EVALUATION OF INFRARED vs. FORCED AIR HEATING

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RE-VERBER-RAY RADIANT GAS HEATERS®

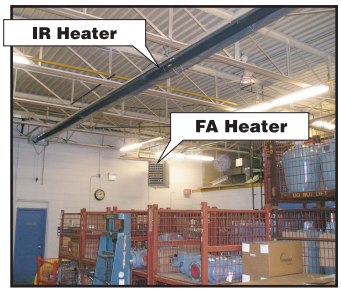
A study determining the effectiveness (23% fuel savings and improved comfort levels) of a two-stage infrared heating system and how it meets heat requirements more efficiently verses forced air heating systems.

R.D. MacDonald, P.Eng., Member ASHRAE; M.E. Armstrong, P.Eng., K.G. Boyd, P.Eng. - Appreciation for technical support and funding from Union Gas, Chatham, ON and Brant Radiant Heaters Ltd., Paris, ON.

DESCRIPTION:

A three-year study was conducted at a commercial facility with frequent overhead door openings. Participant installed both a Forced-Air unit heater (FA) and a tube-type Infrared heater (IR). Units were operated by a common thermostat, with a manual override switch, to allow for either forced air or infrared operation. This evaluation method allowed for an accurate side-by-side evaluation of the different heating systems.

Exterior



Interior

PROCEDURES & METHODS:

- Measure temperatures at 10 minute intervals, outside and a variety of inside and slab locations.
- Measure gas usage daily at designated times, conduct regular interview with staff on comfort.
- Predetermined operating cycles for Forced Air and Infrared heater (i.e. alternate weeks, etc.).

Figure 1 • Hours per year of High Fire and Low Fire Operation.

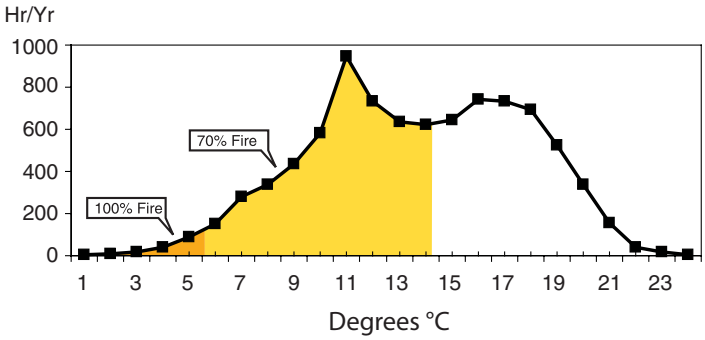
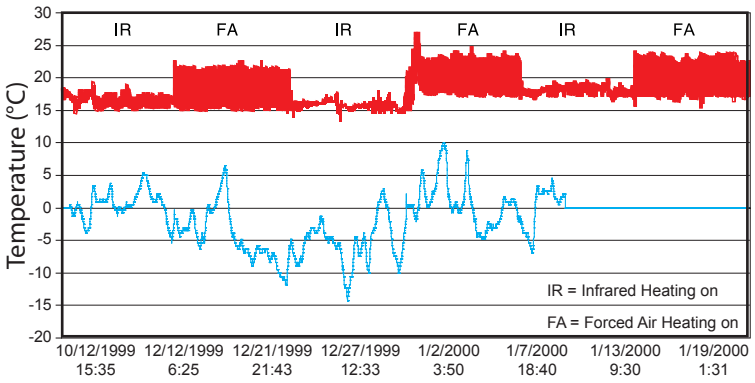
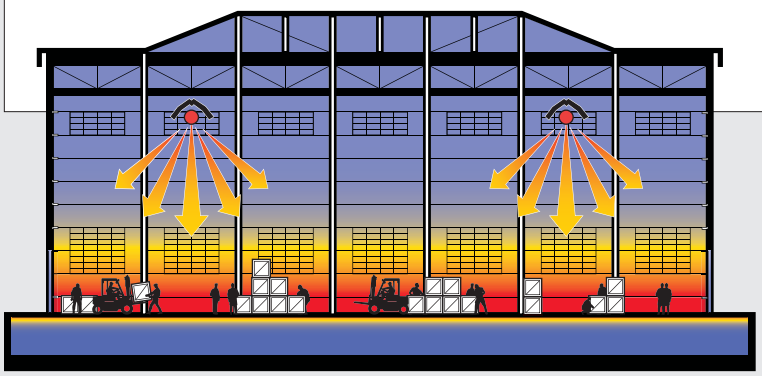
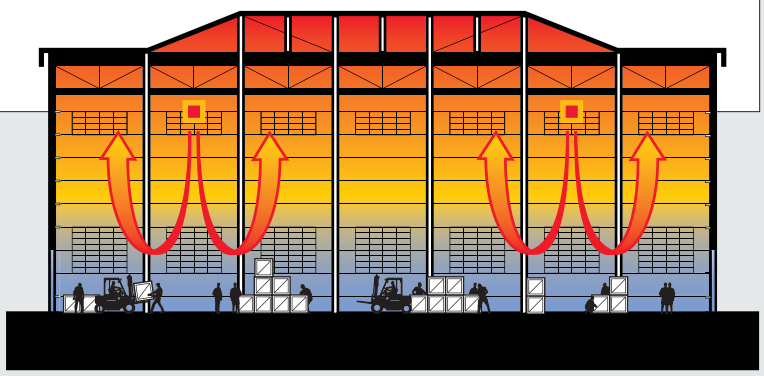


