COMPRESSOR FLUID

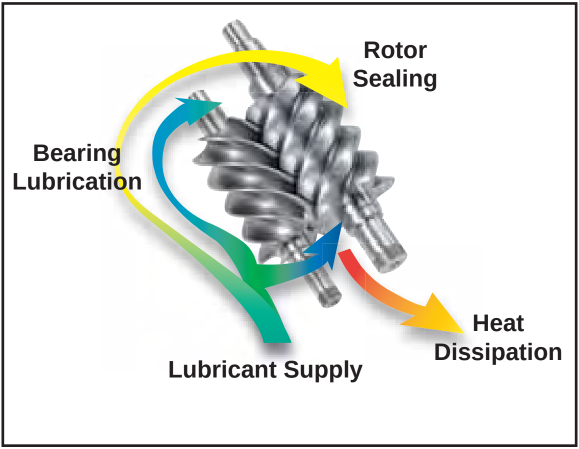
REFERENCE GUIDE

Why do Compressors Need Fluids?

- **Lubricate the Bearings**
  The fluid needs to keep the bearings lubricated.

- **Remove Heat**
  The fluid needs to remove the heat of compression. This heat is not caused by friction, but by the physics of the air compression itself.

- **Seal the Rotor**
  Since the rotors do not touch, the fluid creates the necessary air tight seal with it's film.



Why do the Fluids Have Additives?

- **Prevent Corrosion**
- **Extend the Life of the Fluid**
- **Prevent or Minimize Foam in the Sump Tank**
- **Improve Viscosity**
- **Improve Lubricity**

The quality and level of technology in the additive package of a fluid dramatically affect its performance. The proprietary blends of Sullair's fluid additive packages are carefully formulated to perform at the highest levels.

Competitive fluids invest less money and time into their additive packages and some may not contain any additives at all. This keeps costs lower for competitors but in the end hurts the performance and the customer's machine. You get what you pay for.

FLUID BASE STOCKS: Hydrocarbon

Hydrocarbon based fluids have been around as long as there have been rotary screw compressors. Originally, all rotary compressors used them; however, today's technology has significantly improved. This is the most basic fluid for rotary screw air compressors.

Advantages

- ✓ Lubricate Well
- ✓ Seal the Rotors
- ✓ Low Price

Disadvantages

- Low Flashpoint
- Short Life (1000 hrs.)
- Higher Oil Carryover
- Condensate Disposal Costs
- **Poor Heat Transfer**
- **Easily Forms Varnish**

Poor heat transfer can lead to high temp shutdown which in turn leads to plant downtime. High temperatures also shorten the life of the fluid. At 220 °F (105 °C) fluid life is cut by 50%.

Varnish is the leading cause of air end failure.

When these two combine, varnish leads to high temperatures and high temperatures to more varnish. It becomes a vicious circle.

EXAMPLES: D-A Torque Fluid™, ATF, Motor Oils

FLUID BASE STOCKS: Hydro-treated Hydrocarbon

Through an additional hydro-treating distillation step, some of the basic hydrocarbon components that cause varnish are removed from the fluid. Hydro-treated hydrocarbons are an improvement on basic hydrocarbons; however no improvements have been made to the characteristic of lower heat transfer.

Advantages

- ✓ Lubricate Well
- ✓ Seal the Rotors
- ✓ Longer Life than Hydrocarbons
- ✓ Lower Cost per Gallon than Synthetics

Disadvantages

- No High Temperature Applications
- Condensate Disposal Costs
- **Lower Thermal Conductivity**
- **Varnish Formation Potential**

Lower thermal conductivity can lead to high temp shutdown which in turn leads to plant downtime. High temperatures also shorten the life of the fluid. At 220 °F (105 °C) fluid life is cut by 50%.

Varnish is the leading cause of air end failure.

When these two combine, varnish leads to high temperatures and high temperatures to more varnish. It becomes a vicious circle.

EXAMPLES: SRF I/4000™, SRF II/8000™, AEON® 2000, AEON® 4000

FLUID BASE STOCKS: PAO (Poly-alpha-olphin)

PAOs are the best fluids the petroleum companies have to offer. They are the top of the line hydrocarbon-based products, and while they offer a higher purity level than the basic hydrocarbons, they still have many of the drawbacks. They are as limited in heat transfer as the rest of the hydrocarbon-based oils and will varnish if run at high enough temperatures.

