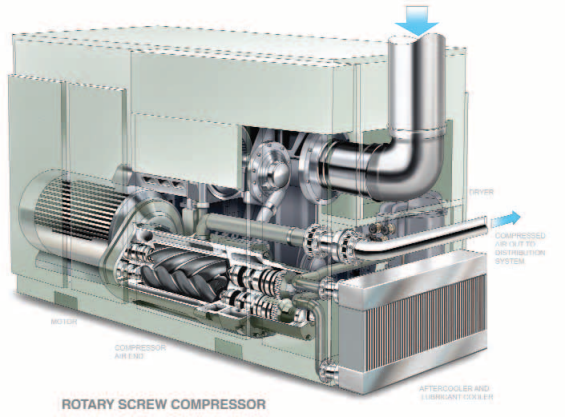
Technical Topic

Oil Flooded Rotary Screw Air Compressors

Air Compressors: Packaged Plant Units

Packaged air compressor units with oil-flooded rotary screw air compressors are typically self-contained and mounted on a skid base (Figure 1). Normally, these units supply plant air (not process air) at up to 150 psi (10 bar). Generally driven by electric motors, the compressors may be enclosed in a sound-attenuating housing whose panels can be removed or opened to service the unit.

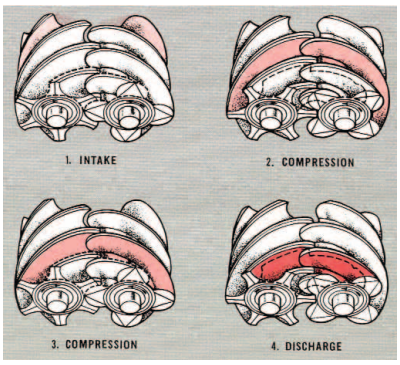


Oil Flooded Rotary Screw Air Compressor

Figure 1

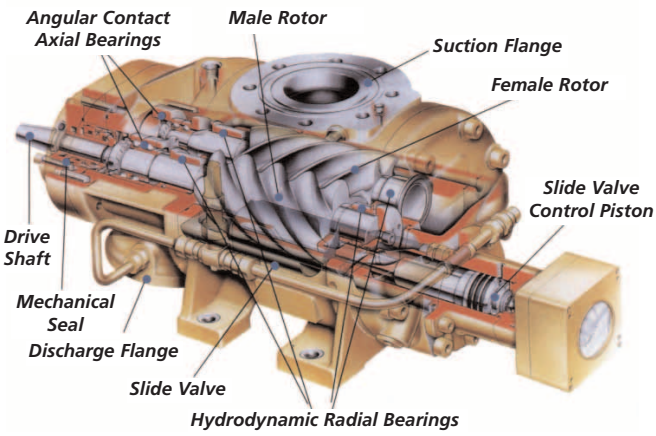
Oil-Flooded Rotary Screw Air Compressors

Oil-flooded rotary screw compressors range in size from 25 to 450 hp (18 to 355 kw), delivering compressed air volumes of 200 to 1,750 cfm (6 to 50 m3/m) at pressures 100 to 150 psi (7 to 10 bar). The compressor assembly is a positive displacement, flood- lubricated, screw-type unit using one or two stages to achieve the desired pressure. The compression process is continuous and is shown in figure 2.



Compression Process

Figure 2



Components – Courtesy of Ariel Corporation

Figure 3

Components include a housing (stator), two screws (male rotor and female rotor), bearings, and bearing supports (Figure 3). The male rotor is driven either directly by the motor or through step-up gears in the drive housing. The male rotor, which has four lobes, drives the female rotor, which has six lobes. The two rotors are helically grooved and mesh to compress inlet air in one stage of compression. The compressed air is discharged through a port in the end plate at a temperature of approximately 185°F (85°C). This pulse-free air is delivered to the receiver or to the inlet of a second compressor stage.

Related components in the compressor assembly include the intake air filter, an oil pump, and the inlet valve. The air filter usually is a dry type paper filter with replaceable elements. The oil pump supplies oil to the bearings, timing gears (on some designs) and to the compressor rotors. Some compressors use differential air pressure, instead of a pump, to circulate the oil. The control system regulates the opening and closing of the inlet valve in proportion to the demand for air.

