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***Critical Information for Improved Bird Performance Through Better House
and Ventilation System Design, Operation and Management***

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Attic Inlet Technology Update

*By Jim Donald, Jody Purswell, Gene Simpson and Jess Campbell**

This past harsh winter constituted a rather extreme testing of current attic inlet technology and management approaches. While many growers using attic inlets have reported being satisfied with their performance, we have received many calls and reports of problems occurring with attic inlets that were not a problem with conventional perimeter inlets. Especially when the outside temperatures were in the teens and 20's, we received a lot of reports of house temperature unevenness and drafting of birds.

Attic inlets are still a rather new and evolving technology. Growers have lots to learn on how to manage attic inlets successfully, and you can bet that there will be many more tweaks and versions to this technology before it stabilizes and fully matures. The interest in attic inlet technology began about five years ago with the installation of quite a few passive gravity type, four way inlets across the broiler belt. Shortly thereafter several types of actuated inlets and combination gravity/actuated inlets appeared on the market. Today, there are many different types of attic inlets being used in the broiler industry.

When complex new technology is introduced to the broiler industry there is often a steep learning curve. For example, consider how long it took for the industry to fully develop and learn to properly manage evaporative cooling. Going from in house foggers, to fogger pads, to various types of pad flutes, and finally to the now-standard 6-inch recirculating cool cells took about 15 to 20 years of tweaking and learning. The technology has to develop and mature, and growers and managers with different levels of technical expertise have to learn how to manage the new tool for best results. Additionally, the economics must be worked out so the technology will pay its way. Similarly, we are seeing the first versions of many of the initial attic inlets being modified based on in-house experience, along with inlet management recommendations being refined.



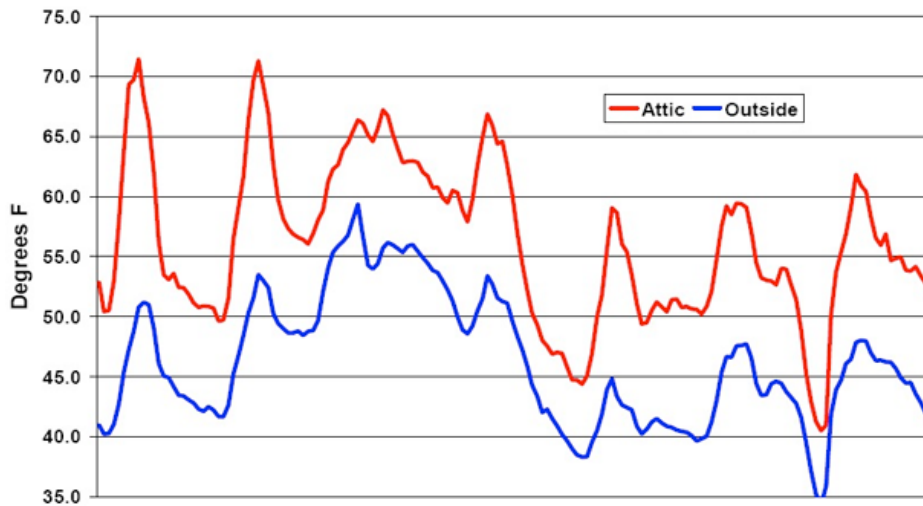
Various types of attic air inlets such as those shown above, as well as others, are currently available. The technology is promising, but hardware, software and management procedures are still rapidly evolving, and growers should exercise cautious due diligence in considering any attic air inlet installation.

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The basic science behind using attic inlets is sound. There is heat available in the attic and this can be used to preheat incoming cold air, which helps reduce BTU's of heat that must be supplied by propane or other fuel. We reported on attic inlet technology in July 2008 and January 2009 (Newsletters 54 and 57 at www.poultryhouse.com). The facts presented in those newsletters are still valid.