Advantages

- ✓ Longer Life than Hydrocarbons
- ✓ Good Compatibility with Air Systems
- ✓ Good Viscosity Index (even without VI improvers)

Disadvantages

- Condensate Disposal Costs
- **Lower Thermal Conductivity**
- **Varnish Formation at High Temperatures**

Lower thermal conductivity can lead to high temp shutdown which in turn leads to plant downtime. High temperatures also shorten the life of the fluid. At 220 °F (105 °C) fluid life is cut by 50%.

Varnish is the leading cause of air end failure.

When these two combine, varnish leads to high temperatures and high temperatures to more varnish. It becomes a vicious circle.

EXAMPLES: QuinSyn®, AEON® 9000, GA-8K®, Sigma S, SynFilm®, Summit SH®, Mobil® and Rarus®

Why Hydrocarbon-Base Stocks Varnish?

- **All Components are Liquid at Ambient Temperature**
- **Some Become Solid at Higher Temperatures**
- **They Plate Out on the Metal Parts**
- **Insulate and Reduce Heat Removal**
- **Cause Temperatures to Rise and Create More Solid Components**

Dangers of Varnish (as shown on the left photo)

- **Air End Failure**
- **Creates an Inefficient Machine**
  Leads to 10% loss of efficiency or 10% more energy cost.
- **Increases Operating Temperature**
  High temperatures shorten fluid life and lead to high temp shut downs resulting in plant downtime.
- **Plug Separators, Oil Return Lines**
- **Coat and Restrict Oil Cooler**

FLUID BASE STOCKS: Diester

Diesters were developed for use in reciprocating air compressors which have major issues with carbon build up on the valves and high operating temperature. Diesters are able to handle those two issues. However, in rotary screw compressors, they are incompatible with elastomers and form *sludge*. They are often used as the primary ingredient in blends. BEWARE, many Polyglycol/Ester blends turn out to be a Diester base with a touch of the Polyglycol.

Advantages

- ✓ Developed as a Reciprocating Compressor Fluid
- ✓ Moderate to Low Cost
- ✓ Handles High Temperature

Disadvantages

- Moderate Carryover
- Condensate Disposal Costs
- **System Incompatibility (solenoids, seals, hoses, gaskets or down stream materials)**
- **Will Form Sludge**

System Incompatibility causes swelling in gaskets, seals, and hose liners. This results in problems with leaks, swelling of O-rings and deterioration of shaft seals.

Sludge will form in the lubricating system. See the “Case in Point” on Weil-McLean.

EXAMPLES: Supra® 32, AEON® 5000, SSR Coolant®, Sigma S, and Anderol®

FLUID BASE STOCKS: Silicone – 24KT™

24KT™ is sold as part of an extended 10-year warranty available only from Sullair. 24KT™ is an extremely long life lubricant that has no recommended change interval. It has a very high viscosity index which allows it to be used in cold weather applications or at high temperatures without affecting fluid life.

Advantages

- ✓ Very Specialized, Extreme Long Life
- ✓ No Recommended Change Interval for Fluid
- ✓ 10-Year Air End Warranty (Renewable)
- ✓ Arctic and High Temperature Applications
- ✓ Extreme High Temperature Operation Does Not Affect the Life Expectancy of 24KT™
  – Allows cold start in arctic conditions
- ✓ High Viscosity Index; Best of Any Fluid
- ✓ High Flash Point (484 °F)
- ✓ Excellent Thermal Stability
- ✓ Performs Well in High Contamination Environments
  – Insoluble to acids and other forms of chemical contamination
  – Vapor contaminants pass through the system

Due to the very low solubility of 24KT™, it can be run in highly contaminated environments without worrying about acidic build up in the lubricating system. Acids pass through the compressor without affecting the fluid life.

Disadvantages

- High Priced
- Condensate Disposal Costs

FLUID BASE STOCKS: Polyglycol (PAG) - Sullube™

Sullube™ will not varnish in the machine, and will remove existing varnish when performing a flush conversion. It will help the equipment run cooler and produces biodegradable condensate. These functions alone differentiate Sullube™ from its competition and make it worth the additional premium.

