Copeland®

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Application Engineering Department

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COPELAMETIC TANDEM COMPRESSORS APPLICATION AND SERVICE INSTRUCTIONS

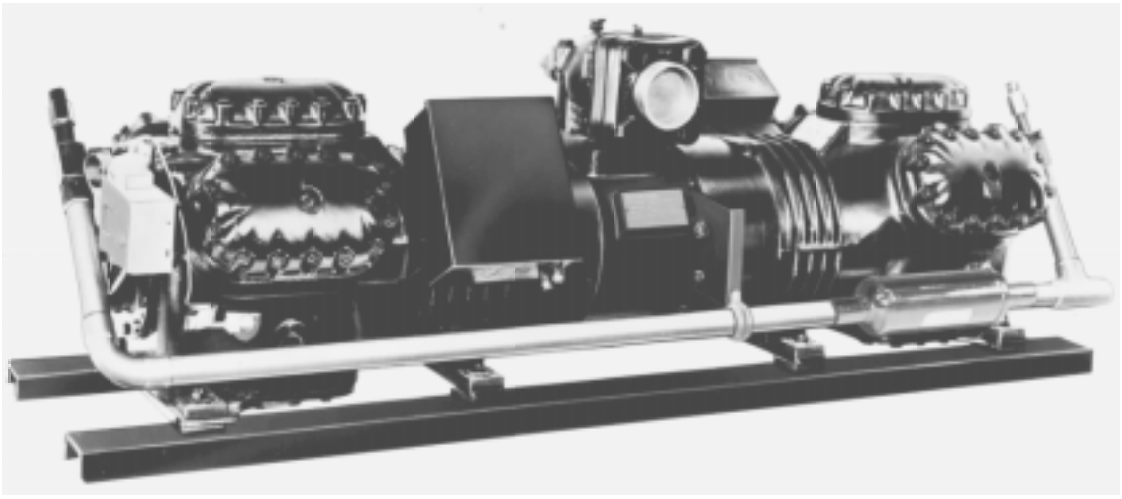
Copeland tandem compressors make possible great flexibility in system design for a wide range of applications 10 H.P. and larger in size. Since each compressor may be operated individually, the tandem provides simple, foolproof capacity reduction and maximum power savings, and greatly simplifies system control. The unique tandem design solves the troublesome problems of oil equalization sometimes encountered on compressors with interconnected crankcases.

In any well designed system, the tandem compressor offers a much greater factor of safety than a single compressor, and provides emergency protection for the product. In addition to greater reliability, one great advantage of the tandem over other large horsepower compressors is the fact that in the event of compressor damage, replacement of either compressor in the tandem can be easily and quickly made with a standard Copelametic motor-compressor stocked nationwide by Copeland wholesalers.

Applications

Since each compressor motor operates independently, each compressor may be wired with a separate control system. If starting current limitation is a problem, a time delay relay may be used to stagger motor starting. See Figure 1 and 2 for typical wiring diagrams of tandem units. Note that the oil pressure safety control and dual pressure control are connected independently on each compressor.

Tandem compressors, because of their large capacity, are often installed in systems with large refrigerant charges and long connecting lines, and adequate system protective devices must be installed. Oil pressure safety controls are supplied as standard on each compressor on all Copeland tandem condensing units, and are a requirement of the Copeland warranty covering these compressors.



A generously sized liquid line filter-drier, and a heavy duty suction line filter, both of the replaceable element type, are highly recommended for all tandem systems. Suction line filters prevent flux, dirt, chips of copper, and other contaminants from entering the compressor, and are undoubtedly the best investment in preventive maintenance that can be made. A suction line filter further provides both protection for the system in the event of a compressor failure, and a convenient means of installing a suction line filter-drier if required for system cleaning.

A suction line accumulator should be installed wherever large fluctuations in system capacity and operating conditions are apt to occur, or in any system where liquid floodback is possible. On systems with long lines and large refrigerant charges, an adequately sized suction line accumulator is especially important.

Motors in individual compressors may run at slightly different speeds, and it is possible as a result a resonant noise condition in the discharge lines may occasionally be encountered. This rarely occurs, but it may be prevented by the use of discharge line mufflers in the individual compressor discharge line.

