# BLOWER BRIEFS

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## *The Gardner-Denver Cycloblower®*

The Cycloblower® is a very unique product offered by REP. It is a helical lobe, axial flow positive displacement blower. It offers unique features which set it apart from its close cousin the straight lobe type units. The meshing of the screw-type rotors that are synchronized by a set of helical timing gears provide high efficiency displacement of gases.

The Cycloblower® has a built in 1.1:1 compression ratio which makes it a superior chose over straight lobe units when operating at pressures over 12 psig. A straight lobe unit offers no internal compression ratio which limits it ability to perform well at higher pressure ratios. The Cycloblower® will consume less horsepower than a straight lobe unit when operated at higher pressure ratios.

Presently, the Cycloblower® line for industrial applications consists of 17 different models ranging in flow from 26 to 6000 cfm. **Table 1** at right summarizes the performance parameters. All the units, with the exception of the A5CDL frame size are rated at 18 psig continuous duty. The A5CDL frame size consisting of the A5CDL5, 9 and 13 are rated for 12 psig continuous duty. Straight lobe type blowers are typically rated at 15 psig continuous duty service. Operating above 15 psig with a straight lobe unit usually results in much shorter equipment life when compared to a Cycloblower®. The Cycloblower® can also be used on wet and dry vacuum applications. Dry vacuums of 16"Hgg and 24"Hgg on wet vacuum service. Wet vacuums require a small amount of water injection to permit the vacuum pump to operate within design temperature limits.

Quality construction features abound in the Cycloblower®. Rotors are milled from high tensile strength ductile iron and are dynamically balanced. Timing gears are alloy steel and are cut with a helical profile offering lower noise and better load transfer. Labyrinth type seals are standard while mechanical and purged labyrinth seals are available for gas handling applications. Splash oil lubrication is provided for optimal lubrication on both the gear and non-gear end. Stainless Steel Cycloblowers are also available which makes them desirable for applications which ductile iron is not suitable. Vacuum applications which may be carrying acid vapors ,processes which expose the unit to corrosive which ductile iron is not suitable. Vacuum applications which may be carrying acid vapors processes which expose the unit to corrosive vapors or processes which can not tolerate rust build up inside the unit. The Cycloblower® also offers an excellent warranty, 12 months from initial date of use or 18 months from date of shipment, whichever occurs first. The factory also offers an exchange program to replace your existing unit should you develop a problem. The Cycloblower® is stocked in Gardner-Denver's state of the art distribution center in Memphis, Tennessee which provides fast shipment to points in the southeast.

Rotating Engineered Products, Inc. provides service and repair work for your Cycloblowers® . Give us a call the next time you need your Cycloblower® serviced.

| MODEL | CFR | MAX RPM | MAX CFM @ MAX PRESS. | MAX PRESS (PSIG) |
|---|---|---|---|---|
| 3CDL5 | .099 | 3500 | 256 | 18 |
| 3CDL8 | .147 | 3500 | 362 | 18 |
| A5CDL5 | .107 | 4000 | 298 | 12 |
| A5CDL9 | .188 | 4000 | 570 | 12 |
| A5CDL13 | .260 | 4000 | 819 | 12 |
| 5CDL5 | .107 | 4000 | 267 | 18 |
| 5CDL9 | .188 | 4000 | 540 | 18 |
| 5CDL13 | .260 | 4000 | 775 | 18 |
| 7CDL11 | .453 | 3600 | 1260 | 18 |
| 7CDL14 | .570 | 3600 | 1650 | 18 |
| 7CDL17 | .673 | 3600 | 1960 | 18 |
| 9CDL13 | .881 | 2700 | 1920 | 18 |
| 9CDL18 | 1.213 | 2700 | 2690 | 18 |
| 9CDL23 | 1.495 | 2700 | 3360 | 18 |
| 11CDL23 | 2.57 | 2000 | 4000 | 18 |
| 11CDL27 | 2.96 | 2000 | 4560 | 18 |
| 11CDL31 | 3.28 | 2000 | 5420 | 18 |

