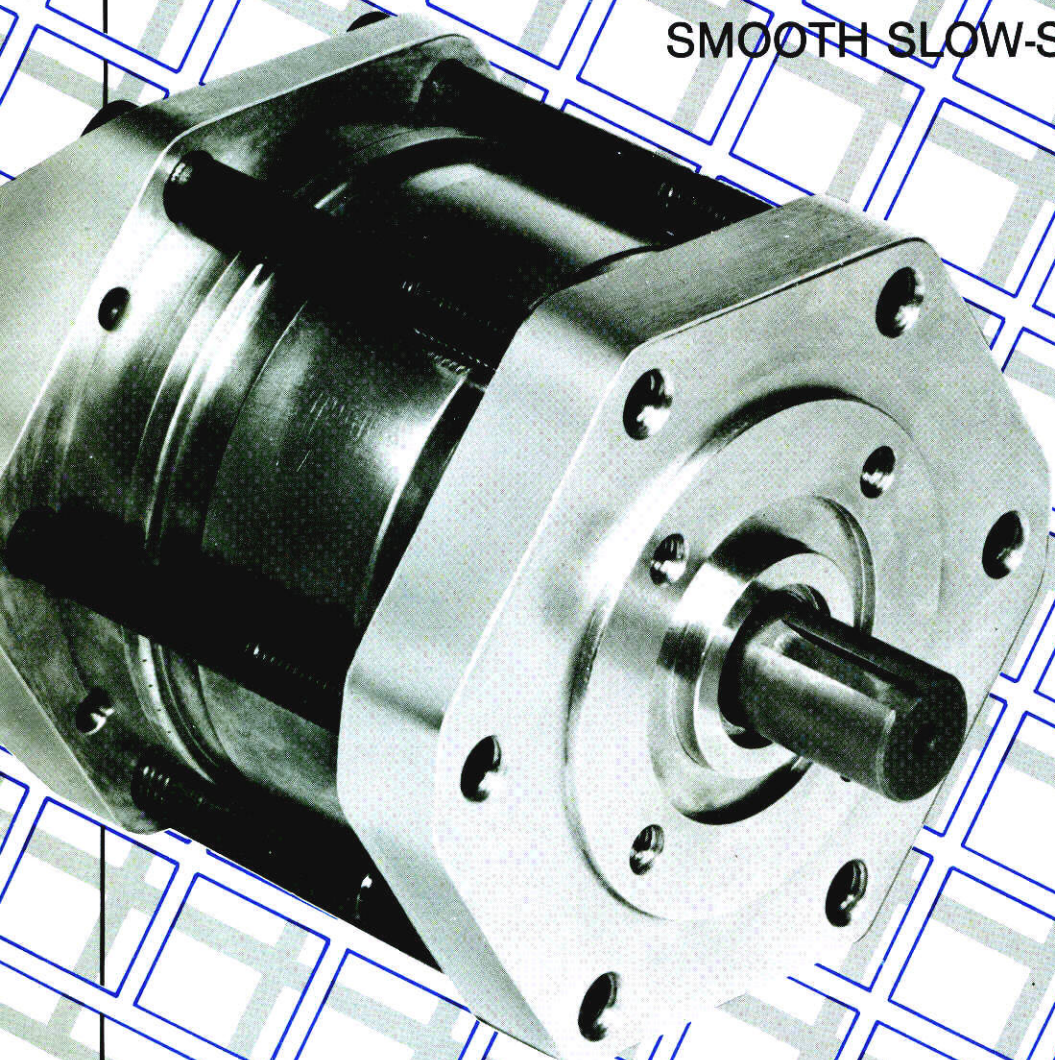


nutron

FLUID MOTORS

BV SERIES

**SMOOTH SLOW-SPEED OPERATION!
HIGH EFFICIENCY!**



- Linear Position
- Metering
- Servosystems
- Industrial Drives
- Food Processing
- Machine Tools
- Conveyers
- Winches
- Off-Road Equipment

Introduction

Nutron: A Renewed Dedication to Quality and Service.

While the 1970's ushered in Nutron's DVT Series Hydraulic Motors, the 1980's mark a breakthrough period for the *new* Nutron.

In 1988 Nutron Controls joined the Hydraulic Controls Group. Our new ownership and management team immediately dedicated themselves to the establishment of demanding new levels of product quality, customer service, in-plant technical support, and competitive pricing. Now, many satisfied OEM

and End Users are benefiting from this new dedication.

Uniquely designed Nutron Hydraulic Motors, with a wide variety of applications, are readily available through a network of national and international distributors.

As we begin to help you find solutions to your particular applications, we think you'll agree that "Nutron motors perform smoothly at slow speeds."

Unique Design

Spherical Pistons: The Heart of the Nutron Motor.

The uniquely designed Nutron Fluid Motor is based upon the principle of free, chrome alloy spherical pistons rolling upon multi-wave cams. Torque is produced by the reaction of these spherical pistons against the slopes of the cam races. This unique configuration provides quiet, shock-free, overlapped porting with near zero leakage.