Advantages

- ✓ **Non-varnishing Performance**
- ✓ **Removes Existing Varnish**
  Performing a flush conversion will remove existing varnish build-up, decreasing energy demand, improving cooling, and extending the life of the air end.
- ✓ **Cools More Effectively**
  Sullube™ has higher thermal conductivity which will help the equipment run cooler and allow for easier stabilization of operating temperature.
- ✓ **Biodegradable Condensate**
  Since the condensate from Sullube™ is biodegradable, it can be directly discharged into sanitary sewer systems.
- ✓ **High Flash Point** (263 °C, 505 °F)
  With a high flash point and good coolant ability, Sullube™ promotes safe and reliable operation.
- ✓ **High Viscosity Index**
  Sullube™ provides excellent film thickness in all temperatures. Even at 200 °F (105 °C) Sullube™ operates efficiently and provides adequate bearing lubrication.
- ✓ **Very Low Carryover** (Less than 1 ppm)
  With less than 1 ppm carryover, less fluid is needed for top off.
- ✓ **Good Compatibility with the Air System**
  Since Sullube™ is compatible with the common elastomers found in compressor seals, hoses and solenoids, we can successfully convert competitive compressors to Sullube™.

Disadvantages

- High Priced

Why is Sullube™ High Priced?

- **Sullube™ Offers the BEST PERFORMANCE**
- **Consistent High Quality**
- **Best Overall Value for the Customer**
- **Full Support from the Distributor, Sullair and Fluid Manufacturer**

Sullube™ Biodegradability

Traces of Sullube™ present in compressor condensate have been shown to be biodegradable in a sewage treatment plant environment (EPA test method 796.3100 – 82% degradation in 28 days).

Prior to disposal of condensate in a sanitary sewage treatment system (POTW), written permission must be obtained from your local authority.

Details, including the biodegradable testing and results, along with a sample letter to local sewage treatment authorities can be found in TechNotes. This means you can quote new machines without needing to add separation equipment.

Sullube™ Conversion Program Customer Benefits

Sullube™ cleans the compressor by dissolving varnish build-up, decreasing kW demand, improving cooling and extending the life of the air end.

- Free Flush Fluid
- Remove the Varnish
- Promote Efficiency and Reduce Operating Costs
- Eliminate Condensate Disposal Costs
- Free Fluid Analysis Program
- Reliable Local Support

CONVERTING FROM A COMPETITIVE "POLYGLYCOL"

INGERSOL RAND® ULTRA COOLANT®

Base stock is Polyglycol and it has many of the same benefits as Sullube™.

- The Additive Package is Different, Sullube™ is Proven
- Sullair is a More Reliable Company
- Local Distributor Has Benefits
  - – Local Parts Inventory
  - – Trained Service Technicians
  - – Air System Knowledge and Engineering Capabilities
- Custom Packaging

SUPRA® 32 / POLYGLYCOL BLENDS

This is a Diester base stock with a touch of Polyglycol added so it can be called a "Polyglycol".

- Diester Blend will Experience Sludge
- Diester Blend will Cause Swelling in Gaskets, Seals, and Hose Liners

Sullube™ Conversion Program Step-by-Step Flush Procedure

ALL MACHINES MUST BE FLUSHED!

DO NOT top off, mix fluids, and/or fill a machine which has not been flushed completely. This goes for IR Ultra Coolant and other "polyglycol" fluids.

1. Run machine up to normal operating temperature, then drain the fluid from the main sump tank, fluid cooler, fluid lines, and fluid strainers (if equipped) while the fluid is still warm.
   (Caution: Depressurize system and take precautions to avoid thermal burns.)

2. Replace fluid filters and fill compressor with 1/2 charge of Sullube™.

3. Operate compressor under normal conditions for 12 hours while paying close attention to operating temperatures. Monitor fluid filter(s) and replace if contaminated.

4. Drain initial charge from sump and refill machine with another 1/2 charge of Sullube™. Run machine for 12 hours while monitoring fluid filters and operating temperatures closely.

5. Drain entire cooling system making sure all flushing fluid is removed from coolers, piping, and sump tank.

6. Install new separator element if an increase in differential pressure was noted during flush charge, and install new fluid filters.

7. Fill machine with fresh Sullube™ and begin normal operation.

8. Take a fluid sample after 200 hours of operation and submit for analysis to determine if system was sufficiently cleaned.

Why Do We Perform Fluid Analysis?

