

Industrial Devices' NS Series rod-type cylinders are ideally suited for automated motion applications requiring high load and duty cycle, precise positioning, or full torque at rest with an open loop system. The NS Series can answer a variety of motion control needs, including open or closed loop positioning, simple or very complex motion profiling, PLC or computer interfacing, and multi-operation programs.

As a replacement for troublesome hydraulic and pneumatics, NS Series systems are cleaner and easier to maintain, and are often less expensive.

These rod-type cylinders incorporate a 5 pitch (5 turns per inch) or 8 pitch acme screw, or a 2 or 5 pitch ball bearing screw to provide a variety of speed and thrust capabilities with a maintenance free 1.8° hybrid step motor as the mechanical power source. Ball screw models are used in applications that require higher speed and duty cycles. Acme screw models generally perform best in applications with up to 60% duty cycle, and where backdrive is not acceptable. Acme screws also provide faster stopping because of their frictional damping qualities. Because they are self locking, no movement occurs when an external force is applied. Another appeal of acme models is their slightly lower cost. The life expectancy of a ball screw is generally better than an acme screw.

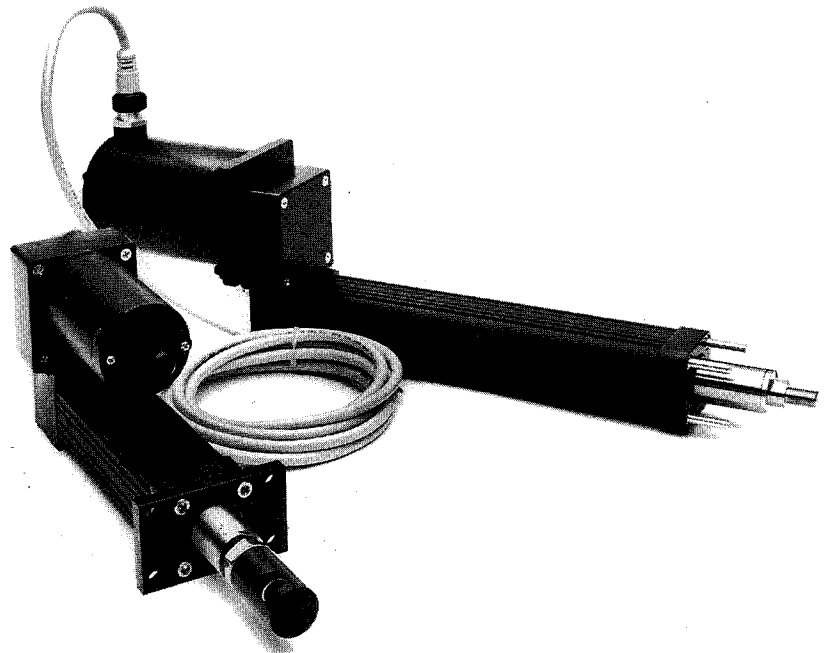
Timing belt and gear reductions between the motor and the lead screw further widen the performance range of NS Series models. Parallel

motor mounted models can have many ratios, while in-line models are always direct driven, with the motor directly coupled to the screw.

NS Series Cylinders are available with several time proven options for application in industrial environments. Options include holding brakes, encoders for position feedback, special materials for high or low temperature environments, linear potentiometer feedback for use with user supplied controls, dual rod-end bearings to increase side load capacity, and more. Industrial Devices will also discuss unique modifications at the customer's request.

FEATURES

- 100% duty cycle with ball screw models
- Speed to 25 inches per second
- Thrust to 800 lbs
- Standard travel lengths to 24 inches. Custom lengths available.
- NFPA style mounting configurations provide direct replacement for hydraulic or pneumatic cylinders
- Five rod end couplings facilitate a variety of loads
- Three motor mounting options optimize installation space
 - Parallel
 - Reverse Parallel
 - In-line Models
- Anodized and fused epoxy external aluminum surfaces, and stainless steel thrust tube provide corrosion protection
- Acme and ball screw models for application flexibility
- High performance step motor size 23 or 34
- Optimized for use with S5000 controls, offering:
 - virtually unlimited programming capability
 - very high position resolution
 - repeatability to +/- .0005 inches
 - integral control/drive/power supply package
 - integral operator interface
 - see page 195



NS SERIES CYLINDERS

COMMON SPECIFICATIONS

Specifications are defined in the Engineering Section.

Thrust Load	800 lbs max
Speed	25 in/sec max, at no load
System Backlash	0.015 inch
Thrust Tube	
Side Load Moment	See load curves on page 257
Rotation	Does not rotate. Note: applying a rotation torque to the thrust tube may damage unit
Standard Travel Lengths	2, 4, 6, 8, 12, 18, and 24 inches

CONSTRUCTION MATERIALS

Bearing Housings	Type 380 die cast aluminum, epoxy coated
Cylinder Housing	6063 T-6 aluminum, hard-coated anodized and teflon impregnated
Thrust Tube	Type 304 stainless steel, 1/4 hard, ground and polished
Wiper Seal	Polyurethane
Lead Screw	
Support Bearings	Ball bearings
Acme Screw; drive nut	0.625 inch diameter, carbon steel screw; lubricated bronze drive nut
Ball Screw; drive nut	0.625 inch diameter, carbon steel screw; alloy steel, heat treated ball nut

WEIGHT (approximate, without options)

2 inch stroke unit—NS2:	5.8 lbs, add 0.25 lbs per additional inch of stroke
2 inch stroke unit—NS3:	9.6 lbs, add 0.25 lbs per additional inch of stroke

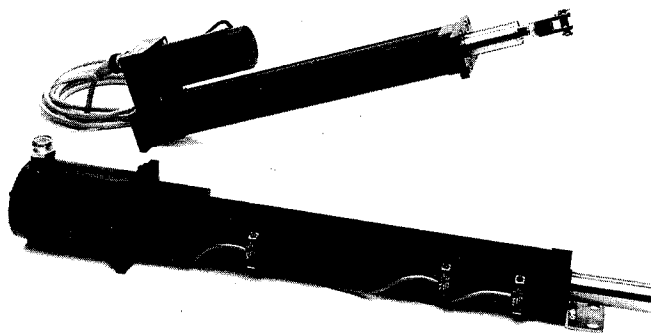
MOTOR SPECIFICATIONS

Type	1.8° permanent magnet hybrid step motor
Inductance	S2T 8 mH; S2V 2 mH S3T 6.2 mH; S3V 1.5 mH
HIPOT breakdown	750 VAC
Static Torque	S2T 135 oz-in max S3T 300 oz-in max
Connections	S2N, S3N: 8 leads, 8 inch length S2T, S2V, S3T, S3V: 5 contact quick disconnect receptacle in anodized aluminum shell, includes 12 ft cable with molded plug
Temperature	212°F (100°C) Maximum allowable motor case temperature Actual motor case temperature is ambient, duty cycle and speed dependent. Refer to speed vs. thrust performance curves for system duty ratings.

ENVIRONMENTAL OPERATION

For applications beyond standard allowable environmental conditions, see the Options and Accessories section.

