**1) Total Fan Motor Kw** - This is calculated by multiplying the *Total Fan Hp* by the *Motor Kw/Hp* factor.

**2) Motor Efficiency** – Electric motors always use more electricity per horsepower than the conversion factor of 740 W/Hp suggests. This entry allows correct calculation of the actual power used by the motor(s). Three-phase motors vary in their efficiency, depending on their size. For small motors (in the 1-2 Hp range), we use a 60% factor. For motors between 2 and 5 Hp, we use 70%. For motors larger than 5 Hp, we use 85%. The number is automatically selected, but may be over-ridden.

**3) Fan Motors Speed (RPM) -** Typically, three-phase fan motors come in two different speed ranges - 1100-1200 RPM, and 1600-1800 RPM. The motor's design speed affects the Frigitek Power Reduction Factor, and should be set correctly for the motor(s) being evaluated.

Usually, the motor speed can be determined by observation, because the slower-speed motors are much quieter than the high-speed motors, but it may be necessary to look at the motor ID plate to be sure.

Note also that all the motors on this sheet must be the same RPM.

**4) Motor Kw/Hp –** The Motor Kw/Hp is calculated by dividing 745.7 (W/Hp) by the motor efficiency percentage.

**5) Cost per KwH** – This is the cost of electricity. It should be determined from a recent electric bill, by dividing the total billing amount by the number of kilowatt-hours listed on the bill. This will then take into account all of the fees and taxes which add to the basic cost of the electricity used.

**6) Normal Duty Cycle** - The ”Duty Cycle” is the percentage of time the refrigeration system is actively cooling the room. Note that this may not be the same as compressor run time, because of the design of the system. We have found, after hundreds of installations, that duty cycle is typically 40%. This is the number which should be used in the calculations, unless a test has been made to determine that the duty cycle is different.

**7) Operation Time Factor** – This factor allows an adjustment of the amount of time the system is in operation during the year. Some refrigerators are only used seasonally, for example, in the case where vegetables are harvested and stored before delivery to customers or processors. Normally, this factor is left at 100, but, if a refrigerator is used less, the number may be adjusted.

**8) Frigitek Duty Cycle –** The duty cycle under Frigitek operation is reduced because of the reduced heat injected into the cooled chamber under Frigitek operation. This reduced Duty Cycle is used in calculating the Frigitek savings.

**9) Duty Cycle Reduction** - The Duty Cycle under Frigitek operation is reduced by about 5%. Other factors may cause the Duty Cycle reduction to be more. If the reduction percentage is known, put it here.

**10) Controller, Tee -** A Controller and Signal Sensor Tee is required for each thermostat in the room. Each thermostat defines a separately controlled evaporator or group of evaporators, and, therefore, a separate Frigitek control group of Power Units.

**11) Frigitek KwH Savings / Frigitek Dollar Savings** – The sum of the savings from the Fan(s), the Compressor, and the Condenser Fan.

**12) Payback Time (ROI)** – this is the *Total Cost* divided by the *Total Savings* per month to determine the number of months required to repay the cost of installing the Frigitek. Also called “Return on Investment”.

**13) Full-time High Speed Fan Cost** – This is the current average monthly and yearly operating cost of the fans in the room. It is calculated by multiplying the *Cost per KwH* by the *Fan Motors KwH/Mo* and the *Operation time factor*. It does not include compressor operating costs.

Note: If the customer is converting evaporators with single-phase motors to three-phase motors, this cell may be used to enter the Single-Phase Full-time High Speed Fan Cost (from the Single-Phase Spreadsheet used to determine the before-conversion operating cost).

**14) Frigitek Power Reduction Factor** – This is the factor by which the Frigitek reduces fan power when it operates the fans at low speed. For three-phase motors, factor depends on the motor manufacturer, and the motor size. For small motors, it may be as low as 85%, and for large motors it can be as high as 93%. The 90% is the most commonly used, as an average.

**15) Fan High Speed Cost** – This is determined by multiplying the *Fan High Speed Cost* by the *Frigitek Duty Cycle*. The fans will be at high speed during the time the room is being actively cooled.

**16) Fan Low Speed Cost** –This is determined by multiplying by the *Full-time Low Speed Fan Cost* by the inverse of the *Fan Power Reduction Factor*. The fans will be at low speed when the room is not being actively cooled.

**17) Fan Dollar Savings** – The *Full-time High Speed Fan Cost* minus the *Total Fan Cost with Frigitek.*

**18) Fan Heat Power Reduction –** All the power used by the fans ends up as heat inside the refrigerator, which must then be removed by the compressor. This number is the amount of heat power which is no longer injected into the refrigerator when the Frigitek is operating. It is determined by multiplying the *Total Fan Motor Kw* times the inverse of the *Frigitek Duty Cycle* times the *Operation time factor*, times the *Frigitek Heat Reduction Factor*. Note that the Heat Reduction percentage is different from the Power Reduction percentage because of power factor.

**19) Heat Reduction Factor -** This is the factor by which the Frigitek reduces fan heat when it operates the fans at low speed, as determined by tests made in the ECE Motor Test Labs.

**20) Fan Heat Reduction** – Because the compressor uses a specific amount of electricity per BTU in its heat-transfer function, we convert the power reduction to BTU for the subsequent calculations. This number is determined by multiplying the *Fan Power Reduction* by the Kw-BTU conversion factor of 3412.1 Btu/Kw.

**21) Heat Transfer Factor -** The Heat Transfer Factor is the amount of heat that the refrigeration system can transfer per compressor horsepower. This factor allows accurate calculation of the electrical energy used in the transfer of a given amount of heat. Although many references place this number at 12,600 BTU/Hp, operating refrigeration systems usually have lower efficiencies, because of ambient temperature, piping runs, refrigerant charge and other reasons. A practical number for this factor is 9500.

**22) Compressor Kw/Hp** – This factor allows accurate calculation of energy cost for the compressor motor. Three-phase compressors are typically about 60% efficient, and use about 1.36 Kw/Hp. This number also takes into account the start-up surge power which the motors use as they are stopped and re-started during normal operation.

**23) Compressor Hp use Reduction –** This is determined by dividing the *Fan Heat Reduction* by the *Heat Transfer Factor.*

**24) Compressor Power use Reduction** – This is determined by multiplying the *Compressor Hp use Reduction* by the *Compressor Kw/Hp*.

**25) Condenser Fan Savings –** Because of the reduced compressor operating time, the Condenser Fan use is also reduced. This is estimated at 9% of the *Compressor Power Use Reduction*.

**26) Compressor Cost reduction** - This is determined by multiplying the *Compressor Power Use Reduction* by the *Cost per KwH*, and adding in the *Condenser Fan Savings*.