Technical Bulletin (TB-0068)

Oil Management System for CO_2 Transcritical Applications

Version 1, September 2018

Introduction

For reliable oil distribution under all load conditions, the application of a suitable oil management system is essential. Based on the combination of CO_2 and POE oil, the return of lubricant out of the system is not challenging. High miscibility in liquid CO_2 and high vapor densities on the suction side of the systems lead to an easy return of the lubricant to the compressors. Two oil distribution design solutions are available as standard applications for CO_2 transcritical systems engineered up to 2320 psig (160 barg) working pressure.

High-Pressure Oil Management System

The high-pressure oil management system is equipped with a combination oil separator-reservoir that is fitted at the discharge side of the transcritical compressors. The main advantages of the oil separator-reservoir is the small space required and ease of mounting. There is no float valve used in the oil separator-reservoir. This type system uses only electronic oil level regulators at the compressor with a design working pressure capable of operation under full pressure differential. The oil is at discharge pressure and will feed directly to the electronic oil level regulators that are controlled indirectly by an integrated or external solenoid valve to make up oil to each individual compressor as required. An additional level sensor inside the oil separator reservoir ensures that the oil level regulators on the compressors only open if the oil level inside the reservoir is high enough to avoid hot gas being bypassed to the compressors. Figure 1 shows a simplified high-pressure oil management system.

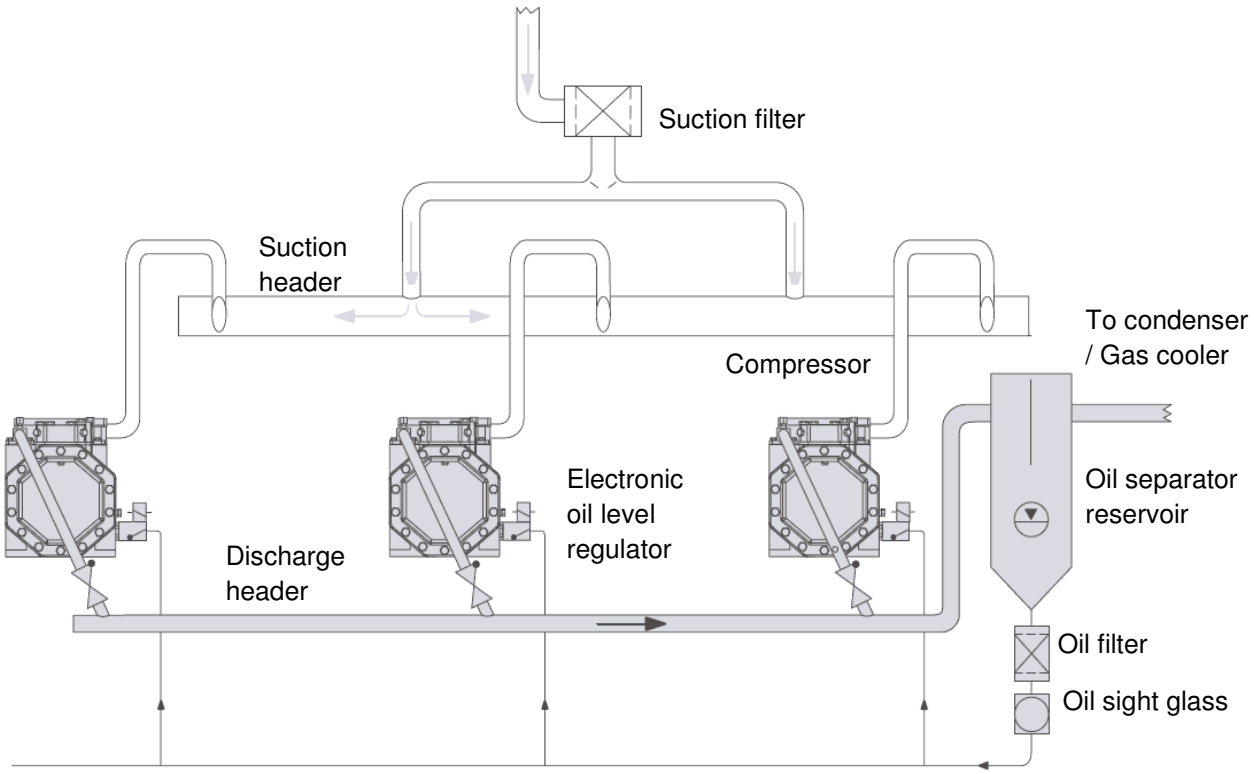

Figure 1. Simplified high-pressure oil management system

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BITZER Mexico:	+52 (81)1522 4500	www.bitzermexico.com	ventas@bitzermexico.com	24 Hour Quickship Hotline: (888) 462-4893