Temperature Range	32° to 140°F, -H high temperature option allows 32° to 160°F -F sub-freezing temperature option allows -20° to +105°F
Moisture	Humid, but not direct moisture contact -W water resistant option allows some direct moisture contact
Contaminants	Non-corrosive, non-abrasive





INDIVIDUAL MODEL SPECIFICATIONS—BALL SCREW MODELS

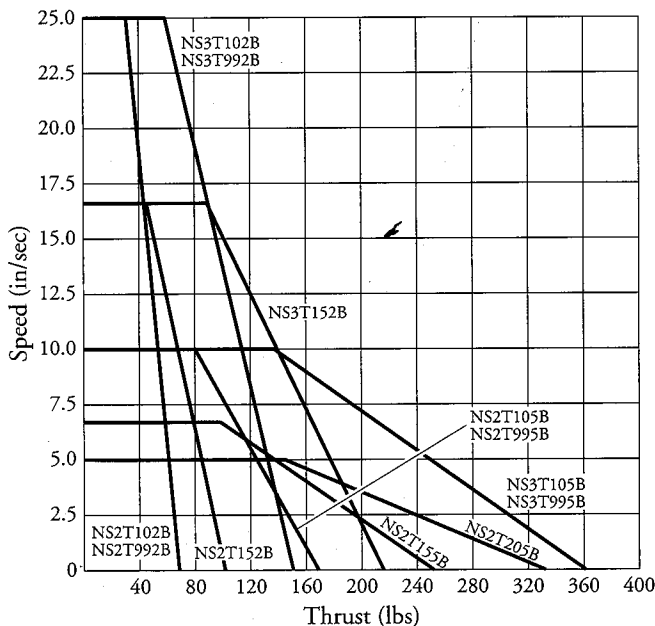
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	NS2T102B	NS2T105B	NS2T152B	NS2T155B	NS2T205B		NS2T355B	NS2T1205B		
	NS3T102B	NS3T105B	NS3T152B	NS3T155B		NS3T255B			NS3T992B	NS3T995B
	NS2V102B	NS2V105B	NS2V152B	NS2V155B	NS2V205B		NS2V355B	NS2V1205B		
	NS3V102B	NS3V105B	NS3V152B	NS3V155B		NS3V255B			NS3V992B	NS3V995B
Drive Type	Timing Belt	Timing Belt	Timing Belt	Timing Belt	Timing Belt	Helical Gear	Helical Gear	Spur Gear	In-Line Flex Coupled	
Drive Ratio (motor:screw)	1:1	1:1	1.5:1	1.5:1	2:1	2.5:1	3.5:1	12:1	1:1	1:1
Screw Pitch (rev/inch)	2	5	2	5	5	5	5	5	2	5

SYSTEM PERFORMANCE USING S5000 SERIES CONTROLS

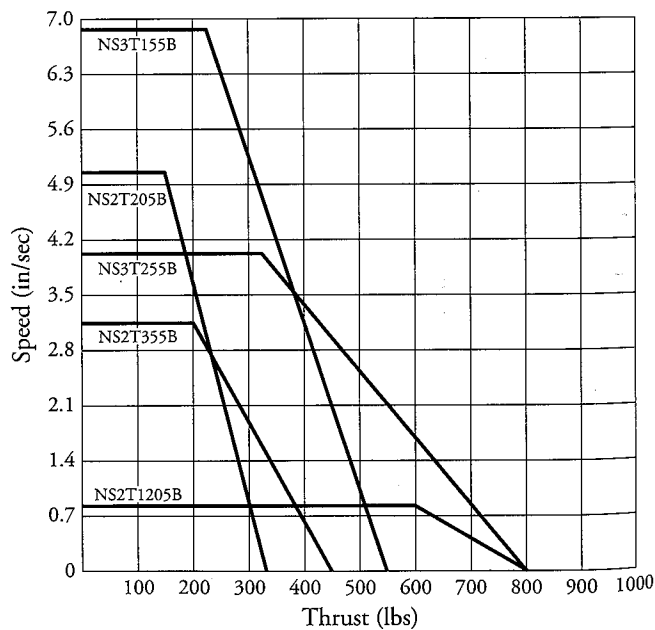
	<i>Stroke</i>										
Max. Speed (ips at no load)	2-18 in	25	10	16.7	6.7	5	4	2.9	0.8	25	10
	24 in	18	10	16.7	6.7	5	4	2.9	0.8	18	10
<i>When applying NS cylinders with greater than 18 inch stroke, maximum speed may be limited by critical screw speed, as shown here in bold. The individual model performance curves shown on the following pages have been qualified (horizontal black lines) for critical speed limitations in 24 inch lengths.</i>											
Maximum S2 Thrust (lbs at rest)	65	165	99	248	330	-	450	800	65	165	
	S3	145	365	219	548	-	800	-	-	145	365
Repeatability (inches) Repeatability values achievable with S5000 controls in open-loop configuration ± 0.0005 ± 0.0005 ± 0.0005 ± 0.0005 ± 0.0005 ± 0.0005 ± 0.0005 ± 0.0005 ± 0.0005 ± 0.0005 ± 0.0005											

A COMPARISON OF SPEED VS. THRUST PERFORMANCE

Using S5101 or S5201 control, at 100% duty cycle—see individual performance curves on page 150.



HIGHER SPEED MODELS



HIGHER THRUST MODELS

NS SERIES CYLINDERS

INDIVIDUAL MODEL SPECIFICATIONS—ACME SCREW MODELS

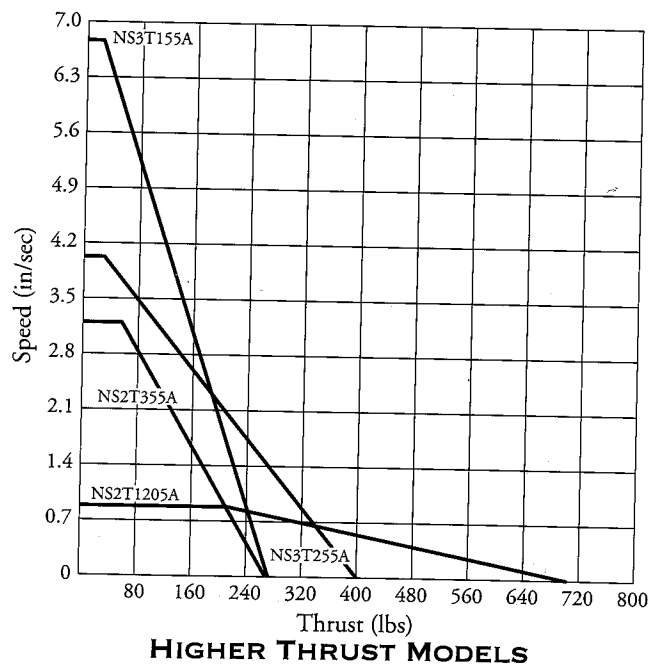
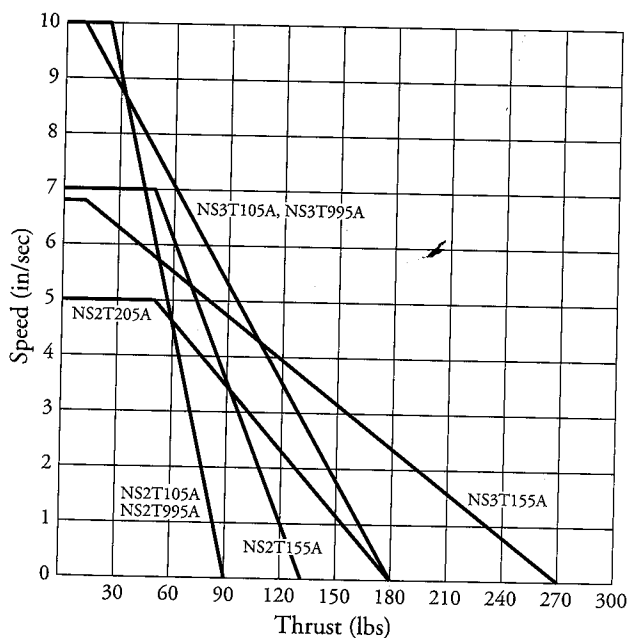
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NS3N105A	NS3N55A		NS3N255A			NS3N995A
NS2T105A	NS2T155A	NS2T205A		NS2T355A	NS2T1205A	
NS3T105A	NS3T155A		NS3T255A			NS3T995A
NS2V105A	NS2V155A	NS2V205A		NS2V355A	NS2V1205A	
NS3V105A	NS3V155A		NS3V255A			NS3V995A
Timing Belt	Timing Belt	Timing Belt	Helical Gear	Helical Gear	Spur Gear	In-Line Flex Coupled
1:1	1.5:1	2:1	2.5:1	3.5:1	12:1	1:1
5	5	5	5	5	5	5

