HVACiQ

SonicWaveClean

ENERGY SAVING FOR HVAC SYSTEMS

SonicWave CLEAN™

0800 368 8815

info@hvaciq.co.uk

www.hvaciq.co.uk

H2OiQ Limited t/a HVACiQ, Chapelry, Walkers Lane, Whittington, Worcestershire, WR5 2RD

Lowers energy cost by reducing refrigerant flow restrictions in HVAC filter /driers

What is it?

The WaveClean is an electronic device that conducts sonic and ultrasonic waves into the filter/drier used on HVAC systems. This reduces the RFD refrigerant flow resistance and the energy required to move the refrigerant through the refrigeration circuit,

How does it work?

The WaveClean generates pulsed sonic & ultrasonic waves which interact to loosen and remove sludge from the filter screens. This reduces restrictions in the cells of the screens reducing the energy needed to keep the refrigerant flowing.
The WaveClean reduces the energy consumption by an average of 16.5% in HVAC systems by reducing the back pressure in the liquid line filter / drier.

*__NOTICE__ : “The WaveClean is not designed to eliminate the need for changing a failed filter. The WaveClean cannot be used to clear moisture saturated and tar clogged defective filters. If the filter was opened to atmosphere and exposed to excessive moisture or has excessive carbon in the refrigerant, the filter must be replaced.”

Typical Filter / Drier

WaveClean reduces particle and oil fouling and allows the refrigerant to flow without disturbing the desiccant or allowing foreign materials to circulate in the refrigerant past the filter / drier.

WaveClean - 2 models:

- **WaveClean1**: has a single transducer for use in systems with a single refrigerant circuit
- **WaveClean2**: has dual circuit transducers for systems with 2 compressors / refrigeration circuits

- (For systems that have 4 compressors / refrigerant circuits require 2 of the WaveClean2 models)

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Introduction to the SonicWave

Background:
The Refrigerant Filter Drier (RFD) is an essential protection device for all the other components built into air conditioners and/or heat pumps. See the diagram below for the location of the RFD in a typical refrigeration system:

