HyperFormance™
Air/Oil Lubrication System

Featuring

- Operation
- Application
- Assembly
- Components

SPECIALITY LUBRICATION

BIJUR DELIMON INTERNATIONAL

For air/oil applications

Introduction

System Components

1. Air Pressure/Regulator/ Filter assembly with coalescing filter delivers clean air to bearings.

2. In-Line Air Oiler (for use with Airmatic® lubricator only).

3. Solenoid Valve and Timer assembly provide adjustable pre-determined operating cycles (Airmatic lubricator only).

4. Airmatic Air-Operated lubricator actuates Positive Displacement Injectors.

5. In-Line Pressure Filter delivers clean oil to bearings.

6. Oil Pressure Gauge displays lubricator pressure cycles.

7. Pressure Monitoring assembly ensures oil pressure is at required levels when needed. Also checks proper air pressure is maintained.

8. Air/Oil Injection Block assembly contains precision-output Positive Displacement Injector and individual, adjustable air flow valve.

9. Coiled tubing ensures prompt air/oil deliveries after prolonged shutdowns.

10. Nozzle delivers air/oil mix precisely where required to successfully lubricate bearing.

Bijur's HyperFormance™ Air/Oil Lubricating System delivers high-efficiency lubrication and cooling for high-speed spindles and other surfaces requiring accurate oil deliveries.

The advanced design delivers precise amounts of lubricant and eliminates residual drift of "oil fog" or mist during operation.

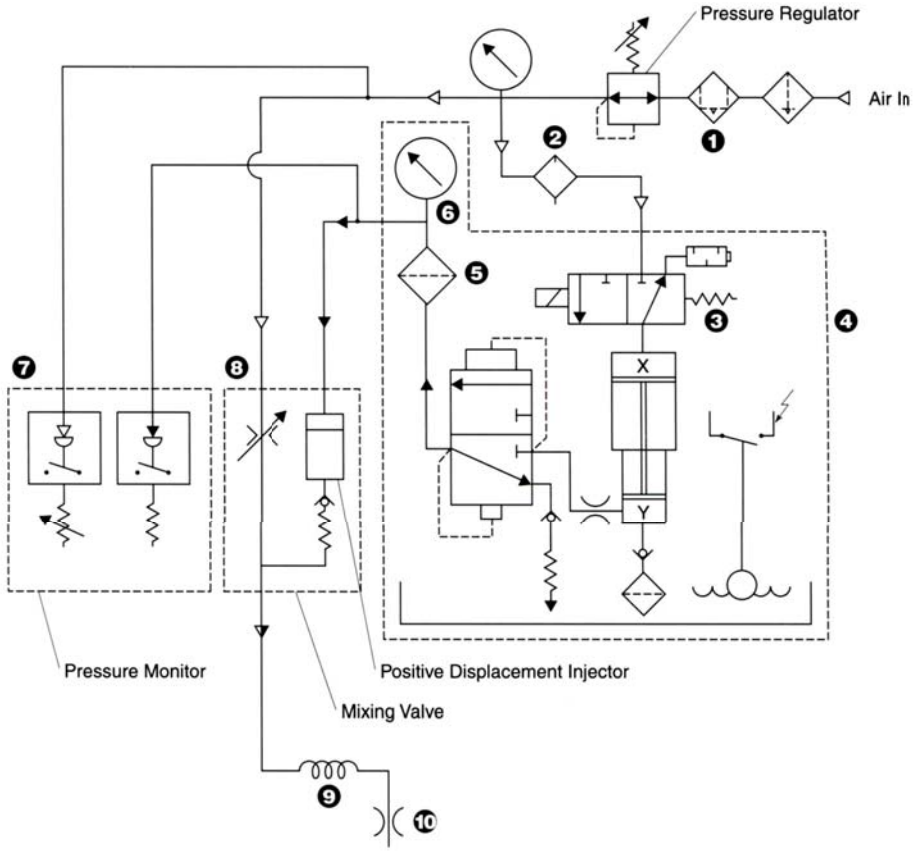
The system utilizes a special design Positive Displacement Injector (PDI) with oil outputs to a close tolerance level down to 0.01 cc/cycle. This permits exact oil volumes to be discharged into an air mixing valve, for controlled air and oil flows through clear plastic tubing to critical bearing points.

Small intermittent discharge from injectors flows along the inside tube wall and stretches out along the length of the tube.