SYSTEM PERFORMANCE USING S5000 SERIES CONTROLS

<i>Stroke</i>							
12-18 in.	10	6.7	5	4	2.9	0.8	10
24	10	6.7	5	4	2.9	0.8	10
	90	135	180	-	245	720	90
	180	270	-	400	-	-	180
Repeatability (inches)	Repeatability values achievable with S5000 controls in open-loop configuration						
	± 0.0005	± 0.0005	± 0.0005	± 0.0005	± 0.0005	± 0.0005	± 0.0005

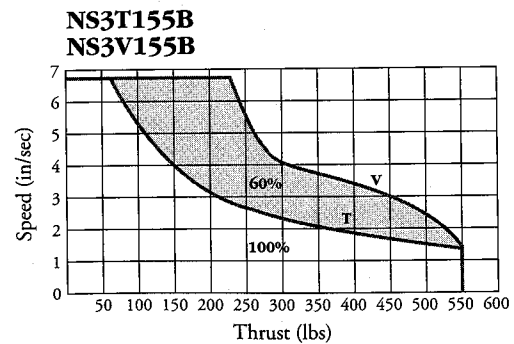
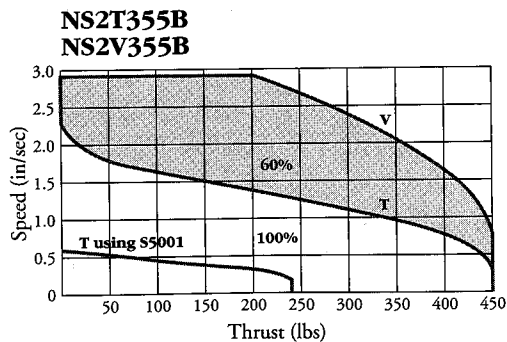
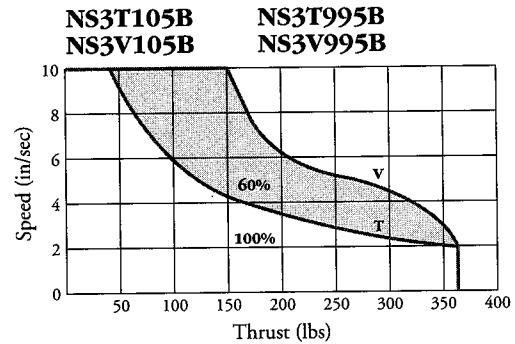
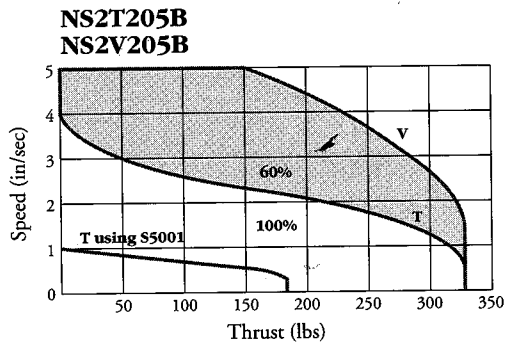
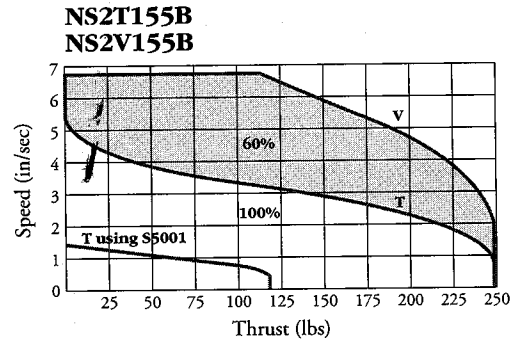
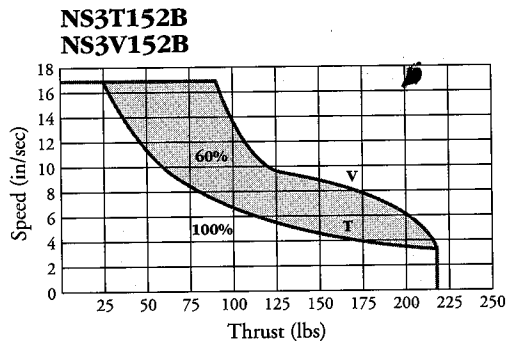
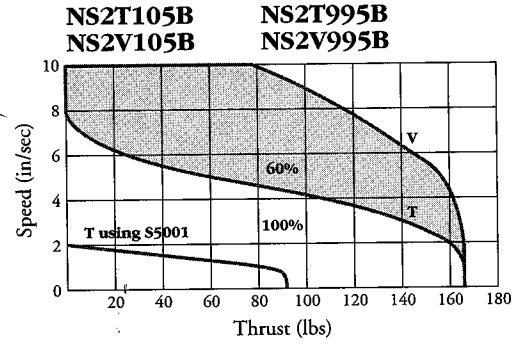
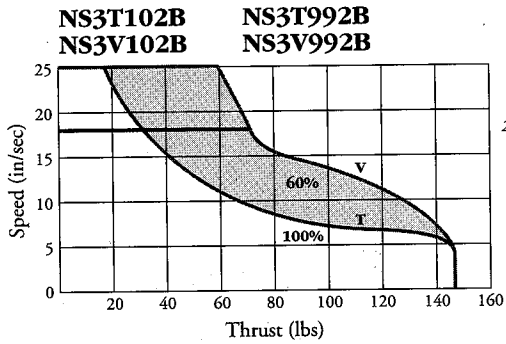
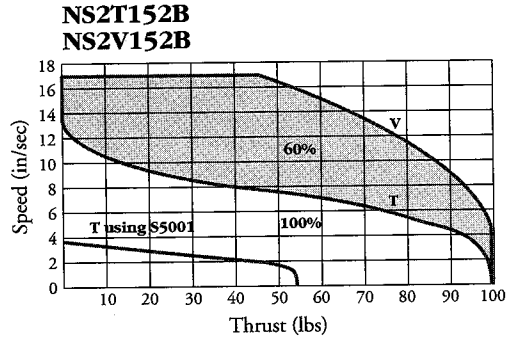
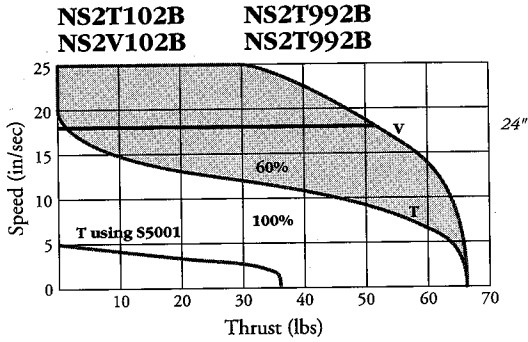
A COMPARISON OF SPEED VS. THRUST PERFORMANCE

Using S5101 or S5201 control, at 60% duty cycle—see individual performance curves on page 151.