Figure 2 - Infrared vs. Forced Air Temperature Cycling





INFRARED TWO-STAGE HEATING SYSTEM



FORCED AIR HEATING SYSTEM

TESTS:

TEST 1 - (10-1-99 to 2-17-00) - Target Set Point -17°C.

- The method of testing was established using the system and verifying the controls.
- Systems operated equally at 1-2 week alternating intervals during the heating season.
- Energy savings comparing FA and IR proved minimal.

TEST 2 - (2-18-00 to 4-28-00).

Set Point - IR=16°C & FA=19°C; Actual Avg. Temp.- IR 13.2°C & FA 17.7°C.

- Systems operated during the heating season at 1 week alternating intervals.
- IR savings measured 19.5%, savings influenced by the lower set-point of IR.

TEST 3 - (10-16-00 to 4-12-01).

Set Point - IR=14°C & FA=17°C; Actual Avg. Temp.- IR 21.2°C & FA 18.9°C.

- Systems operated during the heating season at 1 week alternating intervals.
- Infrared savings measured 23.0% (Note average higher temperature for IR).

TEST 4 - (12-15-01 to 3-25-02).

Avg. Actual 'Delta T' to OAT was 31.3°C and 21.8°C.

- IR and FA systems cycled weekly 2000-2001.
- IR only 2001-2001.
- Saved 25.4% with continuous Infrared vs. weekly interval Infrared vs. Forced Air.

Figure 3 • Slab Temperature Changes of FA and IR.