Torque is produced only by the net pressure difference acting on the driving pistons, so elevated case pressure reduces torque generation at

the source, whenever the outlet port pressure rises. Nutron's patented (U.S. Patent No. 3,662,551) Pressure Compensation System actually modulates its own torque output. This pressure compensation system enables the Nutron Fluid Motor to maintain constant speed regardless of load, even below 1 RPM. In effect, the motor "locks on" to any flow control valve in the return line and modulates its own torque output to exactly hold the speed commanded by that valve.

Freewheeling

The chrome alloy spherical pistons can be made to float freely in their axial cylinder bores. There are no springs. Since centrifugal force cannot move the pistons axially, they move only in

response to the differential pressure between the case and the chambers they seal within the rotor. Less than 1 PSID is enough to move the spherical pistons.

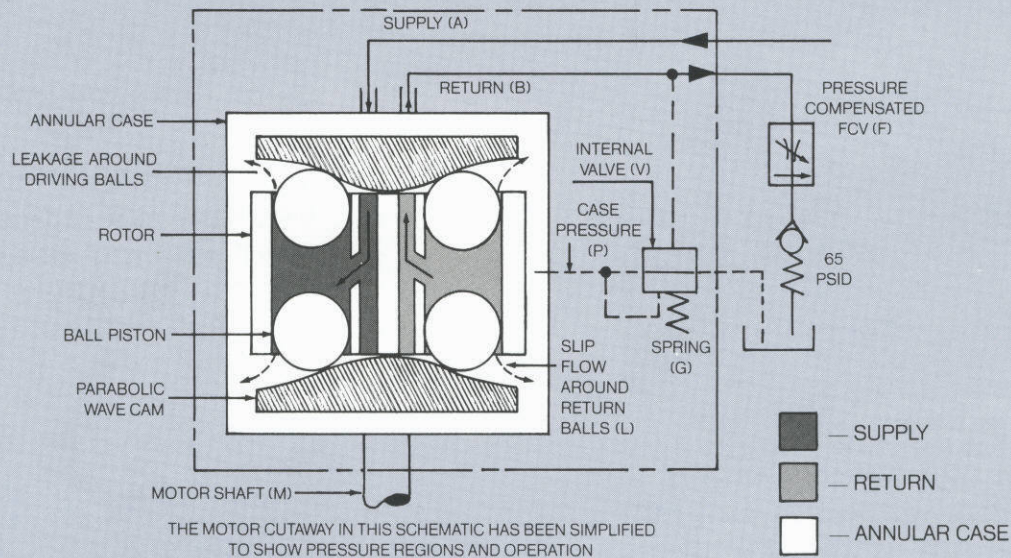
Features

- No cogging or stalling even at low RPM
- SAE B2 industry standard mounting for gearboxes, brakes and bearing blocks
- Control valve manifolds mount directly to the motor
- Quiet operation and low vibration at high shaft speeds
- Two or four bolt mounting is interchangeable with orbital motors
- Starting torque equals running torque at <1.0 RPM
- Uniform stall torque repeatable within 2% at any point
- Ideally suited for frequent start-stop-reversal applications
- Lower leakage provides much greater efficiency than orbital type motors
- Optional nickel plating available for corrosive applications

Pressure Feedback System

- Within the Nutron motor there are three pressure regions: supply, return and the unique annular case.
- The parabolic wave cam design and the porting configuration do not produce either speed/torque pulsation from the shaft, or pressure/flow pulsation in the case.
- Due to the efficient pressure balanced face seals, interport leakage can be considered zero.
- There are two internal pressure feedback valves, one valve for each direction of motor rotation.
- Differential pressure from supply to case produces driving torque, while differential pressure from return to case produces retarding torque.

The above is basic in understanding the operation of the pressure feedback system.



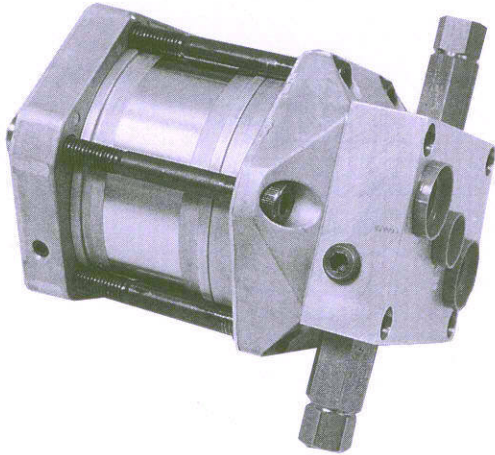
System Functions

A work load on motor shaft (M) increases, which causes the flow in the return line (B) to decrease. The pressure compensated flow control valve (F) then opens, causing the return line pressure to drop. This pressure drop is sensed by the internal valve (V) in the motor, which opens due to the combined case pressure (P) and spring force (G), and vents the case pressure to tank. When the case pressure drops, the differential pressure from the supply (A) to case increases which in turn increases driving torque. Note that the differential pressure from the return to case always remains constant since it must balance the spring force and therefore the retarding torque remains the same. For this reason the torque output of the motor var-