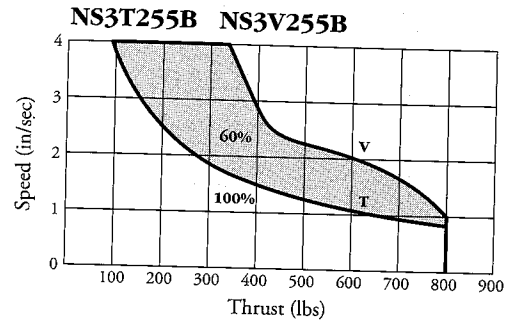
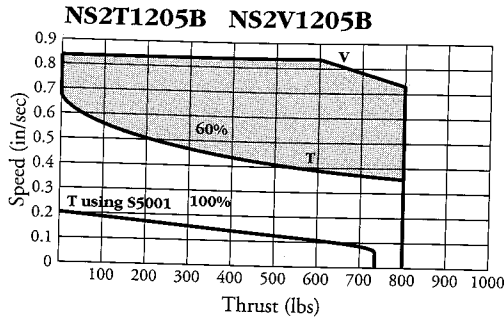


THRUST VS. SPEED PERFORMANCE

BALL SCREW MODELS USING S5101, S5201 AND S5001 CONTROLS



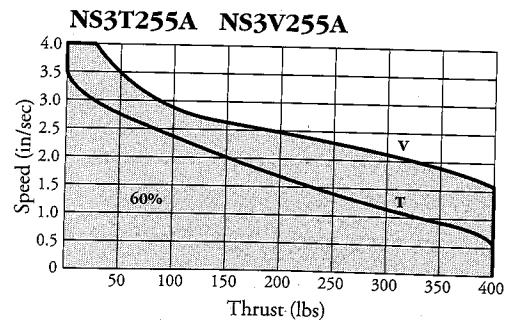
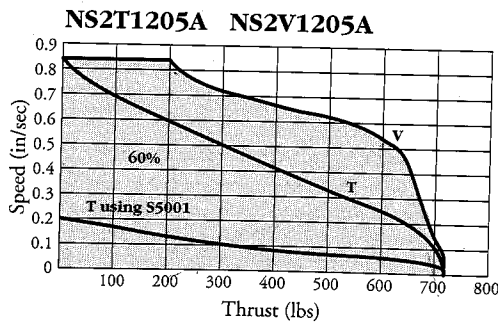
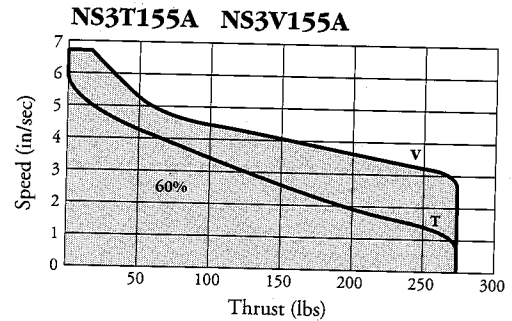
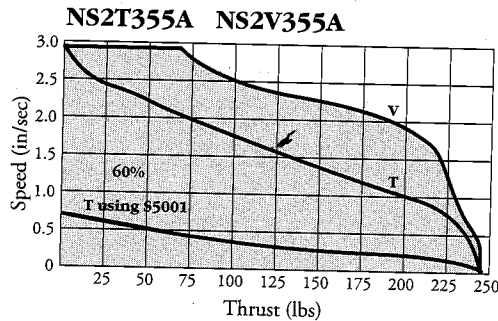
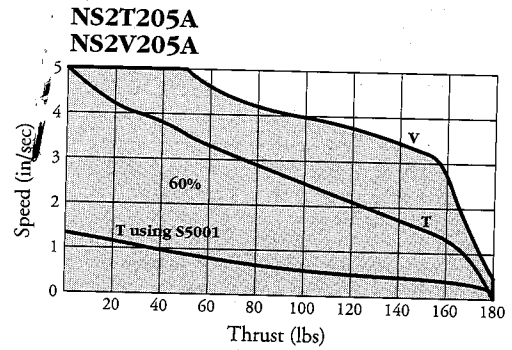
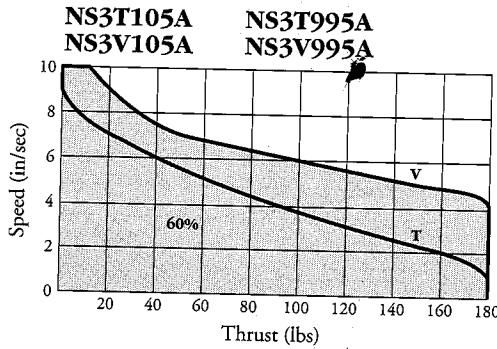
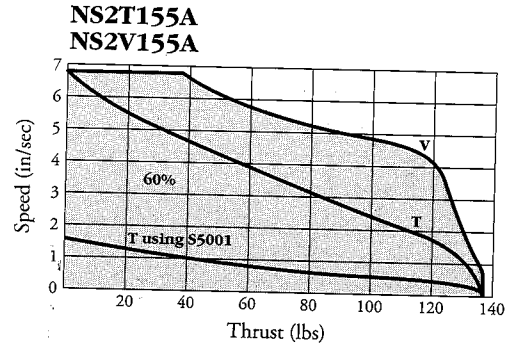
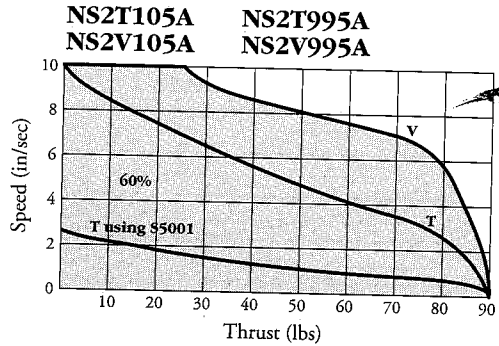
NS SERIES CYLINDERS



THRUST VS. SPEED PERFORMANCE

ACME SCREW MODELS USING S5101, S5201 AND S5001 CONTROLS

Duty cycle for all acme screw models is limited to 60%.

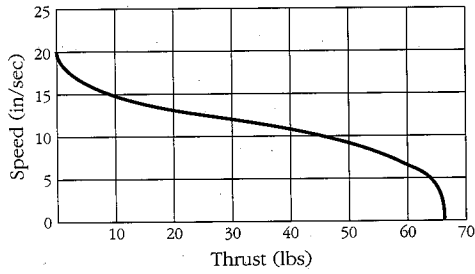


THRUST VS. SPEED PERFORMANCE

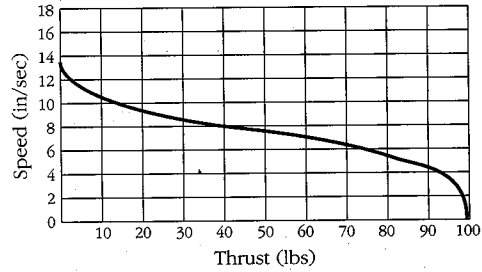
BALL SCREW MODELS USING S5851 CONTROL

- 100% duty cycle for NS ball screw models using the S5851 control.
- All NS cylinders used with S5851 control must have motor windings wired in parallel.