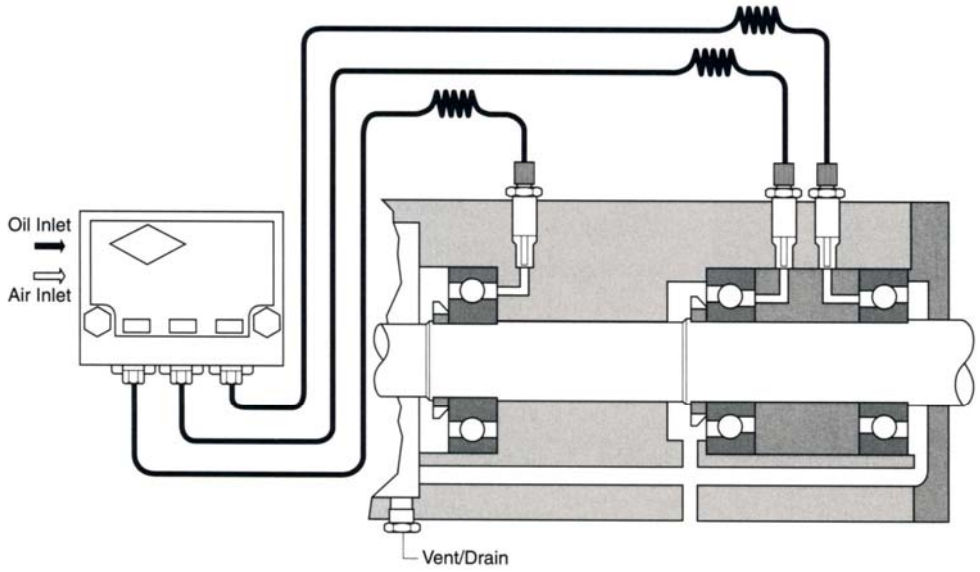
Air expansion at nozzle tip delivers controlled spray (not mist) to bearing for optimum performance.

The HyperFormance system can deliver small or large air flows to bearings and handles a wide range of oil viscosities.

Schematic of the HyperFormance system with components identified at left.



- Integrated package provides clean, regulated air and oil flow to bearings
- Individual, controlled air flow to each point
- Mixing block injectors deliver precise oil output
- Modular system — add or change components as required
- Customized kits available for special applications



Typical high-speed spindle installation.

FEATURES	BENEFITS
• Precise oil output from injectors	• Reduced oil usage
• Continuous delivery	• Ideal for higher speed applications
• Handles large oil flows	• Protects bearing from contamination
• Flexible design	• Easy modifications to system
• Handles wide range of oil viscosities	• Lowers operating temperature
• Handles compounded oils	• Extends bearing life
• Precise air control to bearing	• Maintains bearing performance
• Wide range of injector outputs	• Dial in to precise needs
• Metered discharge through positive displacement	• Minimal affect on output volume with temperature change
• No oil fog	• Environmentally clean

Operation

High performance machinery utilizes high-speed roller bearings. A thin lubricant film separates the rolling elements from the raceways, however over-lubrication can be just as destructive as under-lubrication. Accurate delivery of the correct viscosity oil is essential to maintain maximum bearing life at peak operating conditions.

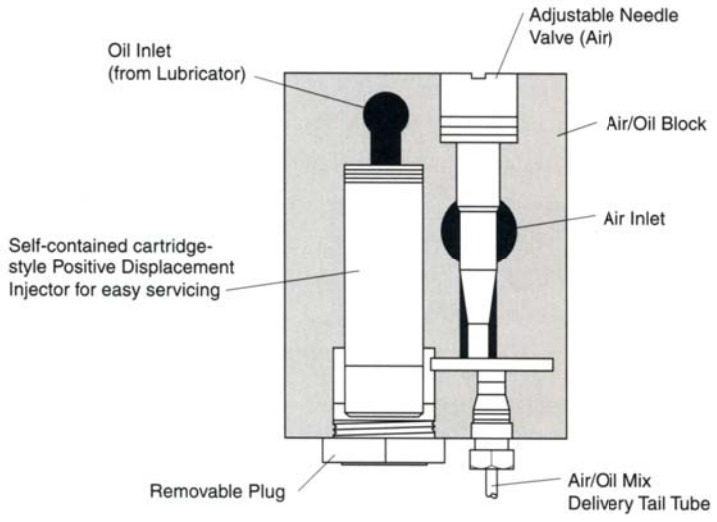
Bijur's HyperFormance Air/Oil Lubricating System utilizes an air/oil positive displacement injector block to deliver a precise amount of oil into a controlled air flow. Air propels the oil droplets along the inside wall of small bore tubing until it reaches the lubrication point. The tubing length stretches out the flow of lubricant so that a continuous flow arrives at the nozzle.