Fluid Analysis Will Tell You:

- If Fluid Needs to be Changed
- If Intake Air is Contaminated
- If Fluids Have Been Mixed
- If Severe Wear is Occurring

Customers Should Perform Regular Analysis:

- Establish Fluid Change Intervals
- Check for Contamination
- Discover Fluids Being Mixed
- Compressor Mechanical Problems (DR Ferrography)

Sample Kits

- Test pH to Determine Acidity to Prevent Corrosion
- Test TAN (Total Acid Number) to Determine Fluid Life
- Assure Viscosity is OK for Efficient Operation
- Check for Hydrocarbon Contamination
- Determine Wear

Interpreting Analysis Results

- **pH**
  - New Sullube™ = 8.0 pH
  - Caution = 5.0 pH
  - Change Point 4.5 pH

A pH less than 5 when all other indicators are normal often indicates contamination of the Sullube™ fluid by intake of air containing acid gases. A low pH can be a warning sign of corrosive wear of the bearings. When the pH is less than 4.5, the fluid should be changed due to loss of corrosion protection, to prevent shortening the air end life.

- **Total Acid Number (TAN)**

  This test gives an indication of the remaining useful life of the fluid.
  - New Sullube™ = 0.10 TAN
  - Change Point = 1.0 TAN
  - Change and Flush 2.0 TAN

High TAN may be caused by several factors including high operating temperature or intake of air containing acidic gases. It may also occur in an initial charge as Sullube™ dissolves varnish and sludge left by previous fluids.

- **Viscosity (VIS)**
  - Viscosity is the measurement of the resistance of a fluid to flow.
  - Viscosity of new Sullube™ = 39 cSt @ 104 °F (40 °C) (184 SSU)

The viscosity of Sullube™ normally ranges up to 43-47 cSt, or 200-220 SSU during the course of 8000 hours. It is rare to need to change Sullube™ due to viscosity, unless it is contaminated. High viscosity will result in somewhat higher operating temperatures, that is the only concern.

- **Methanol Insolubles (MI)**

This test determines the amount of hydrocarbon or diester fluid present as contamination in Sullube™. Generally, 10% or less is acceptable, but may shorten the life of the Sullube™. If it is more than 10%, it is advisable to drain and refill with fresh Sullube™ fluid. Excessive amounts of contamination may cause filter or separator plugging, as well as shorten the life of the fluid.

Atlas Copco®

Product Name	Visual Identifier	Base Stock	Viscosity	Life in Hours
GA-4K®	Grey with white sticker	Hydrocarbon	46	4,000
GA-8K®	Grey with white sticker	PAO	46	8,000
GA-FG®	Grey with white sticker	PAO	32	4,000
GA-OK®	N/A	Diester (Varnish Cleaner)	N/A	500
HD Roto Fluid Plus®	Grey with white sticker	PAO	46	8,000
Roto-Inject Fluid®	Grey with white sticker	Hydrocarbon	46	4,000

GA-4K®, GA-8K®, GA-FG®, GA-OK®, HD Roto Fluid Plus®, and Roto-Inject Fluid® are registered tradenames of Atlas Copco®.

Kaeser®

Product Name	Visual Identifier	Base Stock	Viscosity	Life in Hours
Sigma Food Grade 100	Black container, yellow lettering	PAO (Designed for Recip)	100	
Sigma Food Grade 150	Black container, yellow lettering	PAO (Designed for Recip)	150	
Sigma Food Grade 320	Black container, yellow lettering	PAO	32	
Sigma Food Grade 460	Black container, yellow lettering	PAO	46	
Sigma Food Grade 680	Black container, yellow lettering	PAO	68	
Sigma M 100	Black container, yellow lettering	POE/ Hydrocarbon Blend (Designed for Recip)	100	
Sigma M 150	Black container, yellow lettering	POE/ Hydrocarbon Blend (Designed for Recip)	150	
Sigma M 460	Black container, yellow lettering	POE/ Hydrocarbon Blend	46	
Sigma S-100	Black container, yellow lettering	Diester	100	
Sigma S-150	Black container, yellow lettering	Diester	150	
Sigma S-320	Black container, yellow lettering	PAO	32	
Sigma S-460	Black container, yellow lettering	PAO	46	
Sigma S-680	Black container, yellow lettering	PAO	68	

Ingersol Rand®

Product Name	Visual Identifier	Base Stock	Viscosity	Life in Hours
Food Grade FG Coolant®		PAO	32	
SSR Coolant®	Grey pail, blue lettering	Diester	46	
SSR G-1F Coolant®		PAO (Designed for Recip)		46
SSR Ultra Coolant®	Grey pail, red lettering	Polyglycol	46	8,000
Ultra Plus Coolant®	Gold with black sticker	POE	32	9,000

Food Grade FG Coolant®, SSR Coolant®, SSR G-1F Coolant®, SSR Ultra Coolant®, and Ultra Plus Coolant® are registered tradenames of Ingersoll-Rand®.