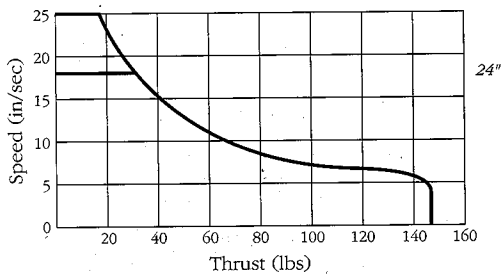
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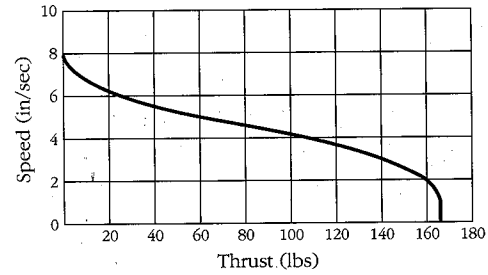
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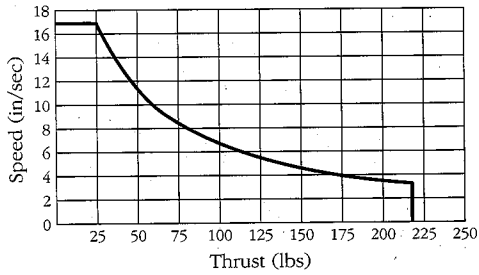
NS3V102B NS2V992B



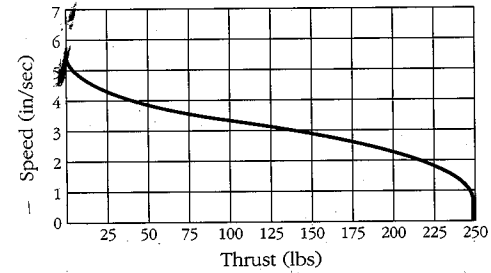
NS2V105B NS2N995B



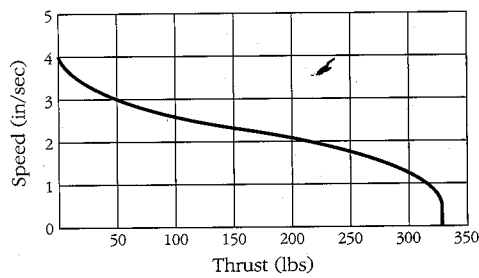
NS3V152B



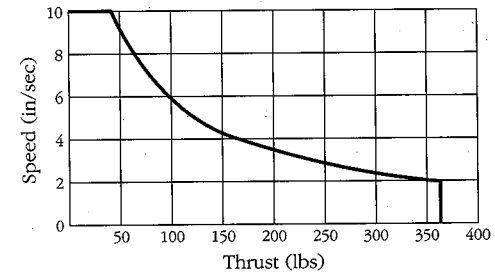
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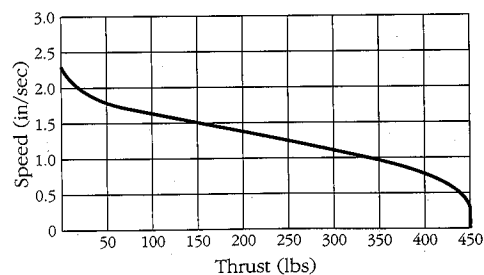
NS2V205B



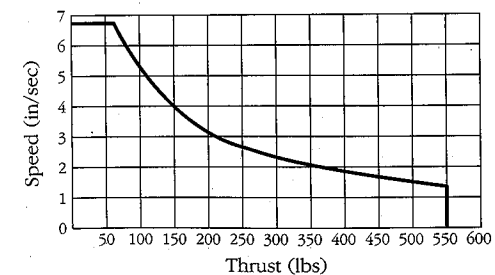
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NS2V355B



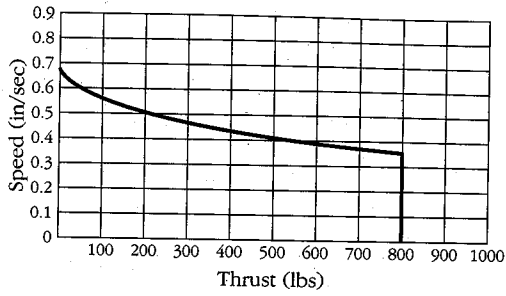
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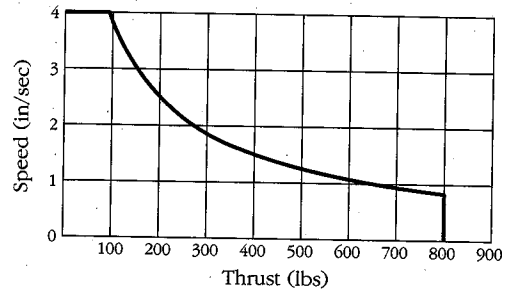
NS SERIES CYLINDERS

BALL SCREW MODELS (CONTINUED)

NS2V1205B



NS3V255B

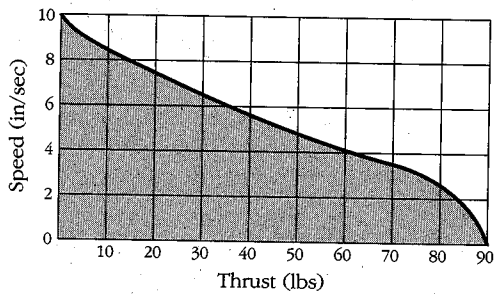


THRUST VS. SPEED PERFORMANCE

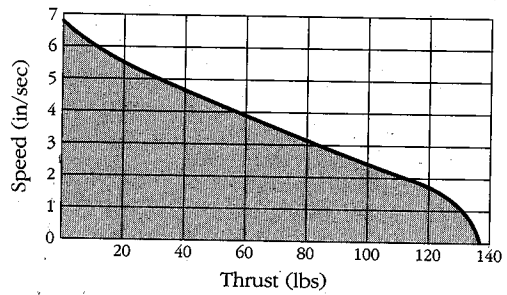
ACME SCREW MODELS USING S5851 CONTROL

- 60% duty cycle for NS acme screw models.