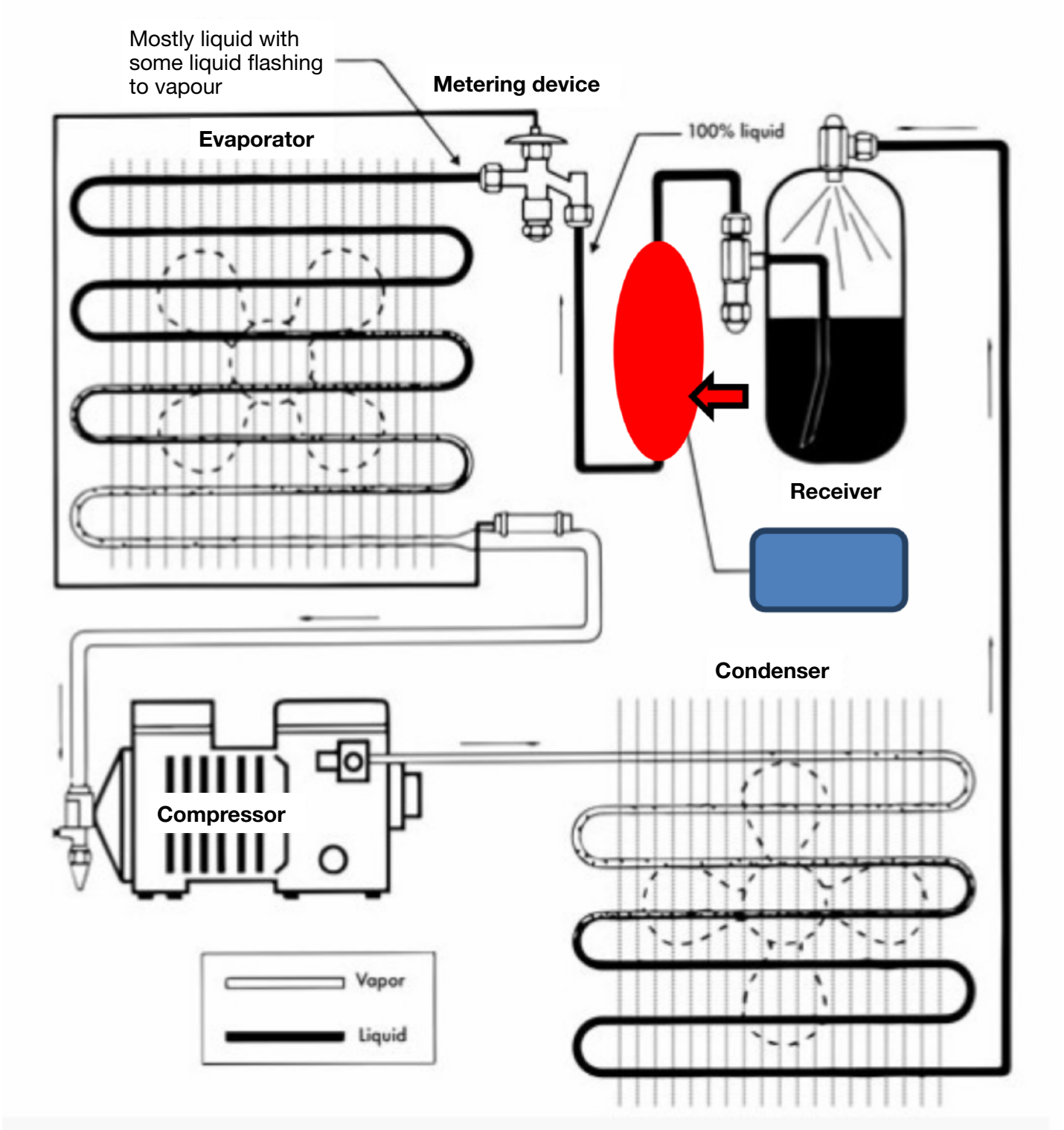

Figure 1: This illustration shows a filter drier's position on the liquid line of a typical refrigeration system

RFD Filtration Function

The function of the liquid line filter drier is filtration of small particles, debris along with the suspension of trace moisture. Filtration is usually done with a screen, wire mesh, and the desiccant core itself (see Figure 2). As small particles accumulate on the screen, wire mesh, or desiccant, they can act as very fine filters that remove even finer particles. However, as these fine particles accumulate over time, they can create enough of a pressure drop to cause the liquid refrigerant passing through to flash to a vapour. This can cause a local cold spot on the filter drier and even cause condensation (sweating) to occur on the outer surface of the filter drier's body. The sight glass also will "bubble" from the refrigerant flashing to a vapour. In this case, a bubbling sight glass is indicating flashing refrigerant. Do not mistake this with a bubbling sight glass associated with an undercharge of refrigerant.

There are many times when a filter drier may be partially plugged and technicians cannot feel a temperature difference across it with their hands. Because of this, many filter drier restrictions go unchecked by technicians because they are difficult to sense by touch and feel.
A sight glass on the liquid line before the TXV helps alert technicians if any liquid flashing is occurring before the TXV. This flashing could be from loss of sub-cooling or too much static and/or friction pressure drop in the liquid line before it reaches the TXV.

RFD Replacement Criteria

1. If the system has been opened and exposed to the atmosphere, the filter will be overloaded with moisture and the desiccant inside the filter will be damaged. In this situation, the RFD should be replaced.

2. If the compressor fails and burns out, carbon can get in the refrigerant and overload the RFD filter materials, and it should be replaced.

Normal RFD Environment

Most Refrigeration Units operate for many years without ever being exposed to either of these conditions. But, the RFD will have some restriction in the screens after only a year or two of refrigerant circulation through the RFD. The oil from the compressor and the particles or residue left in the system after it was installed are captured by the screen cells in the filters. This normal operational process causes the filter screens to become restrictive to refrigerant flow. This does not prevent the unit from operating normally, but it does significantly reduce the energy efficiency of the unit. The compressor must provide more electrical power to pump the same amount of refrigerant through a restricted RFD.

The SonicWave - Introduction

Any restriction in refrigerant flow that was not intentionally designed into the refrigerant circuit will reduce the efficiency of the refrigeration system. Undesirable Restrictions reduce the EER and increase the KW / Tonne ratings for the machine. Undesirable restrictions elevate the energy cost to operate a refrigeration system. The purpose of the SonicWave is to maintain the EER high and the KW / Tonne low at all times by minimising the restriction to refrigerant flow in the RFD. The SonicWave will reduce the energy cost to operate a refrigeration system.

The primary purpose of the SonicWave is to keep the RFD filter screens open to refrigerant flow. It loosens and shifts debris from the individual cells in the screens that are inside the filter. This is the debris that was left in the unit when it was manufactured, installed, charged, and now placed into operation.

Since every refrigerant filter dryer experiences cell restrictions due to residue that was built into the system - then every refrigerant filter dryer is a candidate for the SonicWave.

**NOTICE: "The SonicWave is not designed to eliminate a failed condition in a filter, and cannot repair a defective filter. If the filter was exposed to excessive moisture or to excessive carbon in the refrigerant, the filter must be replaced."*

The SonicWave – Testing

The SonicWave was developed and tested for reducing refrigerant filter dryer restrictions in refrigeration systems owned and operated by the US Federal Government. Packaged Units, Roof Top Units (RTU's) and Split Units have all been tested under the stringent guidelines of the Federal Procurement Regulatory System and in accordance with IPMVP Guidelines.
The graph in figure 2 illustrates the effectiveness of the Exciter in reducing RFD restrictions and describes the delta T improvement of the refrigerant flow through the RTD. As the Exciter operates over a period of time, the screen cells open up more and more. This opening of the cells consistently reduces the KW / Tonne of the refrigeration system.