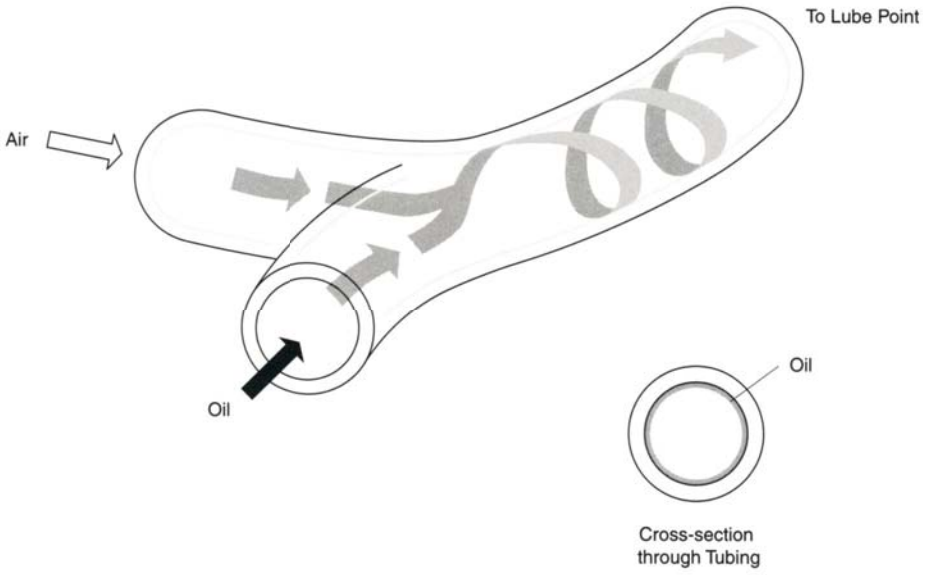
Air expansion at nozzle outlet generates a controlled spray for efficient bearing lubrication.

A wide selection of injector rates combined with individually adjustable air valves provide specific air/oil deliveries to maintain thin lubricant oil films to each high-speed anti-friction bearing or other surface.

Operation of injectors occurs during an alternating pressure and relief cycle controlled by lubricator operation.

Cross section of an air/oil injection block showing major components and air/oil flow paths.





Oil travels along inside wall of tubing propelled by air flow.

How Air/Oil Flows Through Bearings

Bearing dynamics affect the delivery method of air/oil flows.

Air/oil deliveries must flow unimpeded through the bearing for successful lubrication. Always ensure a free air flow passage through the bearing element. Air restrictions and back pressure can impede proper deliveries to critical areas.

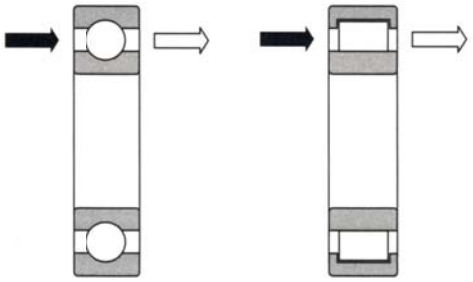
If required, air flow pressures may be adjusted to overcome air turbulence created by high-speed bearings.

One nozzle is required for most applications. For larger bearings, greater than 150 mm (6″), a second delivery nozzle may be required.

For single-row bearings, direct nozzle bore to the side of the bearing at lower inner ring surface. Do not direct output delivery toward ball cage.

Angular contact bearings develop a pumping action in one direction — the oil must be supplied in the direction shown in the diagrams.

Note: In certain situations, lubricant may be directed to the outer bearing ring. Ensure that lubricant is not delivered into the pressure zone between the ball and the outer ring. Always direct lubricant into unloaded ring.