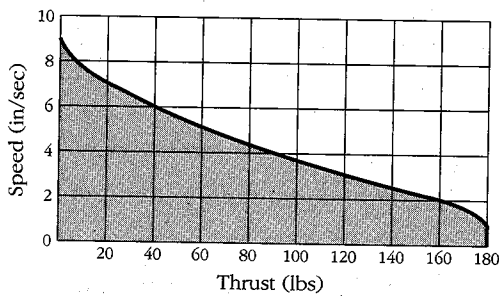
NS2V105A NS2N995A



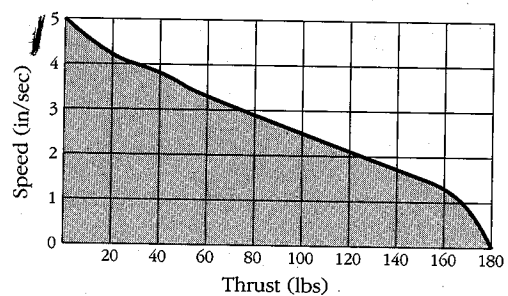
NS2V155A



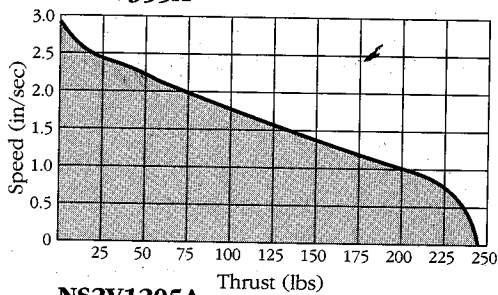
NS3V105A NS3V995A



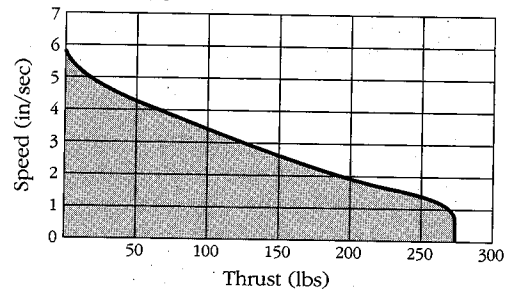
NS2V205A



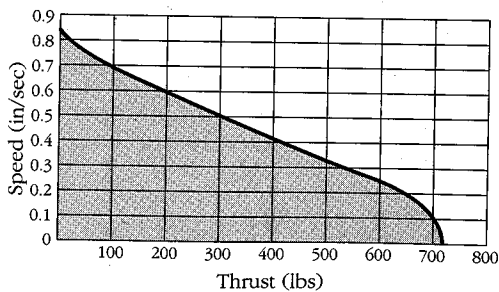
NS2V355A



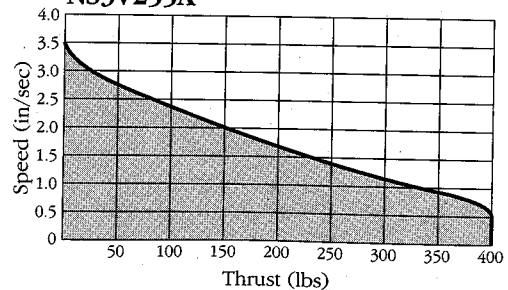
NS3V155A



NS2V1205A



NS3V255A





EIGHT STEPS TO ORDERING A COMPLETE NS SYSTEM

For help:

- Complete the Application Data Form on pages 26 and 27.
- Review the NS Series specifications.
- Refer to the Engineering section for selection assistance.
- Consult your local Industrial Devices distributor, or call the factory.

1. BASE MODEL NUMBER

Select the NS model which provides sufficient thrust and speed for the application, with a comfortable margin of safety. **IDC recommends at least 30% reserve thrust for step motor driven systems.** Available thrust will be consumed by acceleration, friction, pushing/pulling against an external force, and is the case of a vertical application, supporting the load against gravity.

Industrial Devices offers three motor wiring choices. The standard "N" version has 8 motor leads for the customer to wire in parallel or series to the control. The "T" version has the motor pre-wired in series, the "V" version has the motor wired in parallel.

The "T" and the "V" versions include a male quick disconnect receptacle, and a 12 foot motor cable with molded quick disconnect plug.

Refer to the NS Speed vs. Thrust curves and specifications in this section when making this selection.

2. STROKE LENGTH

Seven standard travel lengths are available from 2 to 24 inches. Longer lengths and custom in-between lengths also are available. Consult your IDC distributor or the factory for details.

To maximize cylinder life, the cylinder should not impact either physical end of stroke during normal operation. Extra travel length is needed to decelerate the carriage to a stop when an end-of-travel limit switch is encountered. This extra travel distance depends on load and speed. Consult the Engineering Section.

3. MOTOR MOUNTING (PARALLEL UNITS ONLY)

NS cylinders with gear or timing belt drive reductions have the motor mounted parallel to the lead screw. (With in-line units, the motor is always coupled directly to the screw shaft, with no reduction.)

Though most customers use the standard parallel configuration, NS Series parallel models offer the reverse parallel option for optimum integration into your machine. Full dimensional drawings start on page 156.

① BASE MODEL NUMBER				② STROKE LENGTH	③ PARALLEL MOTOR MOUNTING	④ CYLINDER MOUNTING	⑤ ROD END	⑥ OPTIONS
Rod-type Cylinder	Motor Motor	Drive Config.	Screw Ratio Pitch, Type					
N	S							
S2 or S3 N, T or V								
Ball Screw	Acme Screw	N = Motor with 8 leads, for customer to wire in series or parallel.		2	blank (standard)	-MF1	-FE2	-BS
NS2X102B-	NS2X105A-	T = Motor wired in series includes quick disconnect		4	-RM (reverse)	-MF2	-FT1	-DB
NS2X105B-	NS2X155A-	V = Motor wired in parallel includes quick disconnect		6		-MF3	-MT1	-EM
NS2X152B-	NS2X205A-	Custom lengths available up to 48 inches.		8		-MP2		-F
NS2X155B-	NS2X355A-	Dual Rod- end Bearing Option (-DB) recommended for lengths greater than 18 inches.		12		-MS1		-H
NS2X205B-	NS2X1205A-			18		-MS6		-L
NS2X355B-	NS3X105A-			24	Does not apply to in-line models	-MT2		-W
NS2X1205B-	NS3X155-					-MXA		
NS3X102B-	NS3X255A-					-MXB		
NS3X105B-	X=N,T or V					-MXC		
NS3X152B-						Additional Charge		
NS3X155B-						-MP3	-FC2	
NS3X255B-							-FS2	
In-Line Models								
NS2N992B-	NS2N995A-							
NS2N995B-	NS3X995A-							
NS3X992B-	X=N, T or V							
NS3X995B-								

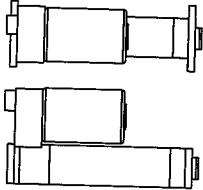
NS SERIES CYLINDERS

4. CYLINDER MOUNTING

Specify any one of these cylinder mounting options. Dimensional drawings start on page 156.

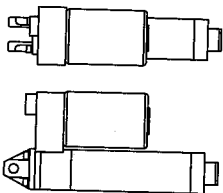
Cylinder base mount options -MP2, -MP3, -MF2, -MF3, -MXB and -MXC cannot be ordered with in-line models.

MF1, 2, 3 Rectangular Flanges

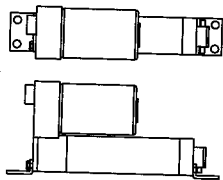


MF1 Front Flange
MF2 Rear Flange
MF3 Both Flanges

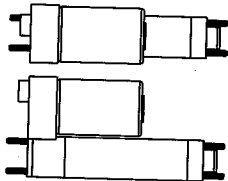
MP2 Rear Clevis



MS1 Side End Angles

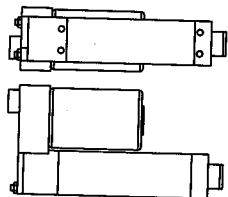


MXA, B, C Extended Studs

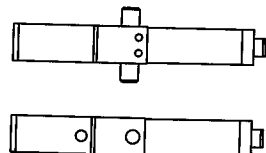


MXA Front
MXB Rear
MXC Both

MS6 Side Tapped Holes



MT2 Trunnion (In-Line Models Only)



5. ROD END

IDC offers 5 rod end options for NS Series cylinders. Carefully consider the best method of attaching the load to provide optimum performance and long life, by preventing excessive backlash, side load moments, rod end rotation, and misalignment. To determine overall cylinder length, be sure to include the rod end dimensions, see page 156.