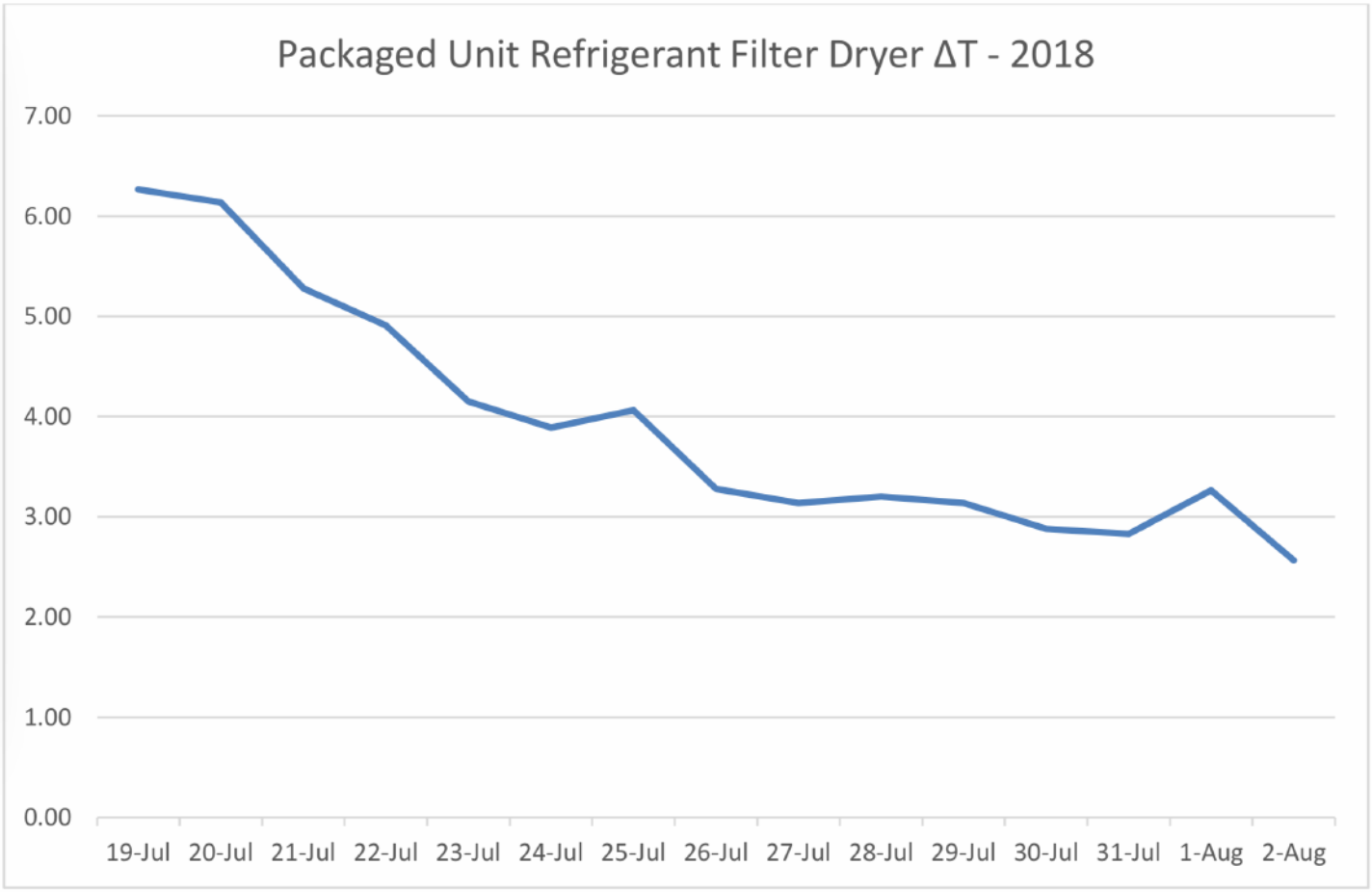

Figure 2: Government Facility Packaged Unit Refrigerant Filter Response to the SonicWave

Measuring the temperature across the refrigerant filter is the most expedient way to determine the level of restriction of the screens in the RFD. Any Delta T across the filter greater than 3 °F is undesirable. Figure 2 (above) shows the RFD had a daily average delta T exceeding 6 °F. Approximately 10 days after installing and activating the SonicWave, the filter Delta T had dropped to less than 3 °F.

The KW / Tonne averaged 2.752 KW/Tonne on July 19th st and dropped to 2.302 KW / Tonne by July 31st.
(2.752 KW / Tonne – 2.302 KW / Tonne) / (2.752 KW / Tonne) x 100% = 16.35% Reduction in electrical energy required to move the same amount of heat for this facility.

It is clear that for this system, an energy reduction of 16.35% was achieved which equates to the following: 20,075 kWh / yr x 0.1635 = 3,282 kWh / year reduction in energy consumed in the unit.
Given a cost of 13.95 pence / kWh: 3,282 kWh / yr x 13.95 pence / kWh = £457.84 per year in energy cost savings

Cost of the SonicWave installed on this single refrigerant circuit = £400.00
Simple payback = £500 / £457.84 / yr = 12.1 Month payback annualised ROI = 31.54%