Single Row Ball Bearing

Straight Roller Bearing

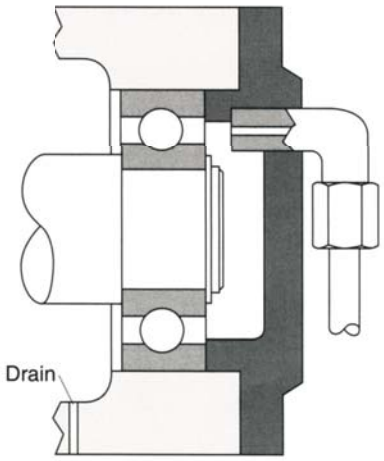
Delivery of air/oil through the bearings for effective lubrication.

How Tubing Connects to Bearings

The feed line is 4 mm × 0.63 mm wall (5/32″ × 0.025″) clear plastic tubing. Minimal tube length is one meter (3.3 feet). Greater line runs are permitted. Runs less than one meter from air/oil injector to bearing should incorporate a series of helical coils to increase developed length. Tubes with two to five coils are available.

Venting the Bearing

It is necessary to locate a 4 mm minimum diameter drain/vent in bearing housing to minimize air back pressure and prevent oil collection in sump.



Drain ports prevent lubricant back-up in housing.

Application

Choosing Oil Lubricants

Typical lubricants for high-speed anti-friction bearings consist of oil viscosities ISO VG 32 to VG 100.

ISO OIL GRADES		
ISO @ 40 °C (100 °F)	*Viscosity (nominal) cSt*	*SSU*
32	30	142
46	45	200
68	65	300
100	100	465

Caution: Do not use oils containing solid lubricant additives with air/oil systems.

Calculating Oil Amounts

A thin oil film separates the rolling elements from the raceways. The oil film should be of a sufficient thickness to prevent asperity contact between moving surfaces.

Lubricant requirements for anti-friction bearings can vary with lubricants and operating conditions. The formula shown is offered as a guide only. Finalized requirements for individual applications can vary from these values:

V = 0.03 × bearing I.D. (inches) × number of rows of rolling bearing elements

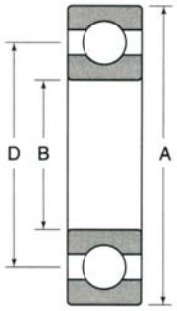
where

V is the oil requirement in cc per hour

Determining DN Value

The DN factor is a convenient way of expressing the application of the bearing in terms of peripheral speed. It is derived by multiplying the bearing nominal bore dimension in millimeters by the speed in revolutions per minute. Normally, higher DN values require fluid oil. DN values in the range of 250,000 to 350,000 normally require air/oil lubrication.

D = pitch dia. or mean dia. in mm
N = shaft speed in rpm
DN value = pitch dia. × shaft speed



DN Value Example

A (outside dia.) = 120 mm
B (inside dia.) = 100 mm
D (pitch dia.) = 110 mm
Shaft speed = 25,000 rpm

DN = 110 × 25,000
= 2,750,000

Checking Air Quality

Precision bearings lubricated by air/oil systems require quality processed air that is dry and filtered. See specifications for Air Filter/Regulator. Normal air flow settings are listed in the table below. Increased flows are required for higher viscosity oils.

AIR FLOW DATA PER OUTLET*					
	Outlet air flow vs needle valve position, shown in normal liters per minute (standard cubic feet per hour)				
Air pressure at inlet	*1/6 turn open*	*1/2 turn open*	*1 turn open*	*2 turns open*	*4 turns open*
3.4 bar (50 psi)	0.61 (1.3)	3.8 (8)	11.8 (25)	27.3 (58)	51.7 (110)
4.1 bar (60 psi)	0.80 (1.7)	4.7 (10)	14.1 (30)	32.7 (70)	58.8 (125)
5.5 bar (80 psi)	1.30 (2.7)	6.6 (14)	18.8 (40)	42.3 (90)	75.2 (160)

**with 1.2 meter long tail tube, 2.7 mm inside diameter.*

Assembly

HyperFormance Air/Oil Assembly

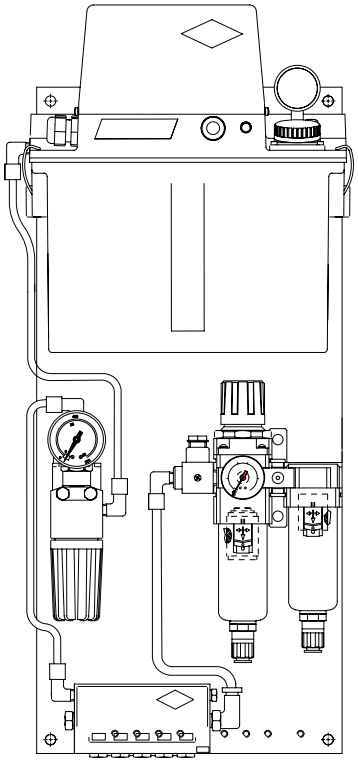
The HyperFormance Air/Oil System can be ordered as a pre-assembled unit.