Quincy®

Product Name	Visual Identifier	Base Stock	Viscosity	Life in Hours
QuinSyn®	Light blue pail, dark blue lettering	PAO	46	8,000
QuinSyn-F®	White blue pail, dark blue lettering	PAO	46	4,000
QuinSyn IV®		PAO/ Hydrocarbon Blend	46	4,000-6,000
QuinSyn XP®	Black pail, blue sticker	POE	68	12,000-15,000
QuinSyn Plus™	Light blue pail, blue sticker	POA/POE Blend	46	10,000-12,000
QuinSyn PG®	Royal blue pail, blue sticker	Polyglycol (Diester Blend)	46	8,000-10,000
QuinSyn Flush®	Grey pail, white sticker	Diester	46	500

QuinSyn®, QuinSyn-F®, QuinSyn IV®, QuinSyn XP®, QuinSyn Plus™, QuinSyn PG®, and QuinSyn Flush® are registered tradenames of Quincy®.

Royal Purple®

Product Name	Visual Identifier	Base Stock	Viscosity	Life in Hours
ParaFilm® 100	Purple Container	Premium Synthetic Blend	100	
ParaFilm® 32	Purple Container	Premium Synthetic Blend	32	
ParaFilm® 46 Premium	Purple Container	Synthetic Blend	46	
ParaFilm® 68	Purple Container	Premium Synthetic Blend	68	
SynFilm® 100	Purple Container	PAO (Designed for Recip)	100	
SynFilm® 32	Purple Container	PAO	32	
SynFilm® 46	Purple Container	PAO	46	
SynFilm® 68	Purple Container	PAO	68	
SynFilm® GT-32	Purple Container	PAO	32	
Acilube™	Purple Container	PAO (Designed for Acidic Environments)	32	

ParaFilm®, SynFilm®, and Acilube™ are registered tradenames of Royal Purple®.

Summit®

Product Name	Visual Identifier	Base Stock	Viscosity	Life in Hours
AU 46		Silicone	46	
DSL® 32		Diester	32	8,000
DSL® 46		Diester	46	8,000
FG 100		H-1 PAO	100	
Lubricant/ Coolant®		Diester		
PS 100		Partial Synthetic	32	
PS 150		Partial Synthetic	46	
PS 200		Partial Synthetic	68	
SH® 32		PAO	32	
SH® 46		PAO	46	
Supra® 32		Diester/ Polyglycol	32	
Supra® Coolant		Diester/ Polyglycol	46	
Ultima		PAO/Ester	46	

AU, DSL®, FG, Lubricant/Coolant®, PS, SH®, Supra®, and Ultima are registered tradenames of Summit®.

Gardner Denver™

Product Name	Visual Identifier	Base Stock	Viscosity	Life in Hours
AEON® 2000		Hydro Treated		2,000
AEON® 4000	White pail, red lettering and green lid	Hydro Treated		4,000
AEON® 500		Petroleum Oil (Designed for Recip)		N/A
AEON® 5000		Diester (Designed for Recip)		N/A
AEON® 5000FG	White pail, red sticker	H-1 PAO		4,000
AEON® 800		ATF/Petroleum Oil		2,000
AEON® 9000SP	White pail, blue lettering	PAO		8,000
AEON® Bio		Polyol Ester		8,000
AEON® CL		PAO/Diester Blend		8,000
AEON® PG	White pail, blue lettering	Polyglycol/ Ester Blend		
Comp Clean II		Diester flush		
Synflo® 80		PAO		

AEON®, CompClean II, and Synflo® are registered tradenames of Gardner Denver™.

Lubricant Characteristics

	Varnish	Thermal Conductivity	Carry Over	Flash Point	System Compatible
Polyglycol (Sullube™)	No	Highest	Very Low	505 °F	Excellent
Silicone (24 KT™)	No	Very High	Low	484 °F	Excellent
Diesters	Will Sludge	Moderate	Moderate	High	Check MSDS
PAOs	Will Varnish	Moderate	Moderate	450 °F	Good
Hydrotreated Hydrocarbon	Will Varnish	Low-Moderate	Moderate	413 °F	Good
Hydrocarbon Oil	Will Easily Varnish	Low-Moderate	Moderate-High	360 °F	Good

Rules of Thumb

Every 18 °F (10 °C) above 200 °F (90 °C) reduces fluid life by 50%
(At 220 °F / 105 °C = half life).

For every 1 psi of compression, it reduces 1 °F of flashpoint down from the fluid's rating. 150 psi is 150 °F less flashpoint. Also need to consider ambient rise (100 °F) and high operating temperatures (20 °F).