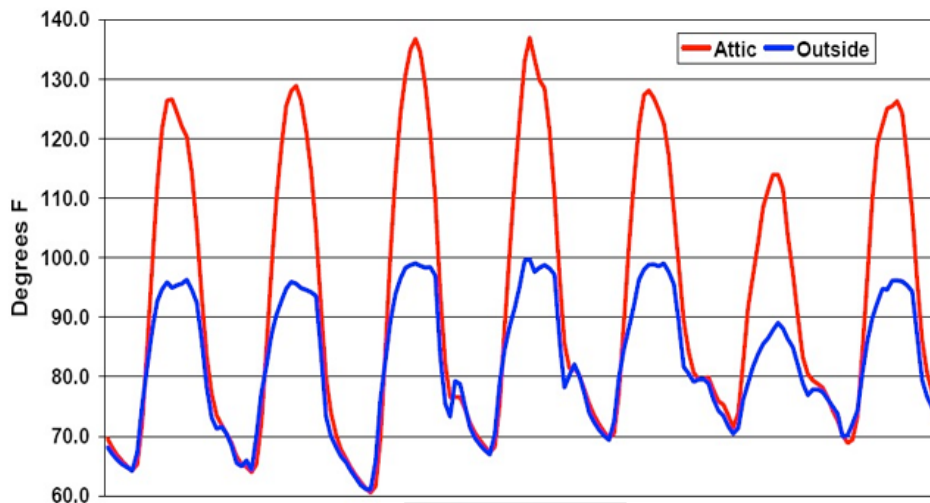
This report provides a brief update on the most common questions and misconceptions regarding current attic inlet technology and management we have been hearing in calls and conferences with growers and managers across the broiler belt, along with some thoughts on developments we think likely to come in the next year or two. While we certainly do have workable and beneficial attic inlet systems now, we are probably nowhere near the final versions of either the hardware or the best management practices.

Attic vs Outside Temperatures, First Week of Brooding in Winter



Attic vs outside temperature data tracking in winter shows attic temperatures generally 10-20 degrees F above outside temperatures and fairly good but variable potential for using supplementary daytime attic heat during brooding in winter. This data is from a house in the U.S. Southeast with good solar irradiation.

Attic vs Outside Temperatures, First Week of Brooding in Summer



Outside vs attic data in summer for the same house shows attic temperatures typically not rising above outside temperatures until outside temperatures are near or above 90 F. Little to no benefit from attic air inlets can be expected in this situation.

Questions, answers and misconceptions about attic inlets

1. If I use attic inlets, can I reduce my minimum ventilation fan run times because I am getting free heat from the attic?

Answer: This is not the best way to look at attic inlets. The attic inlet is not just another air inlet, it is a preheater for incoming air. This means that if anything, a grower or manager of a house equipped with attic inlets should increase his fan run times in order to take advantage of the free attic heat during times when it is plentiful. He should use longer fan run times in the middle of the day and he can start earlier in the morning and run later in the evening because of the attic inlet pre-heating incoming air. Basically, having a pre-heater for cold air allows us to have much bigger windows of time that we can run minimum ventilation, getting even better moisture control and adding heat to the house without

burning more fuel. The air doesn't know if the heat is coming from the attic or from propane burned in the house. Of course another major advantage of attic inlet technology is the ability to dry litter between flocks and to assist in preheating the house. We have seen many cases where people are really not taking advantage of this major benefit.

2. Is there much advantage to pulling air from the attic inlet at night?

Answer: USDA temperature data shows that the amount of heat available from the attic is minimal at night (see charts on previous page). This information was reported in 2007 and is still valid today. During the middle of the night the air temperatures are coldest and solar heat is nonexistent. So attic inlet operation in extreme cold weather in the middle of the night at best will yield little to no fuel savings and at worst has the potential to cause problems.

3. Is it true that attic inlets don't take much management?

Answer: Not true at all. Because unlike conventional perimeter inlets, attic inlets bring (more or less) heated air into the house, they actually introduce another dimension to minimum ventilation management. Yes, there are different levels and kinds of management required for gravity vs actuated attic inlets, but both require proper management to get the benefits they offer. Whatever type of attic inlet system you put into a broiler house, be sure you know what you are getting into, be sure you are not expecting too much, and be prepared to tweak the system as conditions change from day to day and from season to season.

4. Which is better, passive gravity or actuated inlets?

Answer: This is a hard question. Which is better, a hand saw or an electric circular saw? Both cut wood, both get the job done. It depends on what your expectations are, how much time you have to do a precise job cutting wood, and on how you evaluate the cost/benefit considerations involved. There are fairly sophisticated actuated attic inlets systems currently available that we hear good reports on. On the other hand, manual gravity attic inlets, which do require more constant management attention, are doing a good job on many farms where growers have chosen quality hardware, gotten proper installation, and are taking the time and effort needed to run them correctly.