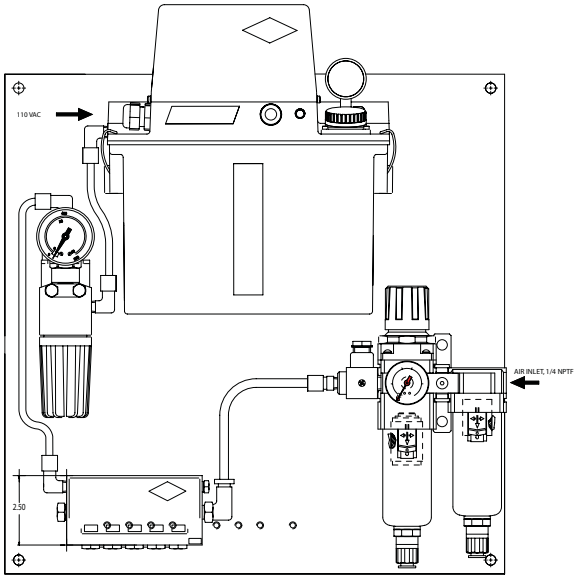
For other installations, separate components (refer to pages 8–11) can be ordered to meet individual needs. Be sure to adhere to operating specifications highlighted.

For original equipment manufacturers, Bijur can design and supply customized HyperFormance units consisting of special pre-assembled parts and bent tube assemblies for fast, easy installation.

HYPERFORMANCE SYSTEM SPECIFICATIONS	
Output	200cc/min @ 60 Hz (115VAC/230VAC) 167cc/min @ 50 Hz (115VAC/230VAC) 250cc/min (24VDC motor)
Max. air pressure	10 bar (145 psi)*
Max. oil pressure	31 bar (450 psi)
Reservoir capacity	1.8L, 2.7L, 6.0L, 12.0L
Operating viscosity	20 to 1500 cSt
Ambient temperature	5˚C to 40˚C (41˚F to 104˚F)
Power consumption	Approx. 140 Watts
Voltage	115VAC, 230VAC, 24VDC, 50/60 Hz (single phase)

** **Caution**: Do not exceed 6 bar (87 psi) in distribution tubing to bearing.*





Components

The motor-driven SureFire lubricator has a compact size and is designed to fit your space requirements and lubrication demands.

SureFire Lubricator

Robust, electric motor-driven gear pump, with timer and controller versions available. Pressure and low-level switches are provided to monitor lubricator operation and reservoir oil level. This unit has a built-in pressure valve to relieve operating pressure during the "OFF" period.

SUREFIRE LUBRICATOR SPECIFICATIONS

Part No.	*Voltage*	*Output*	*ON time*	*OFF time*	*Viscosity range*	*Temperature range*	*Reservoir capacity*
SFxBxxx	115VAC,230VAC 50/60 Hz	200cc/min @ 60 Hz 167cc/min @50 Hz	0.1 sec. to 100 hrs.	0.1 sec. to 100 hrs.	20 to 1500 cSt	5˚C to 40˚C (41˚F to 104˚F)	1.8L 2.7L 6.0L 12.0L
	24VDC	250cc/min					

The simple air operated design of the Airmatic lubricator provides an economic assembly controlled by solenoid and timer.

Airmatic Lubricator

Operated by shop air, the Air/Oil Airmatic lubricator has a built-in pressure valve to relieve operating pressure during "OFF" period. The unit is supplied as an assembly, complete with in-line 25-micron oil filter and pressure gauge to 54 bar (800 psi). A 3/2 way electric solenoid valve with DIN connector is provided for lubricator operation.