Air compressors normally deliver 4 to 5 cfm per horsepower at 100 psig discharge pressure.

Depending on the size of the system, compressed air costs about 25 to 30 cents per thousand cubic feet of free air ingested by the compressor (including operating and maintenance costs).

Power consumption of 1 hp results in operating cost of $450/year based on 8000 hours operation @ $0.07 / kWh [i.e.: 100 hp cost $45,000 per year for an 8000 operation at 7 cents/kWh].

Every 2 psi pressure drop costs 1% of compressor horsepower in efficiency.

For 1000 cfm, compressor fluid consumption would be 4.41 gal / yr based on 8000 hours of operation @ 1 ppm (by weight) fluid carryover rate.

A 50 horsepower compressor rejects heat at approximately 126,000 Btu per hour.

Typical compressor discharge air temperature before aftercooling:

Rotary screw—175 °F
Single stage recip.—350 °F
Two stage recip.—250 °F.
The water vapor content at 100 °F of saturated compressed air equals about 2 gallons per hour for each 100 cfm of compressor capacity.

Glossary

Absolute Pressure/Temp – Total pressure/Temp measured from zero.

Absorption – The chemical process by which a hygroscopic desiccant, having a high affinity with water, melts and becomes a liquid by absorbing the condensed moisture.

Actual Capacity – Quantity of gas actually compressed and delivered to the discharge system at rated speed and under rated conditions. Also called Free Air Delivered (FAD).

Actual Cubic Feet Per Minute (acfm) - Flow rate of air measured at some reference point and based on actual conditions at that reference point.

Aftercooler – A heat exchanger used for cooling air discharged from a compressor. Resulting condensate may be removed by a moisture separator following the aftercooler.

Air Dryer – A devise that removes moisture from compressed air. Typically accomplished by cooling the air through a refrigerator or dessicant bed.

Atmospheric Pressure – Pressure above absolute zero at a specific location and altitude. The measured ambient pressure for a specific location and altitude in psi (pounds per square inch).

Automatic Sequencer – A device which operates compressors in sequence according to a programmed schedule.

Brake Horsepower (bhp) – Horsepower delivered to the output shaft of the drive motor. Unit of comparison between motors. Total package bhp is the sum of all motor shaft outputs, including compressor and cooling fans.

Capacity Gauge – A gauge that measures air flow as a percentage of capacity.

Capacity – The amount of air flow delivered or required under some specific condition. May be in acfm, scfm, etc.

CFM, Free Air – cfm of air delivered to a certain point at a certain condition, converted back to ambient conditions.

Check Valve – A valve which permits flow in only one direction.

Compression Ratio – The ratio of the absolute discharge pressure to the absolute inlet pressure.

Compression, Polytropic – Compression in which the relationship between the pressure and the volume is expressed by the equation PVn is a constant.

Constant Speed Control – A system in which the compressor is run continuously and matches air supply to air demand by varying compressor load.

Critical Pressure – The limiting value of saturation pressure as the saturation temperature approaches the critical temperature.

Glossary, continued

Critical Temperature – The highest temperature at which well-defined liquid and vapor states exist. Sometimes it is defined as the highest temperature at which it is possible to liquefy a gas by pressure alone.

Cubic Feet of Air Per Minute (cfm) – Volume rate of air flow.

Cut-In/Cut-Out Pressure – Respectively, the minimum and maximum discharge pressures at which the compressor will switch from unload to load operation (cut in) or from load to unload (cut out).

Cycle – The series of steps that a compressor with unloading performs; 1) fully loaded, 2) modulating (for compressors with modulating control), 3) unloaded, 4) idle.

Cycle Time – Amount of time for a compressor to complete one cycle.

Degree Of Intercooling – The difference in air temperature between the outlet of the intercooler and the inlet of the compressor.

Deliquescent – Melting and becoming a liquid by absorbing moisture.

Demand – Flow of air at specific conditions required at a point or by the overall facility.

Desiccant – A material having a large proportion of surface pores, capable of attracting and removing water vapor from the air.

Dew Point – The temperature at which moisture in the air will begin to condense if the air is cooled at constant pressure. At this point the relative humidity is 100%.

Discharge Pressure – Air pressure produced at a particular point in the system under specific conditions measured in psi (pounds per square inch).

Discharge Pressure, Rated – Air pressure produced at a rated reference point.