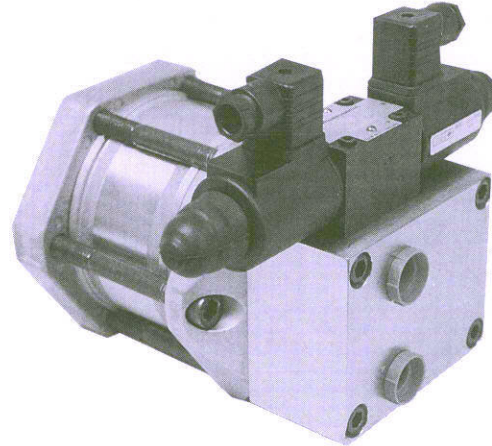
ies only with the differential pressure from supply to case. The speed of the motor is determined by a combination of return flow in (B) and slip flow (L) but since the differential pressure from return to case is constant, the slip flow is constant which causes the speed to vary only with return flow.

It is now obvious that the internal pressure feedback loop cancels out the effects of both load and leakage, and that speed control will be as close as the flow control valve can regulate. Several manufacturers of pressure compensated flow control valves offer valves with regulation of 1%, and when one of these valves is used to meter the flow coming out of BV motor, 1% speed regulation will result.

Control Manifolds



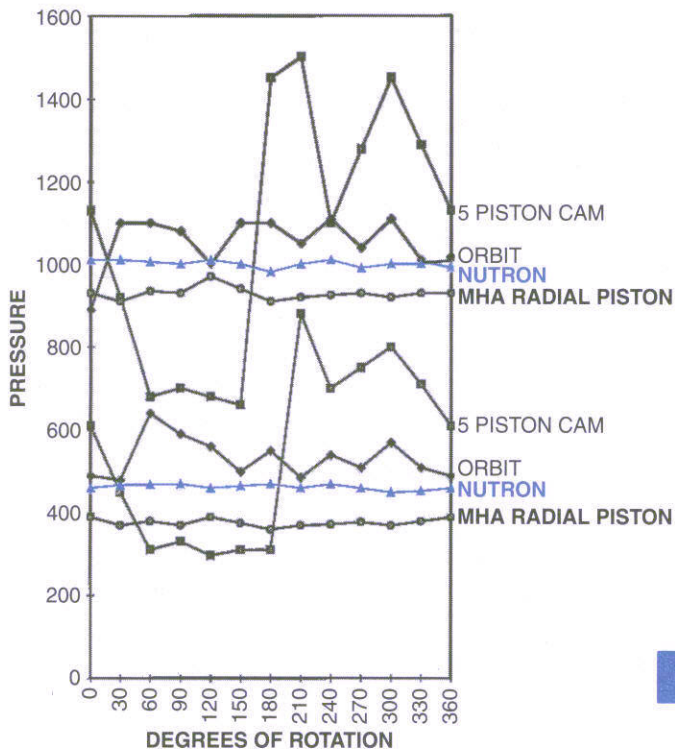
BV motor plus N20004
Cross line relief valve manifold



BV motor plus a special
NG6 directional control valve manifold

Constant Stall Torque

PRESSURE VARIATION FOR DIFFERENT
TYPES OF HYDRAULIC MOTORS TO
ACHIEVE A CONSTANT STALL TORQUE



From graph, one can see that the NUTRON motor achieves a smooth drive with very low pressure variations throughout each complete revolution, even with varying output torques.

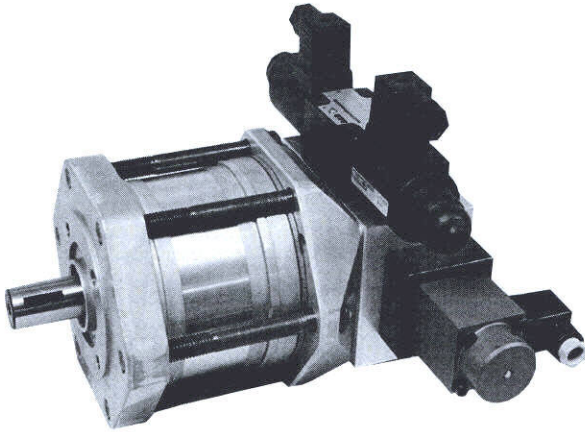
With the use of a simple pressure relief valve, a uniform stall torque can be accurately controlled within 2% repeatability.

The motor is available with pressure transducers mounted on the A & B ports for precise torque control.