5. Do all locations in the USA benefit equally from the installation of attic inlets?

Answer: Not at all. Your location in the United States will determine the solar radiation available and therefore the amount of heat in the attic. Over the course of a year, the largest amounts of solar energy transmitted into a dropped ceiling poultry house will be in the Southeast broiler belt. Texas-Mississippi-Alabama-Georgia-South Carolina-North Carolina-Virginia all link together to form a crescent, or sweet spot, for using attic inlets year round. Further north gets less sun, so a grower in Indiana versus a grower in Alabama won't get the same bang for his buck with attic inlet technologies. See the solar availability charts from the USDA Poultry Laboratory in Starkville, Mississippi, included below on pages 4 and 5.

6. Can attic inlets damage my poultry house?

Answer: If warm moist air from the bird chamber is allowed to chimney into the cold attic of a broiler house and be chilled, sweating will occur. This definitely can happen if an attic inlet is hung open or if attic inlets are allowed to be open when fans are not running and/or attic temperature is much lower than the in-house temperature.. There are over 30,000 linear feet of non-treated lumber in the attic of a 40 x 500 ft broiler house, as well as 20,000 square feet of insulation that must remain dry. Allowing attic inlets to be open at the wrong time can cause serious structural damage to the house.

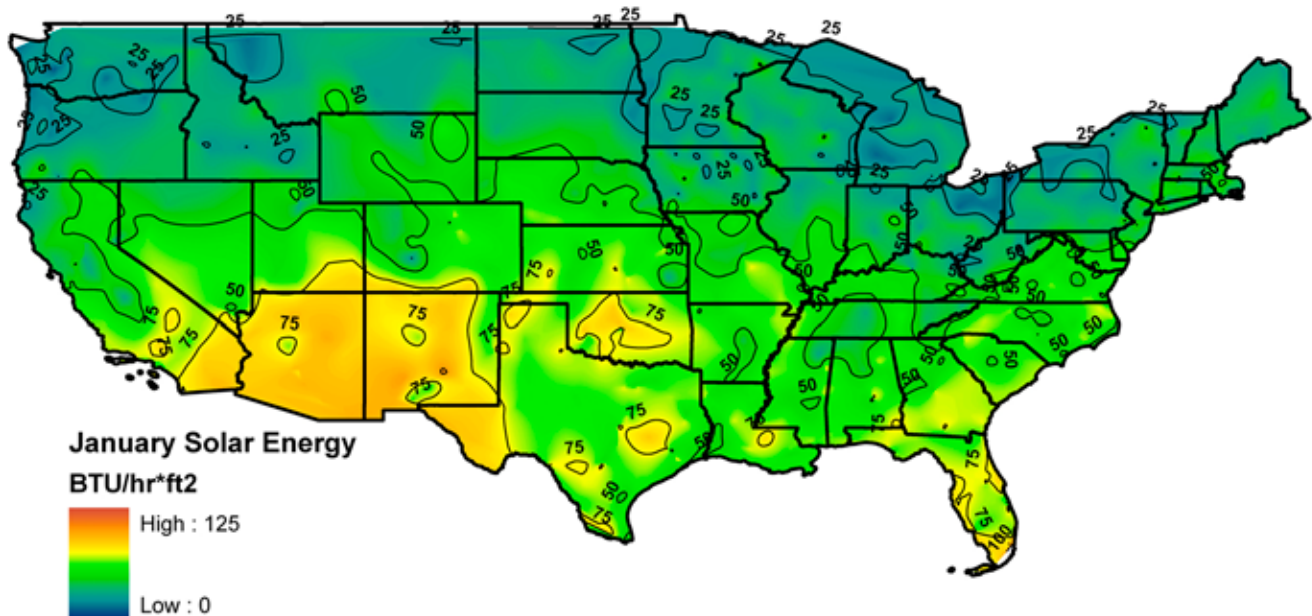
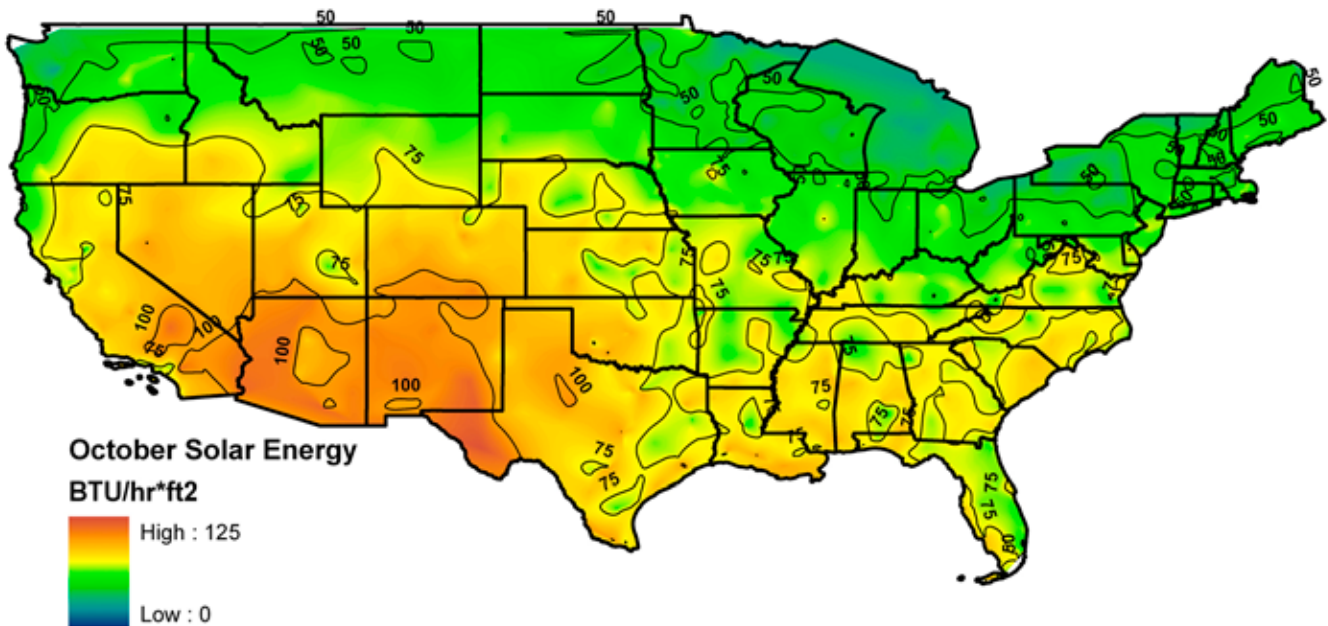
7. What should I do, should I act now, or should I wait to install attic inlets?