Dual Control – Load/unload control system that maximizes compressor efficiency by matching air delivery and air demand. Compressor is normally operated at full load or idle, and is stopped and restarted automatically depending on demand.

Efficiency – Any reference to efficiency must be accompanied by a qualifying statement which identifies the efficiency under consideration, as in the following definitions of efficiency.

Efficiency, Compression – Ratio of theoretical power to power actually imparted to the air delivered by the compressor.

Efficiency, Mechanical – Ratio of power imparted to the air to brake horsepower (bhp).

Exhauster – A term sometimes applied to a compressor in which the inlet pressure is less than atmospheric pressure.

Glossary, continued

Filters – Devices for separating and removing particulate matter, moisture or entrained fluid from air.

Flange Connection – The means of connecting a compressor inlet or discharge connection to piping by means of bolted rims (flanges).

Food Grade – Fluid which is approved by the FDA for “Food Grade” use.
(Sullube™ is *not* food grade. 24KT is *not* food grade).

Free Air – Air at atmospheric conditions at any specified location, unaffected by the compressor.

Full-Load – Air compressor operation at full speed with a fully open inlet and discharge delivering maximum air flow.

Gas - One of the three basic phases of matter. While air is a gas, in pneumatics the term gas normally is applied to gases other than air.

Gas Bearings – Load carrying machine elements permitting some degree of motion in which the fluid is air or some other gas.

Gauge Pressure – The pressure determined by most instruments and gauges, usually expressed in psig.

Guide Vane – A stationary element that may be adjustable and which directs the flowing medium approaching the inlet of an impeller.

Horsepower, Indicated – The horsepower calculated from compressor indicator diagrams. The term applies only to displacement type compressors.

Humidity, Relative – The relative humidity of a gas (or air) vapor mixture is the ratio of the partial pressure of the vapor to the vapor saturation pressure at the dry bulb temperature of the mixture.

Humidity, Specific – The weight of water vapor in an air vapor mixture per pound of dry air.

Hysteresis – The time lag in responding to a demand for air from a pressure regulator.

Indicated Power – Power as calculated from compressor-indicator diagrams.
Indicator card – A pressure – volume diagram for a compressor or engine cylinder, produced by direct measurement by a device called an indicator.

Inlet Cubic Feet Per Minute (icfm) – cfm flowing through the compressor inlet filter or inlet valve under rated conditions.

Inlet Pressure – The actual pressure at the inlet flange of the compressor typically measure in psig.

Intercooling – The removal of heat from air between compressor stages.

Glossary, continued

Intercooling, Degree of – The difference in air temperatures between the inlet of the compressor and the outlet of the intercooler.

Intercooling, Perfect – When the temperature of the air leaving the intercooler is equal to the temperature of the air entering the inlet of the compressor.

Load Factor – Ratio of average compressor load to the maximum rated compressor load over a given period of time.

Load Time – Time period from when a compressor loads until it unloads.

Load/Unload Control – Control method that allows the compressor to run at full-load or at no load while the driver remains at a constant speed.

Modulating Control – System which adapts to varying demand by throttling the compressor inlet proportionally to the demand.

Multi-casing Compressor – Two or more compressors, each with a separate casing, driven by a single driver, forming a single unit.

Multi-Stage Axial Compressor – A dynamic compressor having two or more rows of rotating elements operating in series on a single rotor and in a single casing.

Multi-Stage Compressors – Compressors having two or more stages operating in series.

Performance Curve – Usually a plot of discharge pressure versus inlet capacity and shaft horsepower versus inlet capacity.

Pneumatic Tools – Tools that operate by air pressure.

Positive Displacement Compressors – Compressors in which successive volumes of air are confined within a closed space and the space mechanically reduced, resulting in compression. These may be reciprocating or rotating.

Pounds Per Square Inch (psi) – Force per unit area exerted by compressed air.

Pounds Per Square Inch Absolute (psia) – Pressure above absolute vacuum. Atmospheric pressure is stated in psia.

Pounds Per Square Inch Differential (psid) – Pressure difference between two points.

Pounds Per Square Inch Gauge (psig) – Pressure at some reference point as measured with a gauge.

Power, Theoretical (Polytropic) – The mechanical power required to compress polytropically and to deliver, through the specified range of pressures, the gas delivered by the compressor.

Pressure – Force per unit area, measured in pounds per square inch (psi).

Glossary, continued

Pressure Dew Point – For a given pressure, the temperature at which water will begin to condense out of air.

Pressure Drop – Loss of pressure in a compressed air system or component due to friction or restriction.