**PRESSURE TRANSDUCER OPTION
ORDER MOTOR PLUS N20000**

nutron the smooth, pulsation free, drive

Total Control Package

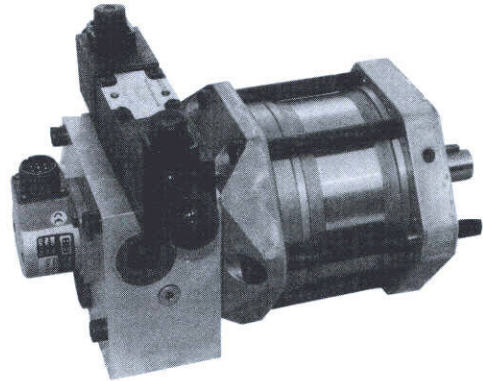


BVE motor plus N20002
Proportional speed control manifold

**TO ORDER ENCODER OPTION
ADD E32 or E500 AFTER PART NO. BV**

The NUTRON range of motors will operate from 1500 rpm down to below 1rpm and hold speed within 1%, despite a varying load (torque). This is achieved using a high quantity pressure compensated flow control.

With today's increasing demands for electronic control, the motor is available with a 32 pulse speed encoder (only available with metric or SAE B 13 tooth spline shaft) or a 500 pulse incremental optical encoder, with marker pulse for linear positioning, metering and precise speed control.



BVE motor and encoder plus N20005
Proportional speed control manifold

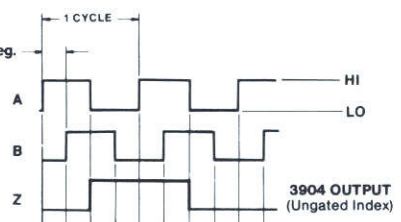
Incremental Optical Encoder Features

- Directly coupled to motor shaft
- Conforms to NEMA 13 requirements
- Connection: - MS3102R16S-1P
- Operating temperature: - 0 to 70 C
- Supply: - voltage 5Vdc, current requirements 80 mA typical
- Output: - current sink up to 40mA with pull-up resistor sourcing 10ma
- Output Format: - 2 channel (A & B) in quadrature
+/- 27 with index one cycle wide
- Frequency response: - 100 kHz
- Shock: - 50 G's for 11 msec duration
- Vibration: - 5 to 2000 Hz @ 20 G's
- Humidity: - 98% RH without condensation
- Resolutions: - 500 cycles per rev. as standard,
optional 2 5 8 10 11 12 24 30 32 40 50 60 64
70 75 80 00 112 120 125 150 200 240 250
256 300 360 400 410 500 510 512 600

OUTPUT TERMINATION

M16 PINS	OUTPUT CHANNELS
A	A
B	B
C	Z
D	+V (VOLTAGE)
E	OV (GROUND)
F	
G	

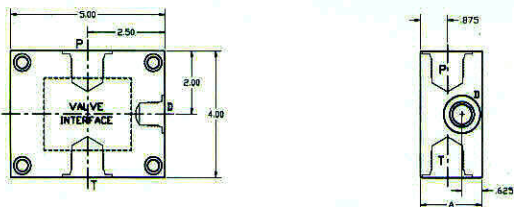
OUTPUT WAVEFORMS



Motor Mounted Manifolds

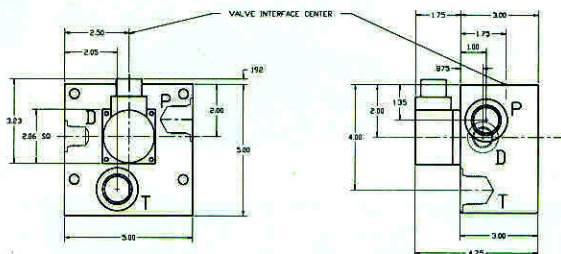
CONTROL VALVE INTERFACE

NFPA INTERFACE	NG SIZE	DIN. A INCHES	PART NUMBER
D03	NG6	2.00	N20011
D05	NG10	2.50	N20012



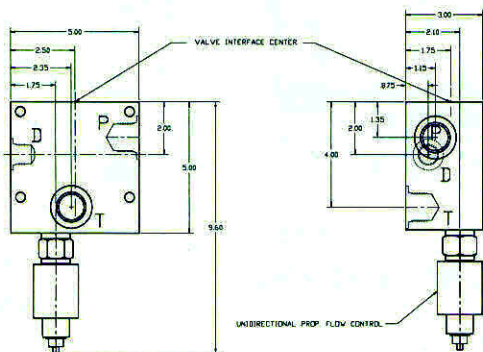
DO 3 INTERFACE N20011
DO 5 INTERFACE N20012

INCREMENTAL ENCODER, CONTROL VALVE INTERFACE



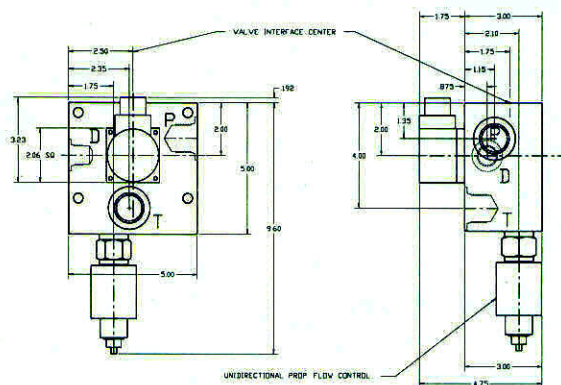
DO 3 INTERFACE N20005
DO 5 INTERFACE N20007

