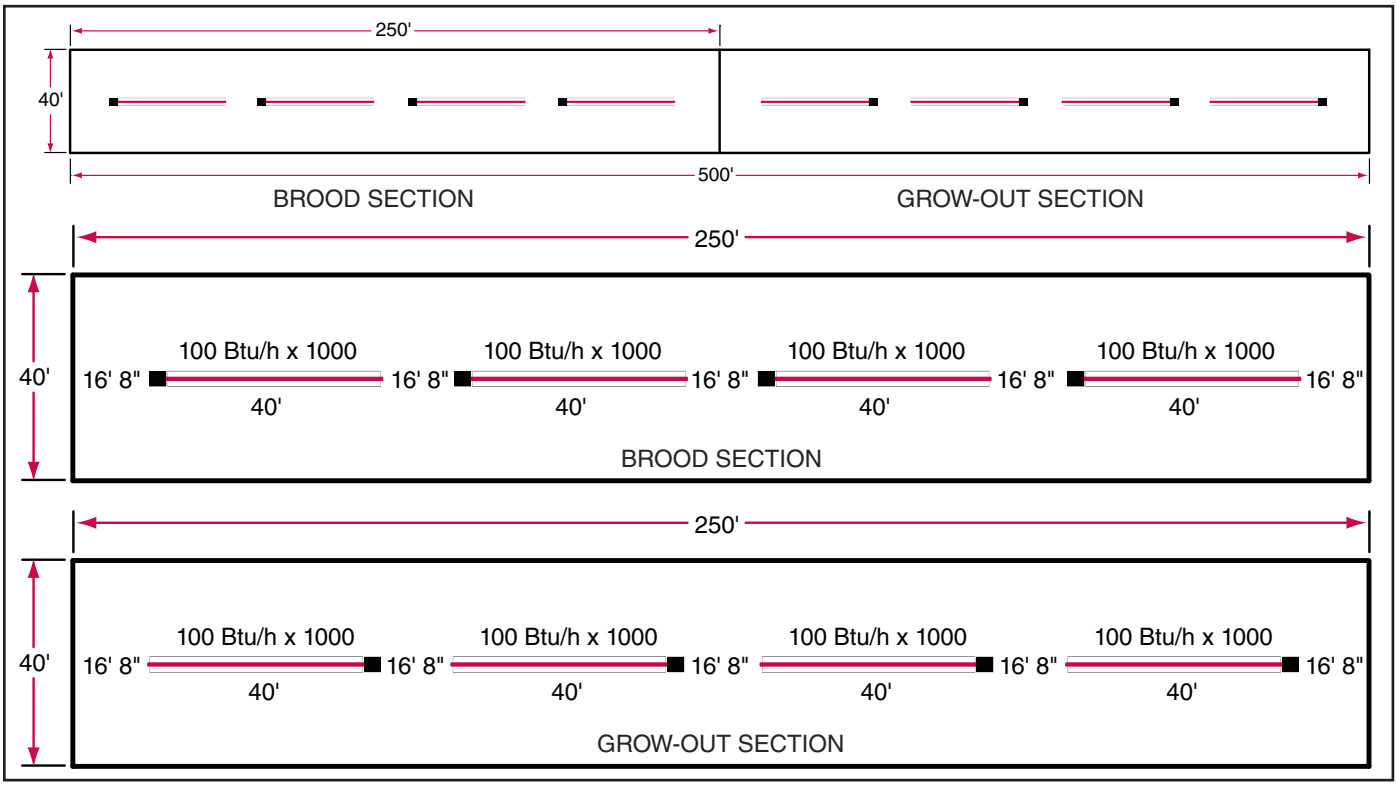

*drawings not to scale

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PART 6: INSTALLATION TIPS

6.1 Heat Coverage

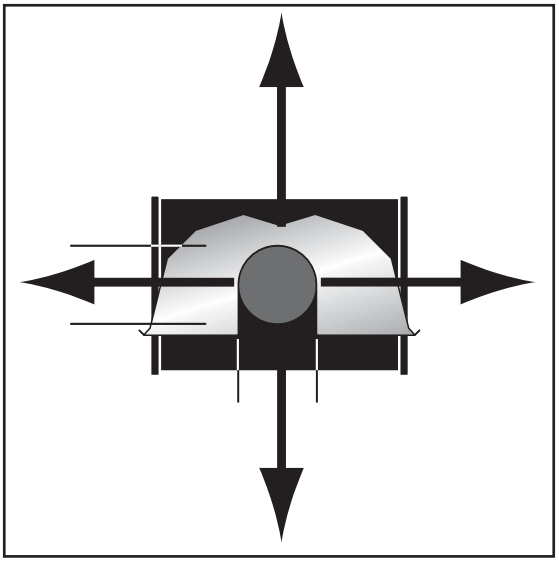
The reflector on a VAL-CO® gas-fired, low-intensity, infrared heater is designed to give a uniform infrared pattern across the poultry house. The proximity of burners in the house and the types of heat exchanger tubes control the uniformity of infrared heat lengthwise in the poultry house. The burner end of the first heater should always face an outside wall. Factors such as width and height of the house also influence uniformity. Where height and width are limiting factors, uniformity may vary.

6.2 Heat Load Calculations

To be sure the poultry house is properly heated based on its location, dimensions and other attributes, the amount of heat required for a successful flock must be determined. This will help identify the proper sizing and positioning of low-intensity, gas-fired tube heaters. In the U.S., integrators set the heat load based on the barn design, its age and location. Integrators typically recommend 70 – 95 Btu/ft^2. However, if the barn has high infiltration or poor insulation, more Btu/hr may be required. Conversely, a new barn with high R-value insulation and low infiltration may need less. It is important to have the heat load calculation performed by a professional qualified in the design, installation and service of poultry equipment sold and supplied by Val-Co.

6.3 Clearances to Combustibles

When choosing a location for a heat exchanger tube, it is crucial to pay close attention to the area immediately above, below and to each side of the tube. Consider the distance from gas lines, house dividers, equipment suspension cables and any possible sensitive material when determining how to meet the required clearances since objects too close to the heat exchanger tube may be damaged. While many objects can tolerate the infrared energy they receive near the heat exchanger tube, a safe and comfortable recommendation would be to keep objects at least a distance equal to the clearances to combustibles from the heat exchanger tube. The Installation, Operation and Service Manual or specification sheet will give specific distances above, beside and below combustibles. Be sure to follow these important specifications.



