CC Technology pro-flo
LUBRICATION DIVISION

Calculating Lubrication Rates for ARIEL Compressor Cylinders & Rod Packing

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INTRODUCTION

The optimum quantity of oil to lubricate compressor cylinders is calculated using several different formulas by compressor manufacturers with an end result of various lube rates. Even identical compressors will require different lube rates depending on application. The purpose of this outline is to provide the end user adequate means of finding a safe starting place for lubricating compressor cylinders and rod packing. A standard practice for new or freshly revamped compressors is to double the lube rates for an initial break-in period of 200 hours. Lubrication rates can also be affected by the condition of your compressor. Excessive lube rates may be necessary due to abnormal wear or overdue maintenance. Under average conditions the following formula will provide an oil film thickness of .002. **Note: Always consult the compressor manufacturer or lubrication system design engineer for specific lubrication rates and dependable system design.**

ARIEL CORPORATION BASE LUBRICATION RATES

Compressor Model	Cylinder Base Lubr. Rate	Rod Packing Pints Per Day
JG,JGA & JGI	.3	.674
JGP,JGM,JGN,JGQ	.3	.674
JGW & JGR	.3	.900
JGJ	.4	1.20
JGH & JGE	.4	1.60
JGK & JGT	.5	2.00
JGZ & JGU	.5	2.88
JGC & JGD	.5	2.50
JGV & JGB	.5	3.12
K-TR	1.0	6.00
C-TR & D-TR	1.0	7.50

CALCULATING DIVIDER BLOCK FLOW RATES in PINTS PER DAY

To calculate the lubrication requirements for a given cylinder and its packing/s multiply the diameter of the cylinder bore times the “Cylinder Base Lubrication Rate” from the table above, add the “Rod Packing Pints Per Day” from the table above (”TR” cylinders have TWO packings). Multiply this total by the multiple to the “Base Rate” obtained from the chart on page 19 “Cylinder / Packing Lube Oil Recommendations for Various Gas Stream Components”, (Use each cylinders actual discharge pressure and gas quality.) **Note:** Do Not use a multiplier on page 19 for "TR" packings. The lube rates fo "TR" packing have been corrected for maximum discharge pressures of these cylinders.

For Example: For a 10-1/2K cylinder with “Pipeline Quality Natural Gas” at 1100 PSIG discharge pressure, calculate 10.5 x .5 + 2.00 x 1.25 = 9.0625 U.S. Pints of oil used for lubrication in 24 hours of operation at rated speed (see the name plate on the top cover for the rated speed) by this cylinder and its packing/s. For each divider block add the lubrication requirements for all cylinder/s and packing/s fed by that particular divider block.

Example:
10-1/2K @ 1100PSIG = 10.5 x .5 + 2.00 x 1.25 = 9.06 ppd
4-1/4K-TR = 4.25 x 1.0 + (6.00 x 2) = 16.25 ppd
9.06 + 16.25 = 25.31 ppd, total flow for this divider block

For Lubrication System Design & and Lubrication Rates for All Other Compressor and Engine Manufacturers Contact C C Technology @ 1-800-664-4033.

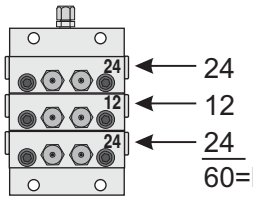
CALCULATING DIVIDER BLOCK FLOW RATES in PINTS PER DAY (Cont’d)

Q = Flow Rate in Pints Per day
M = Total value of the Divider Block Assembly
6 = Constant to convert Cu.In./Seconds **to** Pints Per Day
T = Time in seconds for one complete cycle of the divider block. Note: Cycle indicator pin must travel from full out position and return to full out position to indicate one full cycle. Each blink of the LED on the DNFT indicates one full cycle of the divider block.

To find the quantity of oil currently flowing through the divider block in pints per day: (24 hours operation at current RPM)

Example: Cycle time of the divider block is 22 seconds.

1. Add the total of the numbers on the front of the individual divider blocks. Example:(24+12+24 =60)
2. Multiply the total value of the divider blocks x 6. Example:(6x60=360)
3. Divide the answer (360) by the cycle time in seconds. (360 ÷ 22=16.36 Pints Per Day Total to Compressor)



24
12
24
60=**M-**Total Value of Divider Block

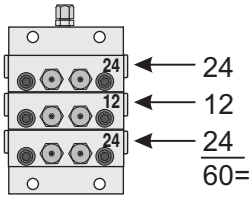
$$Q = \frac{6M}{T}$$

$$M = 60 \times 6 = 360 \qquad T = 22$$

Q=16.36 Pints Per Day Total Pump Rate

To find the cycle time if the flow rate is known

Example: Recommended oil consumption for maximum efficiency is 16.36 PPD.



24
12
24
60= **M-**Total Value of Divider Block

$$T = \frac{M \times 6}{Q}$$

$$M = 60 \times 6 = 360 \qquad Q = 16.36$$

T= 22 Cycle Time In Seconds

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Cylinder / Packing Lube Oil Recommendations for Various Gas Stream Components