-FT1 Female thread

-MT1 Male thread

-FE2 Female eye
(includes -FT1)

-FS2 Spherical joint
(includes -FT1)

-FC2 Clevis (includes -MT1)

6. OPTIONS

IDC offers several NS Series cylinder options to satisfy unique application requirements. **See the Options and Accessories section for complete specifications of these options.**

-BS Holding Brake
20 in-lb holding brake mounted on the rear lead screw shaft extension. *Not available on in-line models or with cylinder base mount options (-MF2, -MF3, -MS1, -MP2, -MP3, -MXB, -MXC).*

-EM Encoder
500 line incremental encoder mounted on the rear shaft of the motor.

-F Sub-Freezing Environment
Increased internal clearances allow thermal expansion and contraction for operation to -20°F. *Increases system backlash to 0.025 inches max.*

-H High Temperature
Increases maximum cylinder operating temperature to 180°F by changing internal materials and lubricants.
Note: -F and -H are not compatible.

-DB Dual Rod End Bearing
Dual rod-end bearings increase side moment load rating (see curves on page 257) This option reduces actual stroke length by 1.5 inches. *Recommended for all applications using 18" and 24" cylinders.*

-L Linear Potentiometer Output
Linear potentiometer mounted inside the NS cylinder.

-W Water Resistant Option
Provides protection from light moisture contact with cylinder.

7. ACCESSORIES

Accessories are ordered as separate items, with separate model numbers. **Details can be found in the Options and Accessories section.**

Magnetic Position Sensors

Position sensors are available for stopping position indication, for changing direction or speed, etc. using user supplied controls.

The S5000 Drive/Controls use a normally open switch (RP1 or RPS-1) for home positioning, and normally closed switches (RP2 or RPS-2) for end-of-travel limit sensing.

To maximize cylinder life, IDC recommends the use of end-of-travel limit switches with all cylinders.

RP1 Normally open Hall-effect switch

RP2 Normally closed Hall-effect switch

RPS-1 Normally open reed contact switch

RPS-2 Normally closed reed contact switch

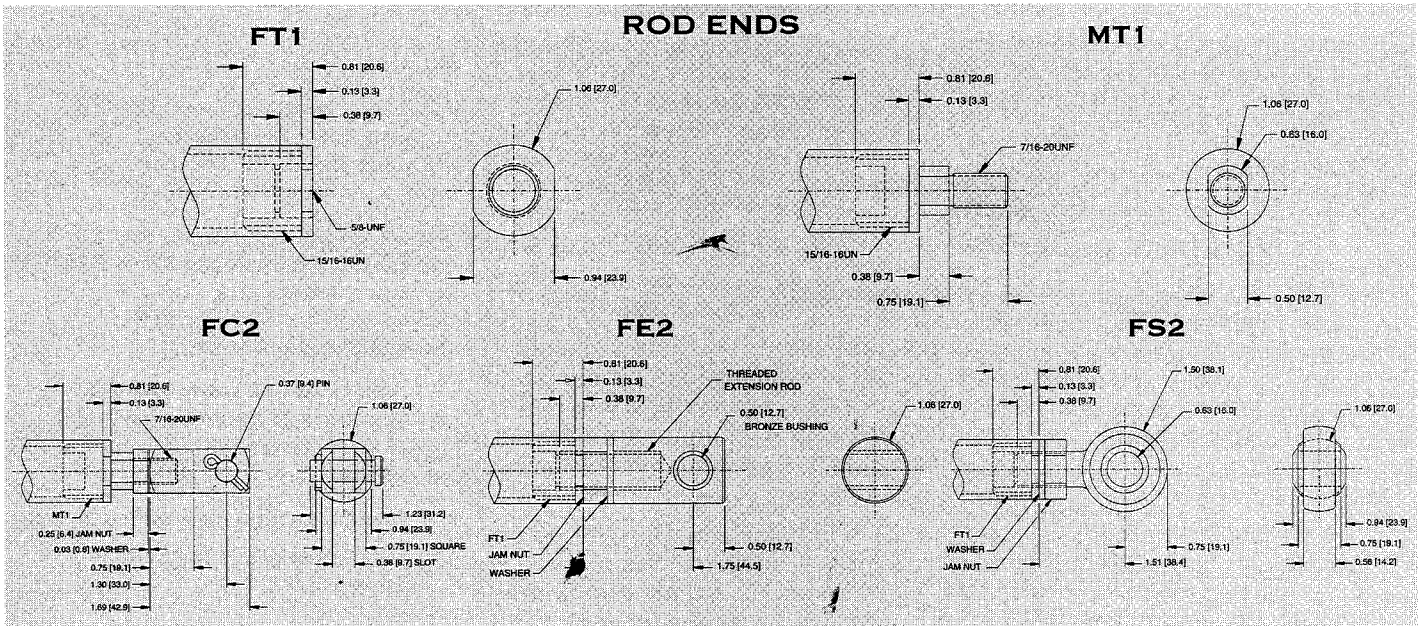
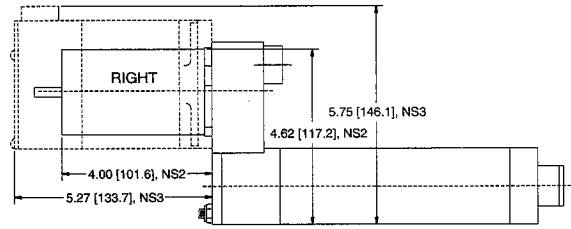
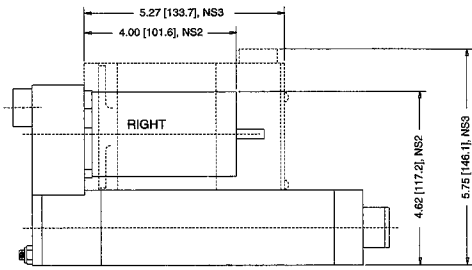
8. S5000 SERIES CONTROLS

To complete the system, Industrial Devices offers controls which are optimized to run NS Series cylinders.

Details of the S5000 Series controls begin on page 193.

STANDARD PARALLEL MOUNTED MOTOR

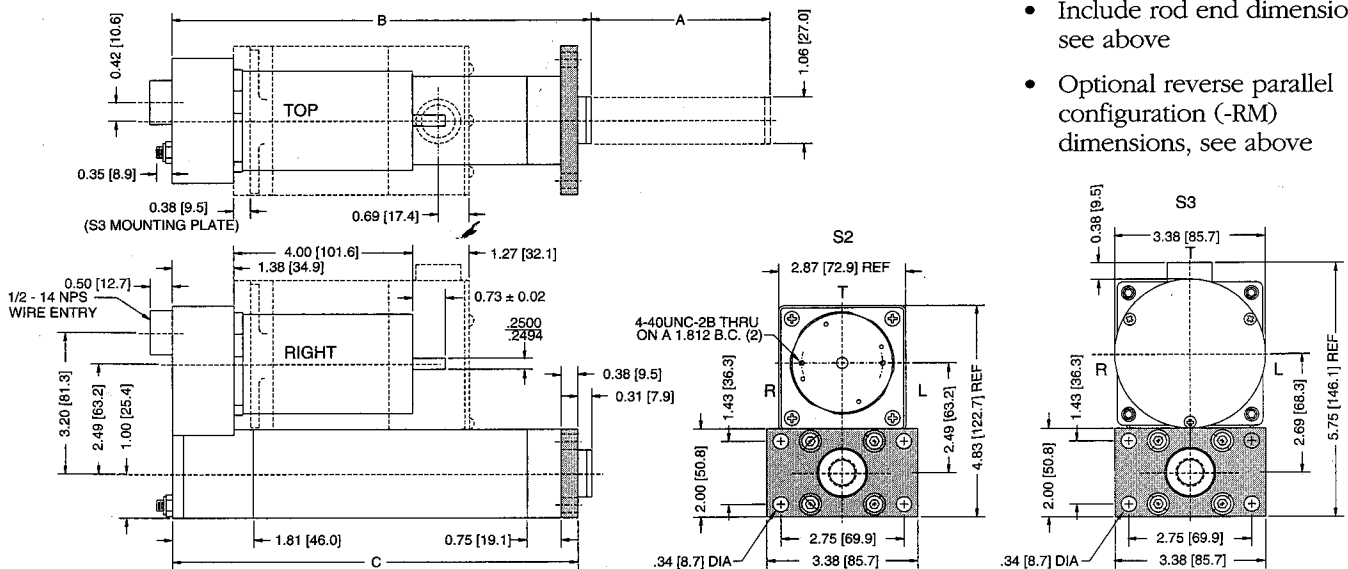
REVERSE PARALLEL MOUNT (-RM OPTION)