6.4 Location of Other Structural Objects

When designing and installing VAL-CO® gas-fired, low-intensity, infrared heaters, it is important to avoid conflict with structural and mechanical features such as low ceilings, dividers, ventilating apparatus, watering and feed lines, etc.

6.5 Heating Criteria

Gas-fired, low-intensity, infrared heaters offer flexibility in design. Long, narrow poultry houses are a convenient shape and easily solve the problem of providing uniform heat. Growers generally prefer to control temperatures to plus or minus 1° F (0.5° C) in 95% of the house production area. Commercial buildings are heated for creature comfort. Poultry house heating is process heating, where the temperature of the poultry is an integral part of their growth.

PART 7: MAINTENANCE

Each fall before the heating season gets underway, it is advisable to do a thorough inspection of the system. Turn on the system and check to see that each burner lights. Have a contractor qualified in the installation of gas-fired heating products check the flame to insure that is has proper color, and check the fan. Check the outlet vent to make sure that the bird screen is in good condition.

Visual inspection of the outside air inlets is required for infrared heaters used in poultry houses. A simple dusting to keep reflectors clean, allow them to continue efficiently directing the infrared rays toward the floor. Any mechanical system will require care and maintenance to remain in peak operating condition. Because the infrared heaters are in plain sight overhead an owner can keep an eye on the general condition and operation of the system during the normal daily routine.

7.1 Maintenance Checklist

Installation Code and Annual Inspections: All installation and service of VAL-CO® equipment must be performed by a contractor qualified in the installation and service of equipment sold and supplied by Val-Co and conform to all requirements set forth in the VAL-CO® manuals and all applicable governmental authorities pertaining to the installation, service and operation of the equipment. To help facilitate optimum performance and safety, Val-Co recommends that a qualified contractor conduct, at a minimum, annual inspections of your VAL-CO® equipment and perform service where necessary, using only replacement parts sold and supplied by Val-Co.