Tandem units supplied with receivers are mounted on the receiver with resilient pads. The condensing unit, and suction line accumulator if floor mounted, should be supported on resilient vibration pads to minimize noise transmission.

Care must be taken in sizing lines for tandem applications to insure that system velocities are maintained at an adequate level to return oil to the compressor during periods when only one compressor is operating. If the load on individual evaporators can vary independently, it is advisable to run individual suction lines to a header near the compressor to maintain adequate suction line velocities.

Oil Equalization

When both compressors are operating in a tandem, the flow of return gas and oil enters the central connection chamber and divides, with flow across each motor to the operating compressor. Under such conditions there is no oil equalization between crankcase, and variations in the oil levels in the two compressors are to be expected. Normal production tolerances, or differences in internal water, can result in different oil pumping rates in the two compressors, with the result the oil level may run high in one compressor and low in the other.

If the oil levels remain within the sight glass, there seldom is any operating problem. It is important to understand that in a tandem, you do not equalize oil between compressors. Instead the goal for trouble free operation is to equalize oil pumping rates so that the oil levels stabilize.

To a considerable extent, the compressor's oil pumping rate is self compensating. As the oil level rises, the oil pumping rate increases, and as the oil level falls, the oil pumping rate decreases. Typically the oil levels in the two compressors will quickly reach a balance point where the oil pumping rate and the oil return rate of each compressor are equal.

Should the pumping unbalance be so great that trips of the oil pressure safety control occur, normally the problem can be cured by adding a small additional amount of oil, and by reversing the rotation of one or both compressors.

In the event that one compressor is badly worn, cylinder blow-by may create an excessive pressure in the crankcase, closing the oil return check valve and preventing oil return to the crankcase. In extreme cases such as this, as a last resort, an interconnecting line between crankcases may restore the crankcase pressure of the worn compressor to an operational level.

Service

The question frequently arises as to the effect on the remaining compressor in the event one compressor motor fails due to a motor burn. Unless the compressors are interlocked with a starting time delay relay, the compressor motors operate independently of each other, and the operative compressor can continue to run, circulating refrigerant through the system.

There have been so few field failures of this nature to date, although there are thousands in operation, that is difficult to predict with absolute certainty just what may occur. Extensive laboratory testing and experience on the very few units on which one compressor motor has suffered a burn, indicates that on units equipped with adequate liquid line filter-dryers and suction line filters at the time of failure, no harm is done to the operating compressor.