CONTROL VALVE INTERFACE C/W PROPORTIONAL FLOW CONTROL



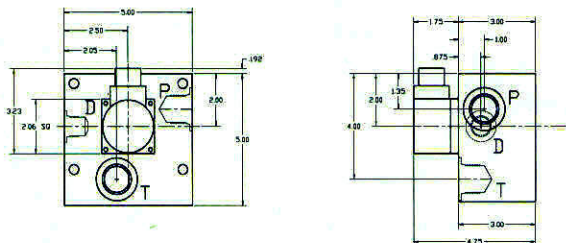
DO 3 INTERFACE N20002
DO 5 INTERFACE N20003

INCREMENTAL ENCODER, CONTROL VALVE INTERFACE C/W PROPORTIONAL FLOW CONTROL



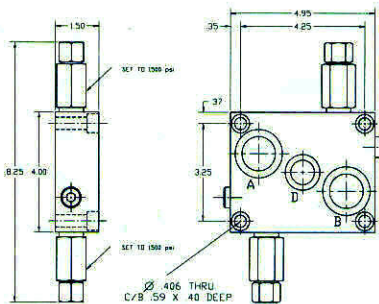
DO 3 INTERFACE N20001
DO 5 INTERFACE N20006

INCREMENTAL ENCODER



N20008

CROSS LINE RELIEF VALVE WITH CARTRIDGES



N20004

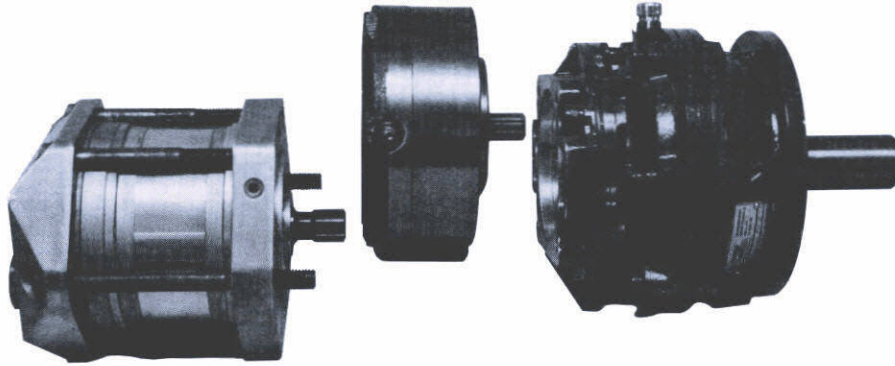
PORTS: - P and T, SAE 12-1.1/16 x 12 UN. Drain, SAE 8-3/4 X 16 UN

Motor mounting socket head cap screws and o-ring seals included.

Standard incremental encoder 500 pulse per revolution, see specification page 2

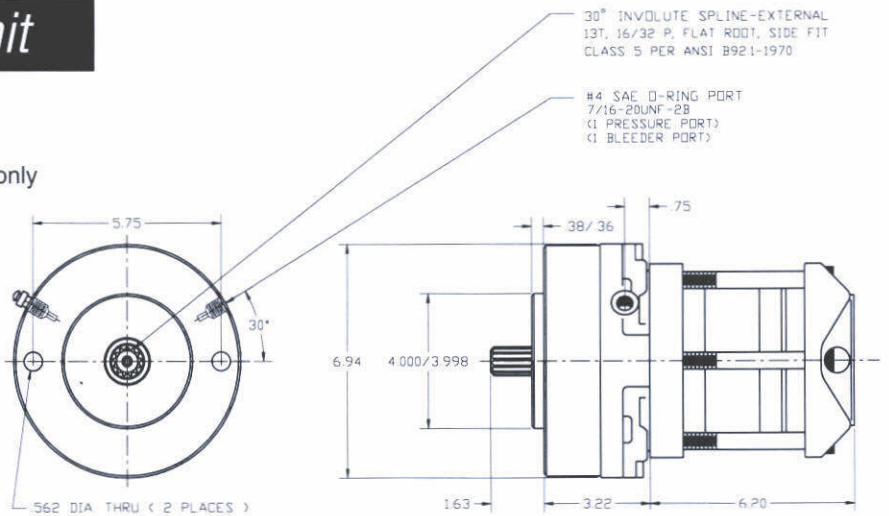
Proportional flow control valve available in a 5, 10, 15 or 20 gpm size, voltage 12 or 24 Vdc.