AIRMATIC LUBRICATOR SPECIFICATIONS

Part no.	*Voltage*	*Output*	*Cycle range*	*Viscosity range*	*Temperature range*	*Reservoir capacity*
27158-1 27158-2	115 VAC 230 VAC	10.5 cc/ cycle	up to 30 cycles per minute	32-1800 cSt (150-8000 SSU)	0 °C to 49 °C (32 °F to 120 °F)	1.5 liter

Air Filter/Regulator

Assembly comprises a 5-micron primary filter with a 0.3-micron coalescing filter, complete with pressure regulator and air pressure gauge 11 kg/cm² (160 psi). Both are equipped with auto drain metal bowls.

Max. Pressure: 1 MPa (10.2 kg/cm², 145 psi)
Max. Temperature: 60 °C (140 °F)

Part No. 27228

Engineered Air Filter/ Regulator provides clean, controlled air to HyperFormance system.

Also available without pressure gauge – Part No. 27159.

In-Line Oiler

Use with Airmatic lubricator inlet air supply. Compact unit with metal bowl and manual drain. Vertically mounted with maximum operating pressure of 10 bar (150 psi).

Part No. 27208

Self-contained In-Line Air Oiler used in conjunction with Airmatic lubricator.

Cycle Timer

A DIN 43650 Form A connector timer easily mounts to Airmatic lubricator solenoid valve (single screw connection).
A wide cycle time adjustment range is offered from 0.5 seconds to 10 hours.

110/230 VAC, 50/60 Hz
Part No. 24476

Compact timer offers wide range of operating cycles for Airmatic lubricator.

Air/Oil Injector Block

Typical inlet air pressure to air/oil injector block ranges from 4.3 bar (63 psi) to 6 bar (87 psi).

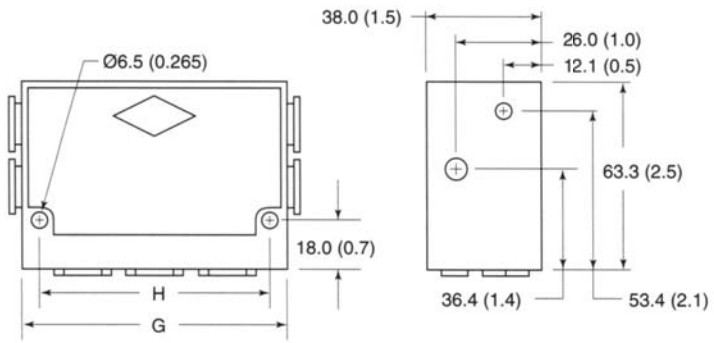
The Air/Oil Injector Block Assembly is available with one to eight injectors. Each outlet has an individual air flow needle valve. Establish the ordering designation for an individual assembly by inserting the codes for required discharges and configurations.

TABLE A

Letter code	*PDI output cc/cycle*
G	0.01
A	0.025
B	0.06
C	0.10
D	0.20
E	0.30
F	0.40

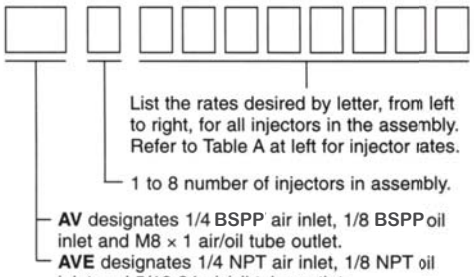
INJECTOR SPECIFICATIONS

No. of injectors	*Dimension G mm*	*in*	*Dimension H mm*	*in*
1	49	1.93	30	1.18
2	69	2.72	50	1.97
3	89	3.50	70	2.76
4	109	4.29	90	3.54
5	129	5.08	110	4.33
6	149	5.87	130	5.12
7	169	6.65	150	5.91
8	189	7.44	170	6.69



Dimensions in mm (inches)

Air/Oil Injector Block Part Number



Example: Requirement is for four outlet block assembly. Three outlets to deliver 0.025 cc and last outlet 0.06 cc/cycle.

Part No. = AV4AAAB

Air/Oil PDIs

Positive Displacement Injectors for HyperFormance Air/Oil Systems are available in seven outputs to cover many types of applications. Note: For critical high-speed applications utilizing ceramic and steel roller bearing elements, the smaller output rates of 0.01 and 0.025 cc/cycle are usually recommended.

PDI SPECIFICATIONS

Injector part no.	*Output cc/cycle*
26903-01	0.01
24209-025	0.025
24209-06	0.06
24209-10	0.10
24209-20	0.20
24209-30	0.30
24209-40	0.40

Positive Displacement Injectors deliver repeatable, exact volumes.