A control panel displays the operating conditions and the condition of the air intake filter, air/oil separator, and oil filters.

Lubrication

During the compression cycle, oil injected into the compressor lubricates the bearings, gears, and rotors. The lubricant cools the compressed air to about 100°F (38°C) above ambient temperature and helps seal running clearances in the rotor housing.

As oil passes through the compressor, it mixes with the air and is discharged into the air/oil separator. There, most of the oil drops out because of velocity change or impingement. The air passes through the air/oil separator at the top of the sump where most of the remaining oil is removed. Separated oil drops to the bottom of the separator filter and is returned to the system through an oil return line. The unit usually has two oil filters: a primary filter through which all oil must pass, and a secondary filter for bearing and gear oil. The flow diagram, figure 4, illustrates the air/oil separation process and the oil circulation process in an air or water cooled system of a typical oil-flooded rotary screw air compressor.

Lubricant Recommendations

ExxonMobil's primary lubricant recommendation for rotary screw compressors is Mobil Rarus SHC 1020 series synthetic lubricants. (Note that during the original equipment builder's warranty period, users should consult their maintenance manual for specific recommendations.) The typically recommended viscosities of these lubricants are ISO viscosity grades 32, 46 or 68. Synthetic lubricants may allow extended oil drain intervals of up to 8,000 hours (versus 1000 hour change intervals typically recommended for mineral oil based compressor oils) with a comprehensive maintenance program and with the Signum in service oil analysis. When using a synthetic lubricant, change air/oil coalescent elements and oil filters per the original equipment manufacturers recommended change intervals for these lubricants.

When changing lubricants, it is important to check lubricant compatibility as not all compressor lubricants are fully compatible. While Mobil Rarus SHC 1020 series synthetic compressor oils are compatible with most mineral and many synthetic compressor lubricants, some synthetic compressor lubricants many require special flushing procedures. Consult with your ExxonMobil representative for assistance.

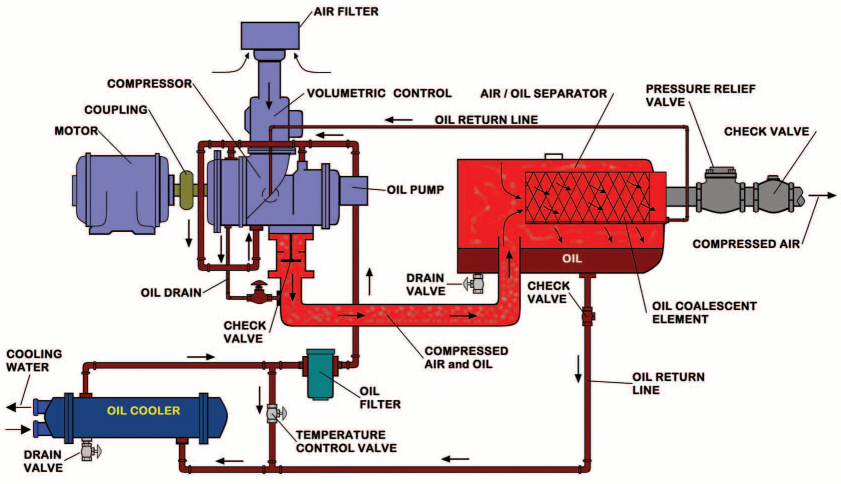
The electric motor and flexible coupling, if used, must be lubricated. Follow the manufacturer's recommendations.

Oilers' Duties

- Check oil level in the sump daily. Add recommended oil, as needed, to maintain correct oil level in sight level gage.
- Check control panel indicator for condition of air/oil separator at least weekly. Remove piping and clean or replace filter as needed.
- Check oil-return-line sight glass to assure that the oil is being removed from the air. Clean sight glass and oil return orifice as needed.
- Check control panel indicator for condition of air intake filters at least weekly. Clean or replace as needed.
- Check control panel indicator for condition of oil filters weekly. Change filters per original equipment manufacturers' recommendations.
- Change synthetic lubricant, when oil analysis shows the need. Clean oil strainer at oil change.
- In all cases of used oil disposal, refer to local community's specific disposal requirements.

Safety Precautions

- Follow original equipment manufacturers procedures for starting and stopping the air compressors.



Flow Diagram for Oil-Flooded Rotary Screw Air Compressor

Figure 4

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