Low-Pressure Oil Management System

Systems that use the Low-pressure oil management system also have an oil separator installed in the discharge of the transcritical compressors. The oil from the separator is fed into a separate reservoir at high pressure. A coalescing type oil separator is used to provide high efficiency oil recovery. The oil separator is equipped with an oil level switch which controls an oil transfer solenoid valve. The solenoid valve is opened when oil is detected in the reservoir. The oil is transferred to the reservoir.

The pressure in the reservoir is controlled at a lower pressure through a differential pressure regulator connected from the reservoir to the compressor suction. The pressure in the reservoir is maintained high enough to allow oil to move from the reservoir to the compressor oil sump through the electronic oil level regulators. If the oil level drops below the required safe operating level an alarm contact is closed, and a signal sent to the system control panel.

This oil management system has the benefit of lower oil temperature and pressure for the compressors. The result will be, better system efficiency due to less superheat imposed on the refrigerant vapor. Also, there is less oil foaming in the compressor crankcase because of less refrigerant being dissolved in the oil. Figure 2 shows a simplified low-pressure oil management system.

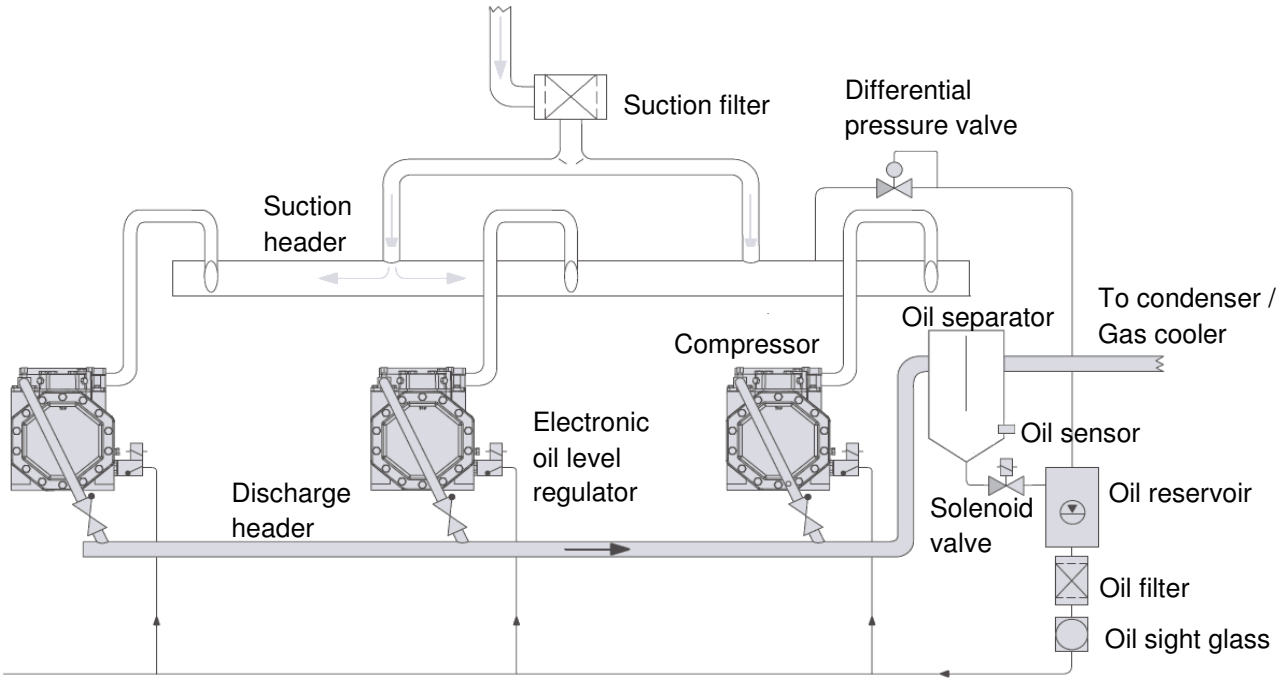

Figure 2. Example of low-pressure oil management system

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Figure 3. Example of electronic oil level regulators for CO_2 transcritical compressors applications.

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