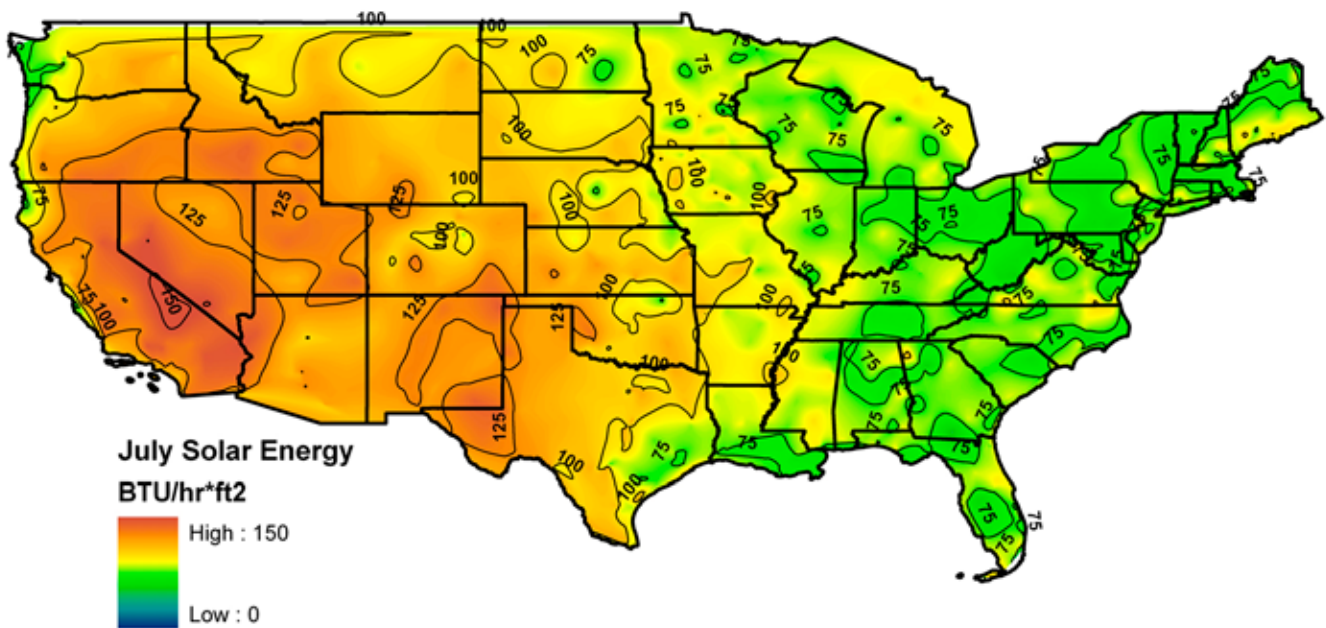
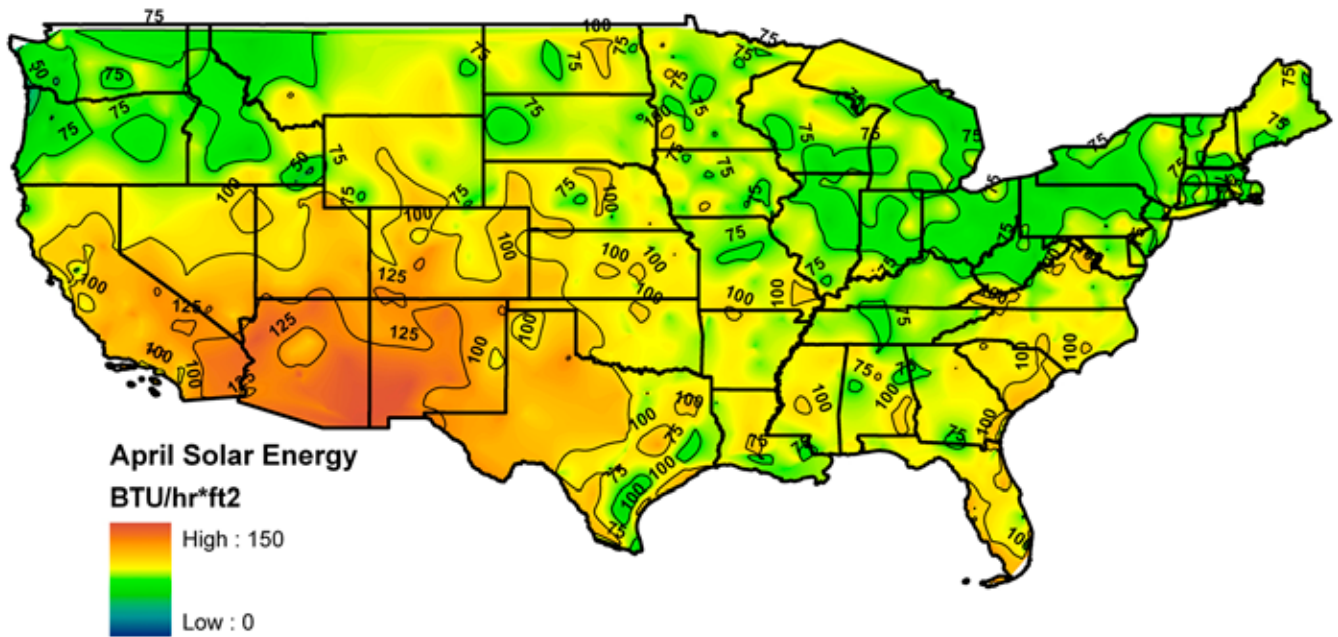
Answer: Our estimate is that attic inlets can pay for themselves roughly over a period of 24 to 36 months, depending on the cost of installation and the type of system that is installed, and assuming proper management. But be very careful in making a purchase decision. We have seen both passive and actuated inlet systems that are not in use because growers have become frustrated or because the technology did not meet their expectations. This is very unfortunate. No grower can afford equipment they can't use and won't pay for itself. Also, realize that that both actuated and passive gravity type attic inlet technologies will be refined again and again as time goes on. Getting your house tight, getting your insulation in order, and getting the most efficient heating system in your house are all things that should