Full dimensional drawings available on request



Multiple Disc Brake Unit

- Positive locking of motor shaft prevents creep under static load conditions
- Compact, self contained, dry design adds only 3.22" to motor length
- Sintered bronze friction plates for high strength and long lining life
- Sealed, isolated from contamination
- Mount 2 bolt SAE B 13 tooth spline shaft
- Can be used with gearbox option



The Brake unit accepts the BV**SM9 S13B motor

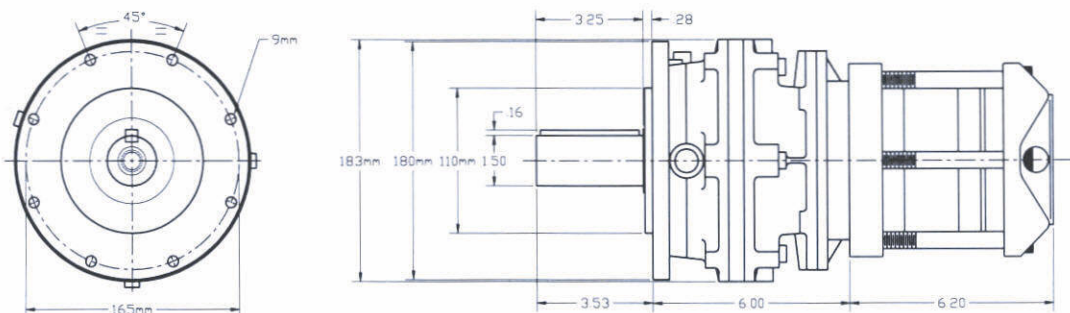
ORDER NO. LMB-131317-B

Planetary Gear Units

- Precision gearing, low back lash
- High efficiency
- High radial loads
- Choice of flange or foot mount
- Heavy duty construction

EFFECTIVE RATIO	MAX TORQUE, BV10@1250 PSIΔP (IN LB)		
	BV3	BV6	BV10
3.38	1612	3228	5381
4.39	2094	4192	6989
6.00	2862	5730	9552
6.94	3310	6628	11048
10.50	5008	10027	16716

DIMENSIONAL DATA IN INCHES UNLESS SPECIFIED



The Gear units accept the BV**MK6 motor

ORDER NO. EM1010/MN2//00**

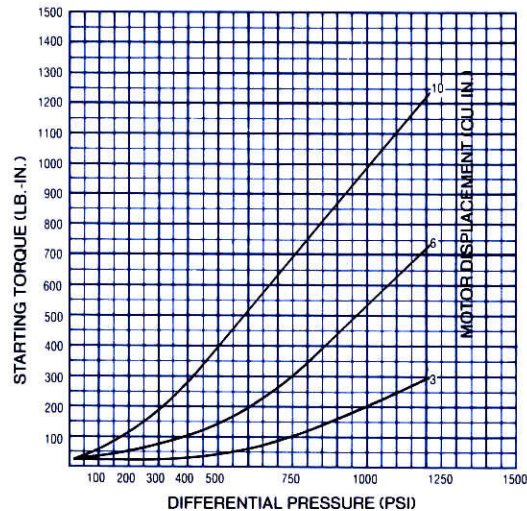
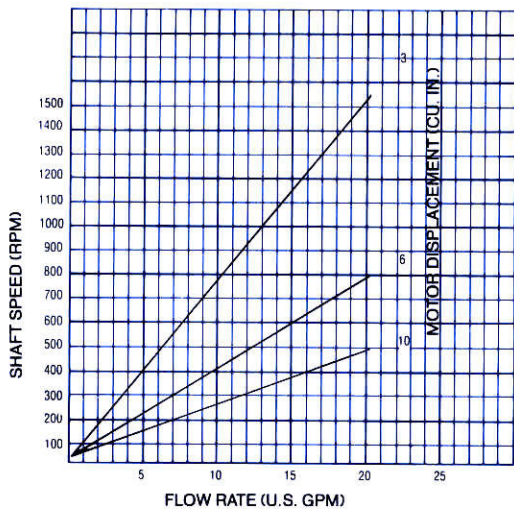
Performance

Displacement	Cubic Inches/Revolution	10.0	6.0	3.0
Speed	Revolutions/Gallon	23.1	38.5	77.0
	Max. Continuous RPM (Recommended)	460	770	1540
	Normal Min. Smooth RPM (Metering-out flow control)	5	15	20
	Absolute Min. Smooth RPM (Metering-out flow control*)	<1	5	15
Flow	Max. Continuous GPM (Recommended)	20	20	20
	Case Drain GPM—Zero Load (1000 PSIG)	.05	.05	.05
	Case Drain GPM—Full Load (1000 PSIG)	.30	.30	.30
Approx. 5 GPM Produces Highest Overall Operating Efficiency				
Torque	Theoretical lb-in/100 PSID	159.2	95.5	47.7
	Max. Continuous lb-in (α 1250 PSID)	1592	955	477
	Min. starting lb-in (α 1250 PSID)	1313	776	328
For starting Torque at other Pressures, Refer to Graph				
Pressure	Max. Continuous Δ PSI (Recommended)	1250	1250	1250
	Max. Working Pressures Ports A & B (PSIG)	2000	2000	2000
	Min. Backpressure above Drain Pressure (PSID)	25	45	65
	Max. Drain Pressure above Ambient (PSIG)	75	75	75
	Min. Drain Pressure above Ambient (PSIG)	5	5	5

*Absolute Min. Smooth RPM can be obtained with correct selection of valves and circuit design. Valves should be mounted directly to back of motor.