The Vicinity of the Heater	Do not store or use flammable objects, liquids or vapors near the heater. Immediately remove these items if they are present.
Vehicles and Other Objects	Maintain the clearances to combustibles. Do not hang anything from, or place anything on, the heater. Make sure nothing is lodged underneath the reflector, in between the tubes or in the decorative or protective grilles (included with select models). Immediately remove objects in violation of the clearances to combustibles.
Reflector	Support reflector with reflector hanger and support strap. Reflector must not touch tube. Make sure there is no dirt, sagging, cracking or distortion. Do not operate if there is sagging, cracking or distortion. Make sure reflectors are correctly overlapped. Clean outside surface with a damp cloth.
Vent Pipe	Venting must be intact. Using a flashlight, look for obstructions, cracks on the pipe, gaps in the sealed areas or corrosion. The area must be free of dirt and dust. Remove any carbon deposits or scale using a wire brush.
Outside Air Inlet	Inlet must be intact. Look for obstructions, cracks on the pipe, gaps in the sealed areas or corrosion. The area must be free of dirt and dust. Clean and reinstall as required.
Tubes	Make sure there are no cracks. Make sure tubes are connected and suspended securely. Make sure there is no sagging, bending or distortion. Clean or replace as required.
Gas Line	Check for gas leaks.
Burner Observation Window	Make sure it is clean and free of cracks or holes. Clean and replace as required.
Blower Scroll, Wheel and Motor	Compressed air or a vacuum cleaner may be used to clean dust and dirt.
Burner Cup and Orifice	Clear of obstructions (even spider webs will cause problems). Carefully remove any dust and debris from the burner.
Electrode	Replace if there are cracked ceramics, excessive carbon residue, or erosion of the electrode. The electrode gap should be 1/8” (3.2 mm).
Thermostat	There should be no exposed wire or damage to the thermostat.
Suspension Points	Make sure the heater is hanging securely. Look for signs of wear on the chain or ceiling.

This document is intended to assist licensed professionals in the exercise of their professional judgment.

Decorative and Protective Grille (optional)	The grille must be securely attached. Check that the side reflector extensions are installed correctly and secured in place if necessary. (Decorative grille only.) Make sure shield is installed correctly and secured in place, if necessary. (Decorative grille only.)
Lower Clearance Shield (optional)	The lower shield must be securely attached. Inspect shield support straps and lower clearance shield anchor points. Make sure shield is installed correctly and secured in place, if necessary.
Wall Tag	If wall tag is present, make sure it is legible and accurate. Please contact Val-C0 or your VAL-CO independent distributor, if you need a wall tag.

PART 8: APPLICATION PHOTOS



Gas-Fired, Low-Intensity infrared heaters heating a poultry house in the United States.



Gas-Fired, Low-Intensity infrared heaters heating a poultry house in the United States.

This document is intended to assist licensed professionals in the exercise of their professional judgment.



Gas-Fired, Low-Intensity infrared heaters heating a poultry house in the Middle East.



Gas-Fired, Low-Intensity infrared heaters heating a poultry house in Africa.



Gas-Fired, Low-Intensity infrared heaters heating a poultry house in Europe.



Gas-Fired, Low-Intensity infrared heaters heating a poultry house in the United States.

This document is intended to assist licensed professionals in the exercise of their professional judgment.



Gas-fired, low-intensity infrared heater being installed in a poultry house in Russia.



Gas-fired, low-intensity infrared heaters heating a poultry house in Russia.

Installation Code and Annual Inspections:
All installation and service of VAL-CO® equipment must be performed by a contractor qualified in the installation and service of equipment sold and supplied by Val-Co and conform to all requirements set forth in the VAL-CO® manuals and all applicable governmental authorities pertaining to the installation, service and operation of the equipment. To help facilitate optimum performance and safety, Val-Co recommends that a qualified contractor conduct, at a minimum, annual inspections of your VAL-CO® equipment and perform service where necessary, using only replacement parts sold and supplied by Val-Co.

Further Information: Applications, engineering and detailed guidance on systems design, installation and equipment performance is available through VAL-CO® representatives. Please contact us for any further information you may require, including the Installation, Operation and Service Manual.

These products are not for residential use.

This document is intended to assist licensed professionals in the exercise of their professional judgment.

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