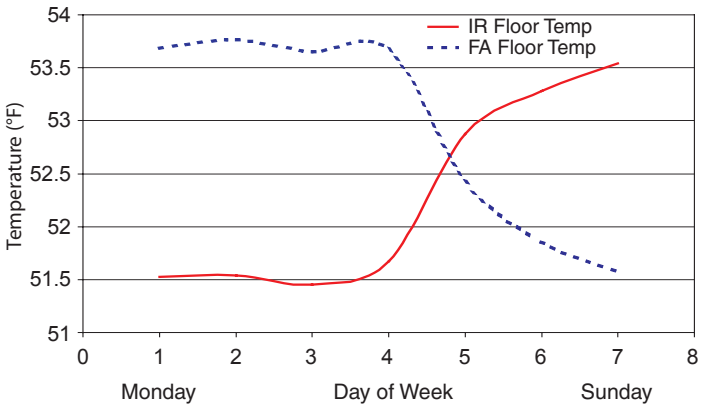
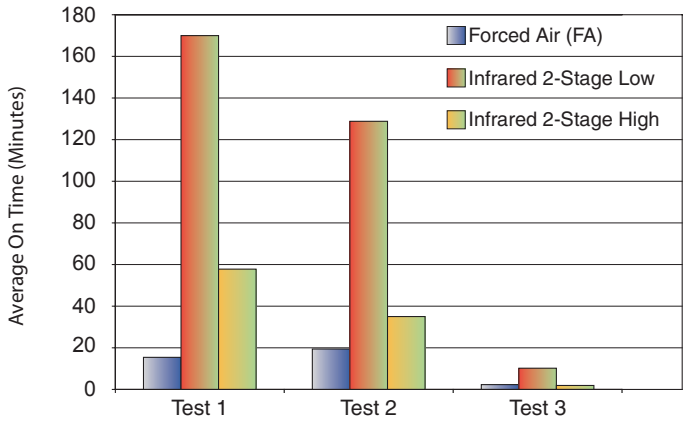


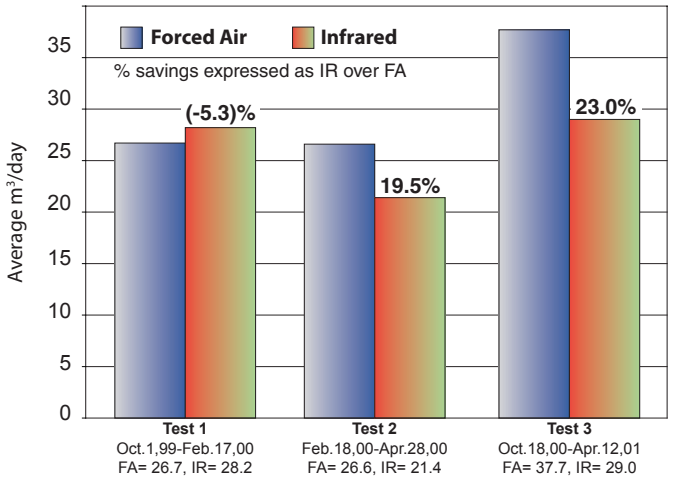
Figure 4 • Average IR Low/High vs. FA Opening Time.

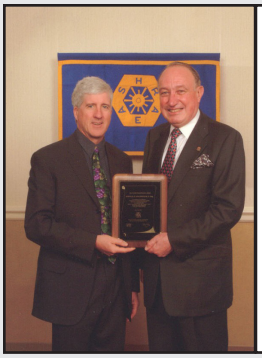


CONCLUSIONS:

1. Infrared heating saved up to 23% energy usage over a conventional forced air heating system.
2. The thermal flywheel effect in the slab contributes to energy use efficiency.
3. A weekly cycle of forced air vs. infrared is not a useful method of evaluating potential in either system due to the flywheel effect.
4. Two-stage infrared heat system ran on low fire longer than forced air per on-cycle; plus only used high fire 8-23% of the total on-time for heating.

Figure 5 • Forced Air vs. Infrared Energy Usage.





In June 2004, the AHR Committee presented its distinguished "Best Poster Award" to Agviro, Inc. for their work on this study.

ABOUT AGVIRO, INC.:

Based in Guelph, Ontario Ronald D. MacDonald PhD and Agviro, Inc. (formerly RDM Engineering) have researched and produced a number of scientific, technical and information papers on the subject of energy efficiency, as well as tested and reported on other energy matters for a wide variety of clients. Serving as an Energy Advisor and Energy Specialist to government, major utilities and private sector clients, Mr. MacDonald and Agviro, Inc. remain actively involved in a broad spectrum of energy matters, including their recent testing and reporting on the benefits of two-stage infrared heaters.

Printed by Brant Radiant Heaters Ltd. based on an independent test report prepared by Agviro, Inc.