Allowable Radial Load (α Shaft key)								
Speed—RPM	50	100	250	450	750	1000	1250	1500
Load—LBS	1350	750	300	165	100	75	60	50

Other displacement models are available. Consult factory for specifications.



Any good quality petroleum fluid with anti-wear additives is recommended. Use higher viscosity for low speed operation. Any fluid compatible with nylon and Buna N (or Viton) and non-corrosive to steel and aluminum is acceptable under normal conditions. High Water Base Fluids (HWBF) are not recommended for general use in Nutron Motors. Consult factory for further information.

Mechanical Specifications

A, B, and D ports are straight thread O-ring. Do not force in tapered pipe threads.

Annular grooves around fluid ports A, B, and D accept standard O-Rings for sealing to flat surface of manifold blocks for control valves or special porting connections.

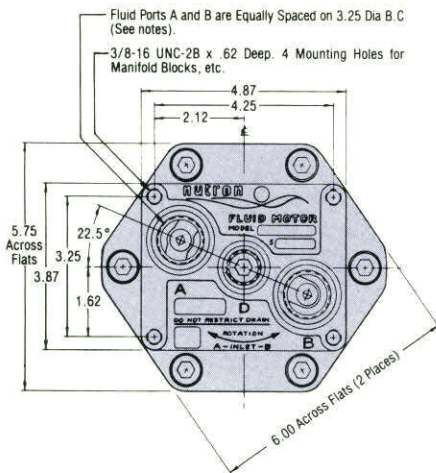
A and B require ring no. ARP-568-029 (1.62 OD x .070 C.S.)

D requires ring no. ARP-568-024 (1.25 OD x .070 C.S.)

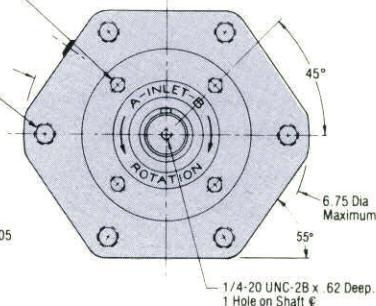
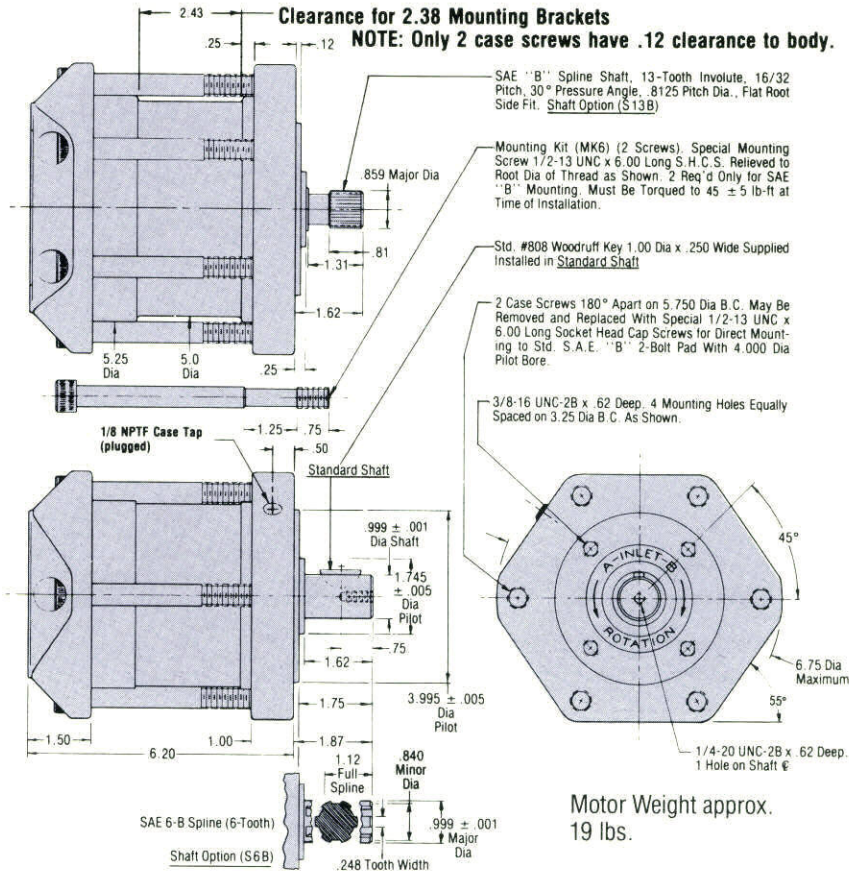
Fluid ports A and B have 1.062-12 UNF thread for standard SAE — 12 straight thread O-ring fittings.

Drain port D has .75-16 UNF thread for standard SAE — 8 straight thread O-ring fittings.

Under no circumstances should tapered-thread pipe fittings be installed in ports A, B, or D. Permanent damage may result. If only tapered thread fittings are acceptable, a manifold block must be used (note 1.) or standard straight thread to pipe thread adapters must be used.



CAUTION:
Do not exceed 25 lb-ft on 3/8-16 screws.
Do not exceed 45 lb-ft on 1/2-13 screws.