Pressure Range – Difference between minimum and maximum pressures for an air compressor. Also called cut in-cut out or load-no load pressure range.

Pressure Ratio – See Compression Ratio.

Pressure Rise – The difference between discharge pressure and intake pressure.

Pressure, Discharge – The pressure at the discharge connection of a compressor. (In the case of compressor packages, this should be at the discharge connection of the package).

Pressure, Intake – The absolute total pressure at the inlet connection of a compressor.

Pressure, Static – The pressure measured in a flowing stream in such a manner that the velocity of the stream has no effect on the measurement.

Pressure, Total – The pressure that would be produced by stopping a moving stream of liquid or gas. It is the pressure measured by an impact tube.

Pressure, Velocity – The total pressure minus the static pressure in an air stream.

Rated Capacity – Volume rate of air flow at rated pressure at a specific point.

Rated Pressure – The operating pressure at which compressor performance is measured.

Receiver (Receiver Tank) – A vessel or tank used for storage of gas under pressure. In a large compressed air system there may be primary and secondary receivers.

Required Capacity – Cubic feet per minute (cfm) of air required at the inlet to the distribution system.

Reynold Number – A dimensionless flow parameter (h < D/:), in which h is a significant dimension, often a diameter, < is the fluid velocity, D is the mass density, and : is the dynamic viscosity, all in consistent units.

Rotor – The rotating element of a compressor. In a dynamic compressor, it is composed of the impeller(s) and shaft, and may include shaft sleeves and a thrust balancing device.

Seals – Devices used to separate and minimize leakage between areas of unequal pressure.

Sequence – The order in which compressors are brought online.

Shaft – The part by which energy is transmitted from the prime mover through the elements mounted on it, to the air being compressed.

Glossary, continued

Sole Plate – A pad, usually metallic and embedded in concrete, on which the compressor and driver are mounted.

Specific Gravity – The ratio of the specific weight of air to that of dry air at the same pressure and temperature.

Specific Power – A measure of air compressor efficiency, usually in the form of bhp/100 acfm.

Specific Weight – Weight of air per unit volume.

Speed – The speed of a compressor refers to the number of revolutions per minute (rpm) of the compressor drive shaft or rotor shaft.

Stages – A series of steps in the compression of air or a gas.

Standard Air – The Compressed Air and Gas Institute and PNEUROP have adopted the definition used in ISO standards. This is air at 14.5 psia (1 bar); 68 °F (20 °C) and dry (0% relative humidity).

Standard Cubic Feet per Minute (scfm) – Flow of free air measured at some reference point and converted to a standard set of reference conditions (e.g., 14.7 psia, 60 °F, and 0% relative humidity).

Start/Stop Control – A system in which air supply is matched to demand by the starting and stopping of the unit.

Temperature Rise Ratio – The ratio of the computed isentropic temperature rise to the measured total temperature rise during compression. For a perfect gas, this is equal to the ratio of the isentropic enthalpy rise to the actual enthalpy rise.

Temperature, Absolute – The temperature of air measured from absolute zero. It is the Fahrenheit temperature plus 459.6 and is known as the Rankine temperature. In the metric system, the absolute temperature is the Centigrade temperature plus 273 and is known as the Kelvin temperature.

Temperature, Static – The actual temperature of a moving gas stream. It is the temperature indicated by a thermometer moving in the stream and at the same velocity.

Temperature, Total – The temperature which would be measured at the stagnation point if a gas stream were stopped, with adiabatic compression from the flow condition to the stagnation pressure.

Theoretical Power – The power required to compress a gas isothermally through a specified range of pressures.

Torque – A torsional moment or couple. This term typically refers to the driving couple of a machine or motor.

Glossary, continued

Total Package Input Power – The total electrical power input to a compressor, including drive motor, belt losses, cooling fan motors, VSD or other controls, etc.

Unit Type Compressors – Compressors of 30 bhp or less, generally combined with all components required for operation.

Unload – (No load) Compressor operation in which no air is delivered due to the intake being closed or modified not to allow inlet air to be trapped.

Vacuum Pumps – Compressors which operate with an intake pressure below atmospheric pressure and which discharge to atmospheric pressure or slightly higher.

Valves – Devices with passages for directing flow into alternate paths or to prevent flow.

Volute – A stationary, spiral shaped passage which converts velocity head to pressure in a flowing stream of air.

Water-Cooled Compressor – Compressors cooled by water circulated through jackets surrounding cylinders or casings and/or heat exchangers between and after stages.

Notes

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