Compressor Cycling Rates
How often should a compressor be required to start and stop each hour?

A refrigeration compressor is normally switched on and off frequently, controlled by a thermostat. This is the simplest way of maintaining a storage condition within required limits while external conditions and service loads (number of door openings and product load) may vary greatly. An air conditioner compressor is controlled in the same way , however it does not normally cycle as frequently. Therefore it is usually in the case of refrigeration compressors that we are faced with the question – how often should a compressor be allowed to cycle (start and stop) per hour?

There are several factors that need to be considered.

1. Compressor Oiling System

Oil drains out of the compressor mechanism when the compressor is at rest. When the compressor starts, it takes a few moments for the oil passages to refill and for oil flow to the bearings to be resumed. During this short time, the bearings operate with the oil coating that remains from the compressor's last period of operation.

It is not uncommon for a small amount of liquid refrigerant to flood back to the compressor on startup, and this can dilute the oil for a short time, adversely affecting its lubricating qualities.

Every compressor pumps a small amount of oil out into the system, and this oil must circulate through the system and return to the compressor. If a compressor runs for a short time only, this oil return process is not effective, and oil may remain in other parts of the system instead of returning to the compressor.

2. Electrical Stress

The greatest stress that a compressor motor experiences is during starting. The windings flex, and there can be small relative movements between adjacent wires in the windings. While this is taken into account in the design and manufacture of the motor, it is obviously true that the total number of starts that a compressor experiences is a factor that adds to the risk, however unlikely, that compressor failure will occur after an extended period.

3. Mounting Springs and Discharge Shock Loop

Other components that are subjected to increased deformation and stress during starting and stopping are the internal mounting springs and the discharge shock loop. The shock loop is the flexible tube that carries the high pressure refrigerant gas from the spring mounted pump assembly to the compressor discharge connector. These components are designed and manufactured to withstand the number of start/stop cycles expected during the normal life of a compressor. Excessive cycling may reduce their service life.

4. Pressure Equalization

When a compressor is designed for balanced pressure starts, it incorporates a motor that has lower starting torque than would otherwise be the case. If the system pressures are not allowed to fully equalize, the compressor may not be able to restart. Alternatively, the compressor may start but not cleanly, and the internal pump assembly will shake inside the housing until the compressor picks up speed. This will also reduce the expected life of the internal springs and shock loop, as well as increasing the stress on the motor windings.

5. Electrical Components

Compressor starting relays and capacitors are selected on the basis of ensuring that, under conditions of maximum load, they will operate normally for the life of the compressor. Excessive starting rates, and any starting difficulty that the compressor experiences, will reduce the time for which these components can be expected to operate.

Summary

All of these adverse effects can be minimized or eliminated by ensuring that compressor cycle rates are as low as is practicable, and run times are sufficiently long to ensure correct lubrication and oil return.

Kulthorn Kirby recommends that refrigeration systems be designed to achieve minimal compressor cycle rates. Ideally, a compressor should not start more than six times per hour.