



## Packaged vs Split-Systems – Analyzing the Real Costs

*agricultural and commercial refrigeration*

### PACKAGED REFRIGERATION VERSUS SPLIT-SYSTEMS FOR AG – UNDERSTANDING THE REAL COSTS

The cost of a contractor-grade mass-produced condensing unit and commercial air handling equipment is perhaps 50%-60% of a purpose-built packaged through-the-wall agricultural cooling system. KoolJet makes both types. The economic temptation of saving on the capital equipment is on the surface worthy of pursuit, but the genuine cost actually clearly favors a packaged approach. Situations differ and may dictate the best approach, but the following compelling thoughts may shed light on the subject.

#### From Condensing Unit to Air Handler

For a split system, there are costs to set the condensing unit, concrete pad, line-set, line-set installation, protection and insulation, wall penetration to the air handler, sealing of the penetration, initial refrigerant charge (KoolJet arrives fully charged), isolation service valves, electrical disconnect, NEMA3 panel, conduit from service. KoolJet also requires power from service, but the electrical disconnect is factory installed on our unit and the other items between the condensing unit and air handler, along with refrigerant and installation labor are eliminated.

#### Installation Cost Differences

There are cost differences to install a single air handler on a wall along with its condensing unit outdoors, versus a packaged wall unit. An air handler can be surface mounted using a lighter-duty support structure. A packaged unit requires cutting a hole in a suitable wall for the best air distribution and has certain support requirements. Of course the benefit is FREE-COOLING that is now possible and worth far more than the cost of the hole and any structural changes suggested. There is more sealing and insulating to do around a free-cooling packaged system than a line-set penetration.

#### FREE-COOLING – Only with Packaged Approach

The ultimate cooling is free. It is possible in a packaged system whenever the outdoor ambient temperature is less than the set point for your storage area, minus an offset. A packaged system can turn-off the refrigeration system entirely, saving huge amounts of electrical energy, and open a motorized damper to allow cool outside air to enter the fan plenum and cool the storage space perfectly.

The only energy expended during FREE-COOLING mode is the fan(s) as the compressors are not operating at all. The number of free-cooling hours available is dependent on the current temperature difference of the return air inside and outdoors.

#### Refrigerant Pressure Loss and Efficiency

There is a cost difference of moving refrigerant 6-8 feet inside a Packaged system versus 50-100 feet or more with a typical split system. More energy is required by the compressor to overcome the increased pressure losses in a split system. The pressure loss between the remote condensing unit and evaporator reduce the performance of the evaporator.

#### Protect Your Plants – Use Dual Circuits

A split system has more leak points and are typically only ONE circuit. So in the case of a refrigerant loss, all of the cooling to that air handler is lost. With KoolJet, there are TWO independent circuits which provides 50% refrigeration capacity redundancy.

#### Redundancy, Safety and Energy Efficiency

Dual independent circuits is more than just redundancy for safety, but allows turning off an entire circuit including the fan if desired. This feature is a significant energy-saver that no single-circuit solution can provide. Even when a refrigeration circuit is not operating, you can still run the fan(s) for enhanced air movement in the storage space and superior gas exchange at the plant tissues.

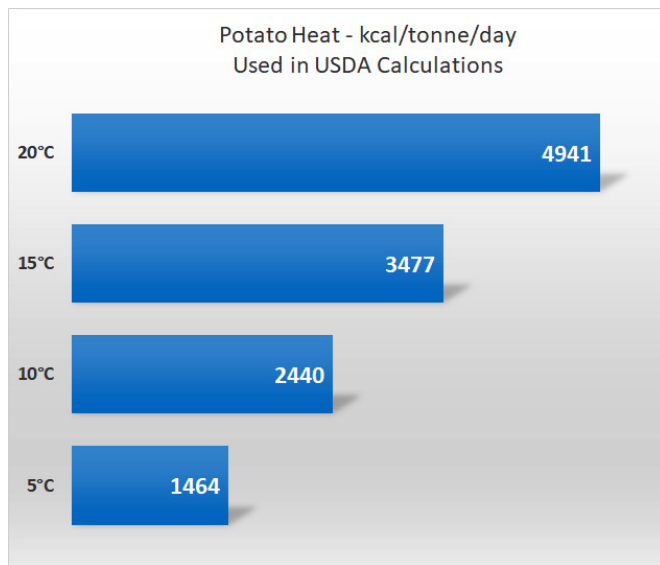
#### The Magic of Dual Interleaved Circuits

Interleaved dual refrigerant circuits provide another advantage in agricultural cooling. Interleaving means that the tubing from both circuits travel inside the same fin-bundle. This provides a significant energy-saving advantage when one compressor is turned-off because ALL of the fin surface now serves just ONE circuit. The result is better heat-transfer of the refrigerant and a closer "approach-temperature" resulting in lower energy required by the compressor. No single-circuit design approach has the capability to create reduced approach temperatures and this becomes important because of the heat profiles

common in agricultural cooling. KoolJet can stage-off entire refrigeration circuits and use the interleaving of the coils to achieve even higher energy savings for the operating circuit as the plant tissues cool and the compressor load is reduced below a single circuit capacity. The use of interleaving dual circuits unlocks this capability and it is relevant for live plant cooling and energy efficiency.

### Follow The AG Heat Generation Profile

A Packaged system can better "follow" the actual heat load changes from plant transpiration. As plant tissues cool, their respiration rate and their heat generation is reduced significantly. The example below shows the rate versus temperature for Potato. Source is USDA.



This means that as the building transmission rate remains steady, the transpiration heat load inside the space is much lower, often by a large measure. Therefore, in the natural cycle of cooling plant tissues, the ability to turn-off some refrigerating power is necessary to match the actual heat load.

### Single Refrigerant Circuits Rob Energy

Single circuit designs must rely on energy-robbing approaches like hot-gas bypass to match the actual load profile of agricultural cooling with the compressor power. This is a waste of energy as the load goes down that a packaged dual interleaved circuit approach overcomes in large measure. The energy savings are enhanced by the short travel distance between all the refrigeration components and the significantly reduced system pressure-losses.

### The Importance of Fresh-Air Mode

A packaged unit can provide a Fresh-Air Mode which has many advantages to the storing of living commodities. The ability to flush a storage area of accumulated transpiration and ethylene gases is a valuable feature when needed. A split system does not have the air path or a motorized damper available for Fresh-Air Mode.

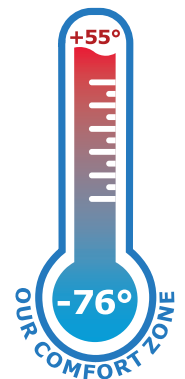
### ONE Electrical Feed to Install and Service

With a split system, there are TWO electrical services to provide and maintain; one for the condensing unit and one for the air handler. A packaged approach eliminates the installation costs of one electrical service feed.

### Agriculture Needs Tight Humidity Control

A packaged KoolJet system can provide excellent humidity control that a split system cannot. KoolJet utilizes the hot-gas from the condenser side for rapid defrost and a de-humidification coil on the evaporator side - all in the packaged unit. A split system cannot provide this feature.

The bottom-line seems clear. Whenever you can use a Packaged approach, you should. Your produce will be happier and your profits higher. Use a split approach when necessary due to site constraints. If you are in a Free-Cooling Zone, a Packaged System should be your best option.



**KoolJet**

Toll Free: (866) 748-7786

[www.kooljet.com](http://www.kooljet.com) | [info@kooljet.com](mailto:info@kooljet.com)