**PERFORMANCE TABULATION**
**TABLE 1**

## PERFORMANCE CORNER

**Slip** is a necessary evil in the performance of a straight lobe type blower. A straight lobe blower is designed with very small clearances between the the impellers and between the impeller and casing. These clearances are referred to as impeller to impeller, end clearance, impeller to cyclinder clearance. These clearances permit the unit to turn freely without need for lubrication, hence clean process gas. Clearances play an important role in determining the efficiency of a unit. Slip is a function of the amount of gas which leaks back around the impeller via the clearances set up for that machine. The greater the clearance, the greater the amount of slip. The amount of gas that slips by the impeller is recirculated internally and caused the temperature rise in the unit. The greater the differential pressure across the unit, the greater the slip will be and hence the greater the temperature rise.

The equation below demonstrates the effect of differential pressure on the application slip. As can be seen application slip is directly proportional to the square root of the differential pressure. Lower inlet pressures and lower specific gravity gases are inversly proportional which causes an increase in application slip. Hence vacuum application and those which handle gases lighter than air will have higher slip.

$$\text{Application Slip} = N_{slip}\sqrt{(\Delta P)\cdot\frac{T_{act}}{T_{std}}\cdot\frac{P_{std}}{P_{act}}\cdot\frac{SG_{std}}{SG_{act}}}$$

**Where:**

**Application Slip = RPM Correction**
**$N_{slip}$ = One PSI Slip**
**$\Delta P$ = Differential Pressure in PSI**
**$T_{act}$ = Actual Inlet Temperaure (°R)**
**$T_{std}$ = Standard Temperature (°R)**
**$P_{act}$ = Actual Inlet Pressure (PSIA)**
**$P_{std}$ = Standard Pressure (PSIA)**
**$SG_{std}$ = Standard Specific Gravity**
**$SG_{act}$ = Actual Specific Gravity**

$N_{slip}$ or One PSI Slip is a term that hasn't been discussed. The definition of One PSI Slip is the RPM required to product 1 psi on the discharge of a blanked off blower. All subsequent pressures are calculated from this value. One PSI Slip would be indicative of the total clearance inside the machine. The higher the One PSI Slip the greater the clearances.
As can be seen in Equation 2, application slip has a direct impact on the amount of gas that is passed through the blower or vacuum pump.

$$Q = cfr \cdot N - N_{appl}$$

***Equation 2***

**Where:**

**Q = Inlet Volume in CFM($ft^3$/min)**
**cfr = cubic feet per revolution**
**N = Operating Speed (RPM)**
**$N_{appl}$ = Slip at application point (RPM)**

Each blower is designed to permit a certain amount of thermal growth inside the unit and the end clearance typically plays the largest role in the amount allowed. If the unit is operated above its design differential pressure for a period of time to allow the temperature to build, the impeller will expand into the headplate causing the unit to lock up. Usually this is a catistrophic type of failure and causes considerable damage to the impeller and headplate. Units designed to operate at higher pressures are designed with larger internal clearances. These clearances allow the unit to expand more before contact is made. Impeller length also plays a factor in the amount of clearance required. Thermal growth is measured in percentage of overall length. A certain percent of temperature rise will result in a certain percent elongation. Therefore for a change in temperature, longer imellers will expand more than shorter impellers.

## PRESSURE RELIEF VALVES

The pressure relief valve is a mechanical device and is usually of the spring or weighted type. A spring type uses a spring loaded piston to set the desired relief pressure. A weighted valve uses weights on a piston to set the relief pressure. The accumulation factor for spring type units is typically 25% while a weighted type valve is typically 10%. Accumulation factor is the percentage above the set point where the valve is relieving 100% of its deisgn flow.

## CHECK VALVES

A check valve is used to prevent flow from the system to pass through the blower in the wrong direction. A check valve should be used on nearly every system to protect the blower. Many blowers can not operate backward without damage to the unit. A split wafer type has become the standard for most blower applications.