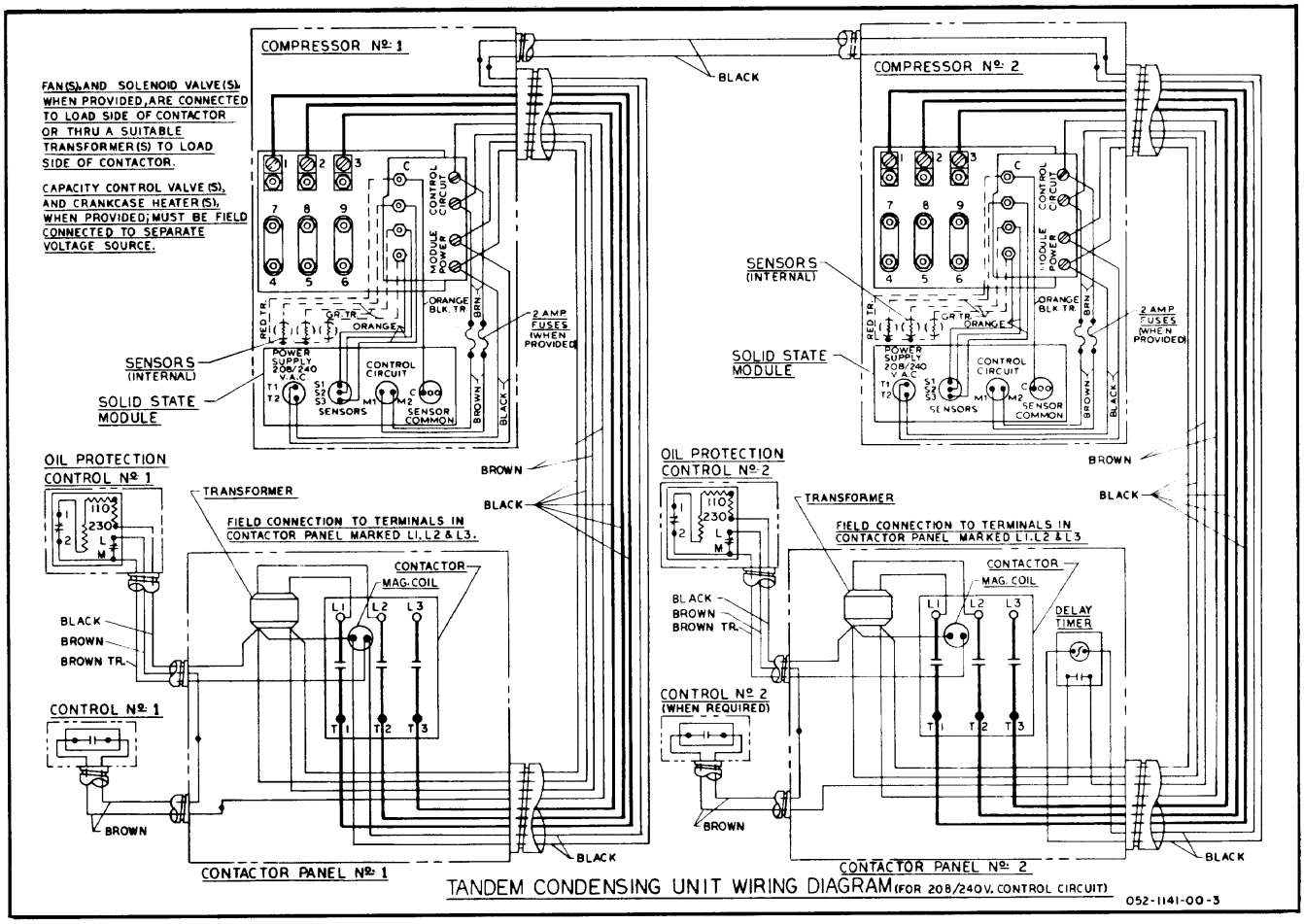
There is little circulation of refrigerant and oil through the stator housing or crankcase of the inoperative compressor, so any carbon, sludge, or other impurities will have little tendency to leave the motor chamber. There will be some mixing of oil in the connecting housing and some slight amount of acid will undoubtedly be in circulation in the refrigerant. The percentage of contamination of the operating system is very small due to the relatively stagnant condition of the inoperative compressor, and any acid and contaminants in circulation will be effectively removed if the system is equipped with an adequate liquid line filter-drier and a suction line filter when the failure occurs.

It is probable that pressure drop through the liquid line filter-drier will increase as contaminants are removed, the amount of increase being dependent on the filter-drier size and the nature of the motor burn. Although emergency operation is possible until replacement of the inoperative motor-compressor, it is recommended that the replacement be made as soon as possible.

Before removing the damaged compressor, the oil from both compressors should be removed and discarded. Oil can be removed by pumping the system down, inserting a 3/8" or 1/4" O.D. copper tube in the oil filler hole so that its end is below the oil level in the crankcase, sealing the space between the oil filler hole and the tube with a rag, and then pressurizing the crankcase with refrigerant to 3 or 4 psig to blow the oil out.

When the inoperative compressor is replaced, install a suitable suction line filter-drier and replace the liquid line filter-drier. Add sufficient Suniso 3GS, 150 viscosity refrigeration oil to bring the oil level in both compressor crankcases to the center of the sight glass. For complete information on system cleaning and replacement procedures, see Copeland Application Engineering Bulletin AE-24-1105.

The unit may be put back into operation immediately after the replacement is made, resulting in a minimum of down time.



TYPICAL WIRING DIAGRAM FOR TANDEM UNIT — COMPRESSORS INTERLOCKED WITH TIME DELAY RELAY

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