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GAS STREAM	< 1000 PSIG (<70 BAR_G)	1000 to 2000 PSIG (70 to 140 BAR_G)	2000 to 3500 PSIG A* (140 to 240 BAR_G)	3500 to 5000 PSIG A* (240 to 345 BAR_G)	> 5000 PSIG A* (> 345 BAR_G)
Pipeline Quality Natural Gas	SAE 40 Weight ISO 150	SAE 40-50 Weight ISO 150-220 1.25 x Base Rate	SAE 50 Weight W/Compounding ISO 220-320 1.50 x Base Rate	Cylinder Oil ISO 320-460 2.0 x Base Rate Or Synthetic Diester / Polyglycol	Cylinder Oil W/ compounding ISO 460-680 3.0 x Base Rate Or Synthetic Polyglycol
Natural Gas with Water B* & or Heavy Hydrocarbons Methane < 90% SG > 0.7 Propane > 8%	SAE 40-50 Weight ISO 150-220 1.25 x Base Rate	SAE 50-60 Weight W/Compounding ISO 220-320 1.50 x Base Rate	Cylinder Oil W/Compounding ISO 460-680 2.0 x Base Rate	Cylinder Oil W/Compounding ISO 680 3.0 x Base Rate Or Synthetic Diester / Polyglycol	Contact Lubricant Supplier
CNG Compressed Natural Gas	SAE 40 Weight ISO 150	SAE 40-50 Weight ISO 150-220	See Pipeline Quality Natural Gas or Synthetic Diester / Polyglycol	See Pipeline Quality Natural Gas or Synthetic Diester / Polyglycol	See Pipeline Quality Natural Gas or Synthetic Diester / Polyglycol
Air	SAE 40 Weight Compressor Oil ISO 150	SAE 50 Weight Air Compressor Oil W/Compounding ISO 220 1.50 x Base Rate	Synthetic Diester 1.50 x Base Rate	Contact Lubricant Supplier	Contact Lubricant Supplier
Wet Air	SAE 40-50 Weight Air Compressor Oil W/Compounding ISO 150-220	Synthetic Diester 1.50 x Base Rate	Synthetic Diester 2.0 x Base Rate	Contact Lubricant Supplier	Contact Lubricant Supplier
Carbon Dioxide 2% to 10%	SAE 40-50 Weight ISO 150-220 1.25 x Base Rate	SAE 50-60 Weight Or SAE 40 Weight W/Compounding ISO 220-320 1.50 x Base Rate	Cylinder Oil W/Compounding ISO 460-680 2.0 x Base Rate Or Synthetic PAG	Cylinder Oil W/Compounding ISO 680 3.0 x Base Rate Or Synthetic PAG	Contact Lubricant Supplier
Carbon Dioxide > 10%	SAE 40-50 Weight ISO 150-220 1.50 x Base Rate	SAE 50-60 Weight Or SAE 40 Weight W/Compounding ISO 220-320 2.0 x Base Rate	Cylinder Oil W/Compounding ISO 460-680 3.0 x Base Rate Or Synthetic PAG	Cylinder Oil W/Compounding ISO 680 4.0 x Base Rate Or Synthetic PAG	Contact Lubricant Supplier
Nitrogen	SAE 40 Weight ISO 150	SAE 40-50 Weight ISO 150-220	SAE 50 Weight ISO 220	SAE 60 Weight ISO 320	Cylinder Oil ISO 460-680
H_2S Hydrogen Sulfide 2% to 30%	SAE 40 Weight W/Compounding ISO 150 1.50 x Base Rate	SAE 40-50 Weight W/Compounding ISO 150-220 1.75 x Base Rate	SAE 50 Weight W/Compounding ISO 220 2.0 x Base Rate	SAE 60 Weight W/Compounding ISO 320 3.0 x Base Rate	SAE 60 Weight W/Compounding ISO 460-680 4.0 x Base Rate
H_2S Hydrogen Sulfide > 30%	SAE 40 Weight W/Compounding ISO 150 1.75 x Base Rate	SAE 40-50 Weight W/Compounding ISO 150-220 2.0 x Base Rate	SAE 50 Weight W/Compounding ISO 220 2.5 x Base Rate	SAE 60 Weight W/Compounding ISO 320 4.0 x Base Rate	Cylinder oil W/Compounding ISO 460-680 6.0 x Base Rate
Propane (Refrigerant) Notice: Verify oil pour point temperature is below inlet gas temperature.	SAE 40 Weight or Refrigerant Oil 0.5 x Base Rate	SAE 40 Weight or Refrigerant Oil 1.0 x Base Rate	Refrigerant Oil Contact Lubricant Supplier	Refrigerant Oil Contact Lubricant Supplier	Refrigerant Oil Contact Lubricant Supplier

CAUTION:

Always consult the compressor manufacturer for lube oil requirements. The formulas on the previous page and the lube oil recommendations are calculated quantities and influenced by several unknown factors which must be included in the calculations when designing the lubrication system. An easy method for detecting correct lubricant quantities is a visual inspection of internal surfaces of the compressor cylinder. The obvious sign of excessive lubrication is oil collecting in cylinder low spots or valve ports. Wipe the cylinder with a tissue paper. If oil appears evenly on the tissue paper you are close to optimum efficiency. If the tissue paper is dry or unevenly spotted the feed rate is too low. A few recommended steps for efficient compressor lubrication are: ★**Always consult the compressor manufacturer or lubrication system designer to insure existing divider blocks are designed correctly for the compressor cylinders and packing.** ★ **Pressure test divider blocks and lubricator pump for output volume annually to verify integrity.** ★**Use divider blocks with smaller pistons. This will regenerate oil film thickness more often.** ★**Use good quality oil formulated for the service of the compressor.** ★**When adjusting for optimum lubrication, reduce or increase oil rates by 10% and operate under existing conditions for 10 to 14 days before next inspection.**

A*: It is recommended to use water cooled packing for compressor cylinders operating with these pressures.

B*: Lean burn engine oils contain detergents, dispersants and ash additives which hold water in suspension. In certain applications this suspended condensate can cause problems with possible inadequate lubrication of the cylinders and packing.