Motor Weight approx. 19 lbs.

Ordering Information

Typical model code:

BV — 6 — S6B — MK6 — V — SF

Type

- BV** — Valve model for meter out speed control
- BVN** — Nickel plated for corrosion resistance
- BVE** — Encoder model specify no. of pulses

Displacement

- 3 — 3 in³/rev
- 4.5 — 4.5 in³/rev
- 6 — 6 in³/rev
- 8 — 8 in³/rev
- 10 — 10 in³/rev

Shaft

- No Designation** — Standard 1" Dia Shaft with 1/4" Key
- R** — 5/16" Dia Reamed Tailshaft Socket in standard 1" Dia Shaft
- S6B** — 6-Tooth spline
- S13B** — 13-Tooth SAE "B" spline
- M** — 25 mm Dia Shaft with 8 mm Key

SF — Absolute min. smooth

No Designation — Buna N
V — Viton seals

Mounting Style

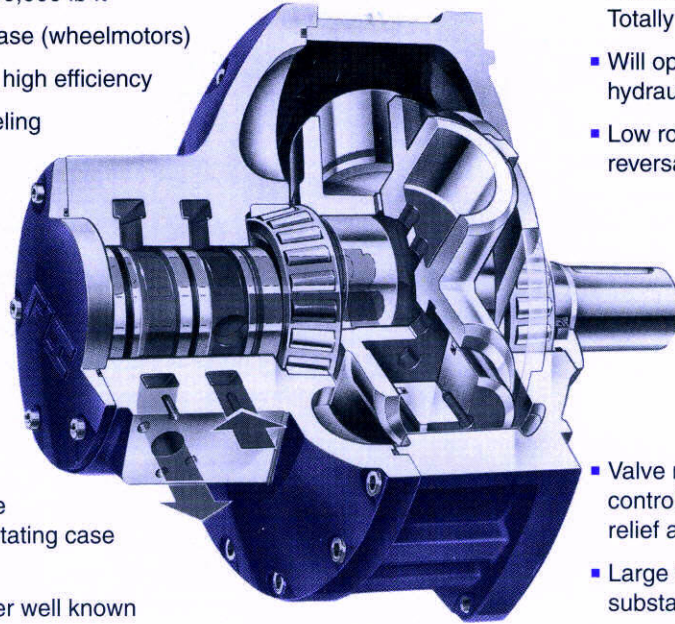
- No Designation** — Standard Face Mount or Bracket Mount
- MK6** — 2 Special Bolts factory-installed for direct SAE B 2-Bolt Flange Mount ONLY
- SM6** — 2 Standard SHCS 1/2-13x6"

Note: Fluid used must be compatible with nylon. All motors (including viton seals option) have parts made of nylon.

Heavy Duty Hydraulic Motors

The versatile MHA series motors

- High Torque at low speeds
Direct couple drives to 5125 lb ft
Speed reducer drives to 300,000 lb ft
- Rotating shaft or rotating case (wheelmotors)
- Simple rugged design with high efficiency
- True mechanical free-wheeling



- Ideal for extreme environmental conditions
Low/high ambient temperatures
Hazardous explosive atmosphere
Totally immersed
- Will operate on all types of fire resistant hydraulic fluid, HWB and Phosphate Ester
- Low rotational inertia allows for rapid reversal and fast speed changes

- Spring applied safety brake option available for both rotating case and shaft motors
- Interchangeability with other well known makes of radial piston motors
- Operates at full stall torque without damage

- Valve mounting face option for load control, Transmission, Servo, Pressure relief and Directional control valves
- Large taper roller bearings that enable substantial radial and axial shaft loading
- Smooth rotation down to 1 rpm

Summary of Performance Data

MODEL	TYPE	MAX RPM B' TYPE WHEEL	MAX RPM C' TYPE SHAFT	SWEPT VOLUME cu in /rev	TYPICAL RUNNING TORQUE lb ft / 1000 psi	CONT. PRESS., psi	PEAK PRESS., psi	MAX INT. POWER Hp
MHA90	B & C	500	1000	5.5	66.11	2500	4000	20
MHA125	B	500	N/A	7.6	90.52	3000	5000	28
MHA180	B & C	500	500	11.2	140.86	3000	5000	29
MHA250	B & C	500	500	15.4	193.75	3000	5000	52
MHA300	B & C	500	500	18.3	230.36	3000	5000	52
MHA350	B & C	300	550	21	254.26	3000	5000	78
MHA500	B & C	300	550	31	378.34	3000	5000	96
MHA580	B & C	300	550	35.5	432.24	3000	5000	96
MHA750	B & C	200	550	45.8	564.96	3000	5000	134
MHA1400	C	N/A	300	85.9	1059.24	3000	5000	173

Complete details of the **MHA ROTATING SHAFT & ROTATING CASE** motors available on request
Full service available from our National and International distributors

nutron Motor Co., Inc.

102 DOW HWY.
P.O. BOX 370
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TELEPHONE: 207-439-5272
FAX: 207-439-8611
INTERNET: nutron@gwi.net