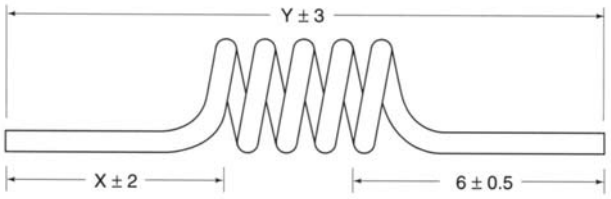
Installation Techniques

HyperFormance Air/Oil Systems provide accurate oil delivery on a continuous basis. When required, higher air flow may be used to pressurize bearing enclosure to prevent entry of contaminants.

It is important to test the system as necessary to ensure that oil output, air flow and nozzle orifice diameters are balanced to create optimum lubrication conditions. Adjust air pressures to compensate for pressure drops across delivery tubes.

Helical coiled tubing may be used where short line runs are encountered. In longer line runs, multiple coils may not be necessary. Two to five coils are available.

Note: Fewer coils deliver proportionally less lubricant on start-up after shutdown.

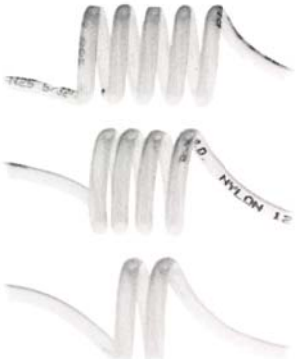


TUBING SPECIFICATIONS			
Part no.	*No. of coils*	*X (mm)*	*Y (mm)*
26263-2	2	25	31.5
26263-3	3	25	31.5
26263-4	4	25	31.5
26263-5	5	25	31.5

Coiled tubing extends tubing length in short line runs to stretch out lubricant deliveries.

Coiled Tubing

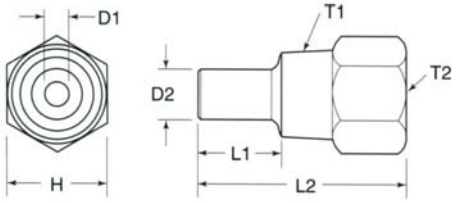
Tubing is normally mounted in a horizontal position or at a slight incline. Coils help to stretch out deliveries in short tubes for continuous lubricant flows. During shutdown, a small volume of oil collects at the bottom of each loop for faster delivery during start-up.



Nozzles

Offered in various sizes. Nozzles normally produce a round spray pattern. Typically, this nozzle configuration is suitable for anti-friction bearings and other applications where precise wetting is required. Nozzle orifice size and air pressure determine the shape and velocity of the air and oil mix. For special applications, contact your nearest Bijur representative.

Varied nozzle lengths ensure air/oil deliveries exactly where required.



NOZZLE SPECIFICATIONS							
Part no.	*T1*	*T2*	*L1 (mm)*	*L2 (mm)*	*D1 (mm)*	*D2 (mm)*	*H (mm)*
27107-1	1/8-27 NPTF	5/16-24 NF	4	20	2.5	6	11.1
27107-2	1/8-27 NPTF	5/16-24 NF	4	20	1.5	6	11.1
27107-3	1/8-27 NPTF	5/16-24 NF	10	26	2.0	5	11.1
27107-4	R1/8 (1/8 BSPT)	M8x1	4	20	2.5	6	10
27107-5	R1/8 (1/8 BSPT)	M8x1	4	20	1.5	6	10
27107-6	R1/8 (1/8 BSPT)	M8x1	10	26	2.0	5	10

Innovators of engineered lubrication technology since 1923

Sometimes you know what kind of lubrication system you need. Sometimes you don't. Bijur has experienced regional sales managers that can walk you through the process of selecting a system that fits your needs when you aren't sure. And when you need additional parts for the system, our trained customer service representatives can help you choose genuine Bijur parts that can generally be shipped to you within 24 hours.

Bijur also has ISO 9001:2000 quality certified manufacturing facilities around the world, so you'll know your centralized lubrication system meets the highest industry quality standards. It's all part of the Bijur commitment to quality and customer service.

CORPORATE HEADQUARTERS:
Bijur Delimon International
808 Aviation Parkway, Suite 1400
Morrisville, NC 27560

BIJUR LUBRICATING CORPORATION:
1-800-631-0168

YOUR LOCAL DISTRIBUTOR: