CANADIAN PURCELL MACHINERY LTD.
"A World of Compressed Air & Gas Solutions"

TECHNICAL BULLETIN

PISTON VS ROTARY COMPRESSORS (ROTARY VANE OR ROTARY SCREW)

As a distributor of both piston and rotary type air compressors the question most often asked of us is, “which is better?”

Simply stated, the answer depends on the specific end-use application. Both offer reliable service when they are installed in the right application.

PISTON (RECIPROCATING) COMPRESSORS

Reciprocating compressors trap consecutive quantities of air in a cylinder, and compress it by a piston with a reciprocating motion, much like a conventional automotive engine. Inlet and discharge valves open and close to allow air to enter the cylinder and be discharged into an air storage tank.

Control is accomplished by starting and stopping the electric motor of the compressor by means of a pressure switch. The contacts on the pressure switch open at the high pressure point to shut the unit down and close on low air demand to re-start the compressor as air is used up in the air receiver tank.

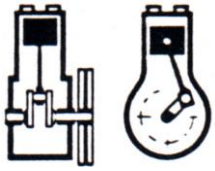
Starts and stops should not exceed about 8 times per hour to prevent damage to the electric motor, which results from excessive cycling. In addition, running an air-cooled piston compressor fully loaded for excessively long periods of time will cause it to overheat resulting in breakdown of the lubricating oil and premature valve wear. This is particularly critical with SINGLE-STAGE compressors, which will run as hot as 350^{o} F. The compressor should run for no more than 2-3 minutes and then stop for 4-5 minutes to allow it to cool.

The size of the air receiver is matched to a compressor by the manufacturer, based on the CFM output of the compressor.

The common notion is that the larger the air receiver tank, the longer it takes for the pressure to drop, which is correct.

What users forget to consider however, is that the larger the receiver tank, the longer it takes for the compressor to pump the tank back up to pressure.

This is particularly important with piston compressors since an excessively large receiver tank will result in excessively long run times, causing overheating and valve damage.



Reciprocating Compressors

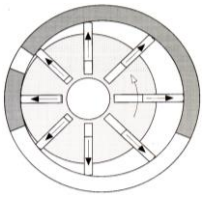
Where should an air-cooled piston compressor be used?

- Piston type air compressors are generally used only where the demand for air is occasional and the demand does not exist for prolonged periods of time such as automotive shops, home workshops and small industrial applications.
- If pressures above 110 PSIG are required.
- Where pressure fluctuations of 20 – 25 PSI can be tolerated.
- Because piston compressors have a strong similarity to conventional automotive engines, they can be easily serviced ro repaired by the owner's maintenance staff.

ROTARY COMPRESSORS

Rotary Sliding Vane Compressors

Rotary sliding vane compressors use vanes sliding in a rotor, which is eccentrically mounted in a cylindrical casing. Air, trapped between the vanes, is compressed and displaced. They are generally of single stage design and most widely used for pressures in the 100 – 110 PSIG range.



Rotary Vane Compressor

Rotary Screw Compressors

The twin rotary screw compressor consists of an intermeshing male and female rotor mounted in a close tolerance housing.

Air is compressed in much the same way that it would be done if a bowling ball were rolled through a pipe with very tight tolerances. The ball would advance like a piston, compressing the air that is trapped in front of it as it moves forward.

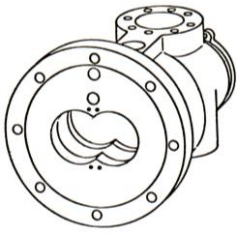
As the two rotors revolve in opposite directions, air is trapped in the pockets between the rotors and compression is accomplished by moving the trapped volume of air away from the inlet and towards the discharge.

As the position of the lobes completes the discharge phase, the voids at the opposite (inlet) end began to fill with air through the inlet port. When the female lobe is filled with air along its entire length, the intake phase is completed.

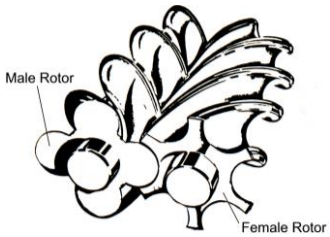
Further rotation causes the male lobe to mesh with the female rotor, trapping the air that has been taken in.

The male rotor then begins to squeeze the trapped air toward the discharge end of the compressor. As the male rotor progressively reduces the trapped air volume, oil is injected into the compression chamber.

Upon reaching its maximum discharge pressure the rotors pass over the discharge port and the air is discharged.



Rotary Twin Screw Casing



Male/Female Rotors

Where should rotary compressors be used?

- Rotary compressors are designed for applications where the demand for air is relatively constant throughout the day or where a fairly high demand for air is required for prolonged periods such as abrasive blasting cabinets etc.
- These compressors are also well suited for installations where the available electrical power limits the size of compressor that can be run and the demand for air is relatively high. For example, if a constant air capacity of 15 – 20 CFM is required, but electrical power limits the motor to 5 HP a rotary compressor is your best choice.
- Where some demand for air exists constantly throughout the day or where a high demand exists for durations of time that would cause a piston compressor to start and stop excessively. Rotary compressors can be operated FULLY LOADED 24 hours a day, seven days a week without damage.
- Where reliability is critical. Rotary compressors do not have piston rings, pistons, valves or connecting rods and therefore require less maintenance than conventional piston machines. When properly maintained, rotary compressors will often operate for up to 50,000 hours between major overhauls.
- Operating temperatures play a key role in oil life expectancy, breakdown of mechanical components and moisture carryover. Rotary compressors typically operate at only 180^{o} F (before aftercooling), while single stage piston compressors operate at temperature as high as 350^{o} F and two stage piston compressors operate in the range of 250^{o} F.