be done before considering installation of attic inlets. Here are some thoughts to consider before you make an investment:

- a) Be sure you want attic inlets and understand the payback and time involved in their operation and management. If you don't have time to manage sidewall vent doors, don't think about having time to manage any type of attic inlet.
- b) Do as much pre-purchase investigation as possible, thoroughly checking out all the options.
- c) Look at the solar availability charts to see what the potential for attic heating is where your houses are located. Limited sunshine in winter, spring and fall equals limited benefit. Talk with any neighbor growers who have installed or are considering installing attic inlets.
- d) Get a quality installation, with special attention to make sure that all inlets seal tightly when not in use.
- e) Study and learn how to manage what you bought.

Solar energy mapping, which takes into consideration both hours of sunlight and average cloud cover, makes it possible to make at least a ballpark estimate of the potential for using attic heat at various locations. For example, if the map shows an average 75 BTUs per hour per square foot at your location, the attic of a 40 x 500 foot poultry house would be receiving a heat input of about 1.5 million BTUs per hour. Attic inlets make it possible to capture and use a significant amount (certainly not all) of that heat input. More specific information is available from the National Renewable Energy Laboratory at: http://rredc.nrel.gov/solar/old_data/nsrdb/redbook/atlas/





Likely trends in future attic inlet technology

For nearly forty years we have been equipping broiler houses with sensors, controllers and actuators to manage feed flow, air flow, temperature and relative humidity. The goal has been to let these sensors send information to the controller (computer) and allow it to make the best decisions for bird environment based on those conditions. We don't see any reason for that overall trend toward automation to stop. With the time demands that have been placed on the modern poultry grower, we feel the emerging trend will continue to be toward actuated inlets that are run from software parameters that have been set by the grower or company. Here are some of the examples of what we see emerging.

Attic temperature parameters

It is possible that when attic temperatures drop below a certain level in very cold weather, attic inlets might cause drafts or cold spots. So a "don't use below set point" setting might be included in the controller software. For example, don't use attic inlets if the attic temperatures are below 20 degrees F. It

is also possible that if the attic reaches a certain high temperature in extreme hot weather, you might want to stop the use of attic inlets. For example, a high limit set point of 110 degrees F might be set to discontinue use in the middle of the summer.

Time of day

Since little heat is available in the night time hours, a time of use clock might also be put in the software. Example: don't use attic inlets before 8:00 A.M. or after 9:00 P.M., as there is not much heat available in the attic during those hours. Save the wear on the inlet machine and use perimeter inlets during this period.

Maximum cfm allowable through the attic inlet

We have seen or heard of many cases of operators trying to run far more air through the attic inlets than the inlets were designed to handle. For example, if a 40 x 500 house (20,000 sq ft) has attic inlets installed, they are usually designed to handle about 20,000-30,000 cfm of air. The range is about 1.0 to 1.5 cfm per sq ft of attic inlet capacity to be installed. This would allow about the equivalent of three 36-inch fans to be run through the attic inlets before the perimeter inlets would need to be opened. If no perimeter inlets open and more air is turned on, the static pressure becomes very high and damage to the house can result. We have seen or heard of houses that had run as many as four tunnel fans through the attic due to mismanagement or misunderstanding. This is a very serious problem. We must educate and warn of the consequences of trying to pull too much air through the attic.

Blending software

With two actuated inlet machines in a house (one for the perimeter inlets and one for attic inlets) we now have the possibility to develop software that would use attic inlets for the first stage of ventilation, use and coordinate both sets of inlets for the second stage of ventilation, and then shift to perimeter inlets for the third stage. With sensors and software this can be done accurately. The sensors and software can also be used to lengthen run times when beneficial and minimize them when it could be detrimental.

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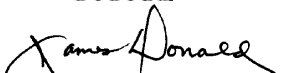
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