MF1 HEAD RECTANGULAR FLANGE MOUNTING

PARALLEL

- CAD drawings available on diskette
- Include rod end dimensions, see above
- Optional reverse parallel configuration (-RM) dimensions, see above

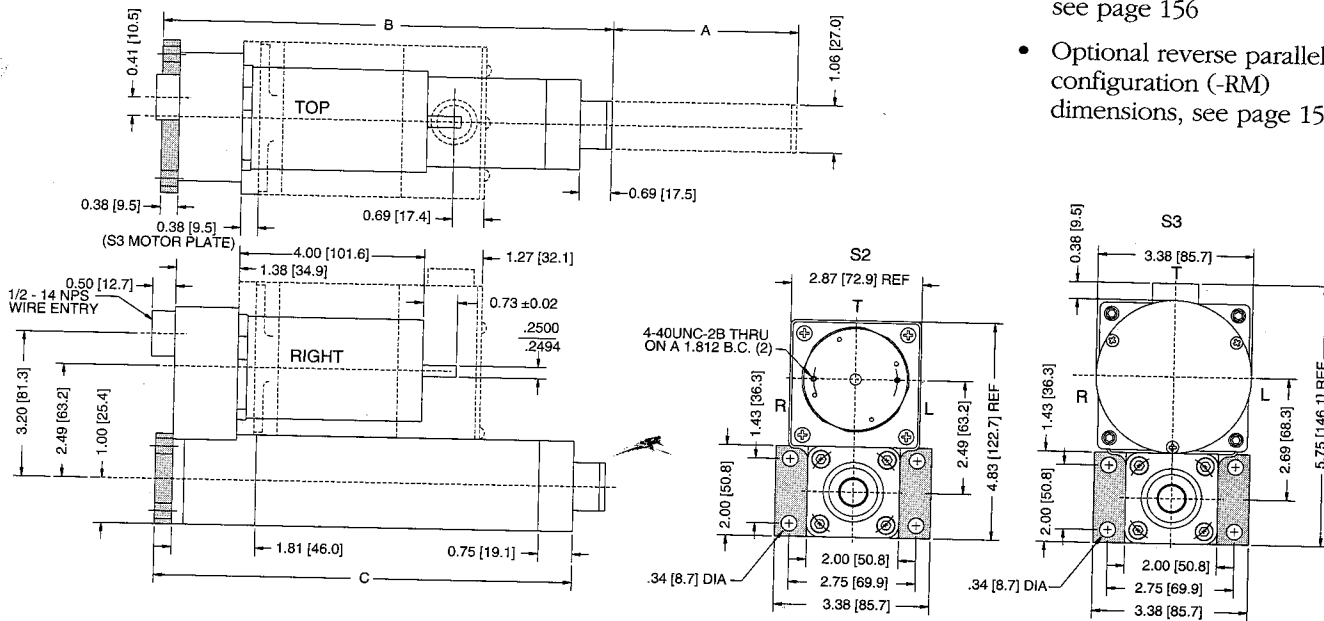


	Inches	(Metric)			
A Strokes	2.00	(50.8)	8.00	(203.2)	24.00 (609.6)
	4.00	(101.6)	12.00	(304.8)	
	6.00	(152.4)	18.00	(457.2)	
B Retract	stroke +	5.37	(136.4)		
C Mounting	stroke +	5.06	(128.5)		

NS SERIES CYLINDERS

MF2 CAP RECTANGULAR FLANGE MOUNTING

PARALLEL

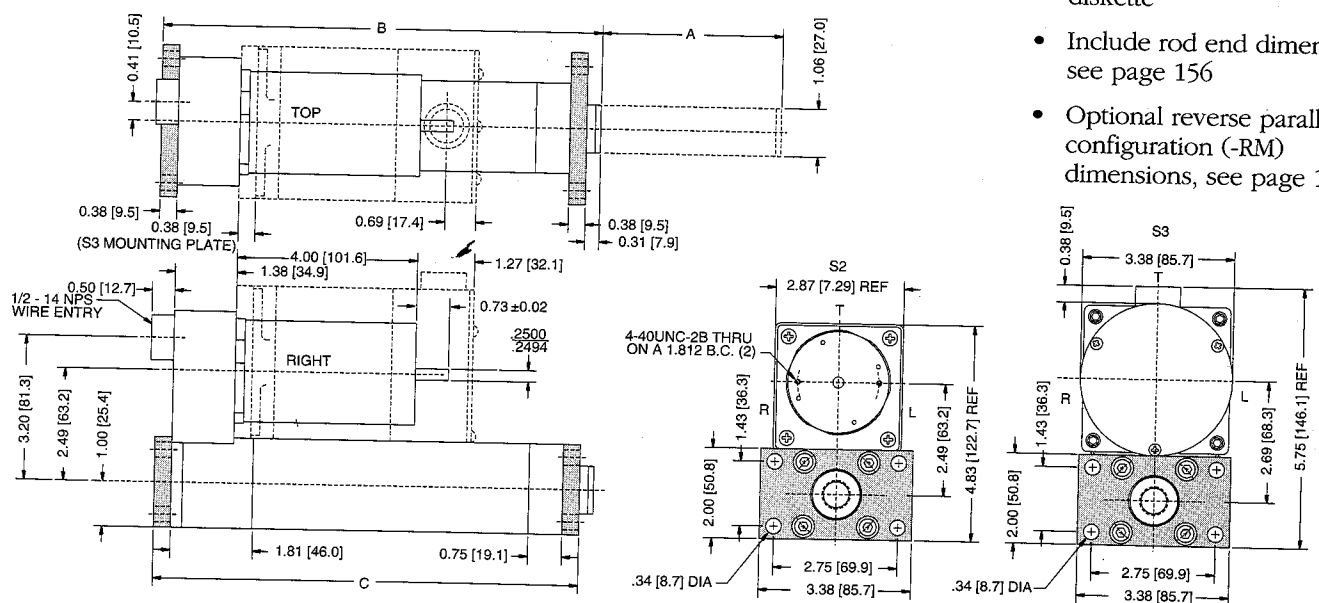


- CAD drawings available on diskette
- Include rod end dimensions, see page 156
- Optional reverse parallel configuration (-RM) dimensions, see page 156

	Inches	(Metric)			
A Strokes	2.00	(50.8)	8.00	(203.2)	24.00 (609.6)
	4.00	(101.6)	12.00	(304.8)	
	6.00	(152.4)	18.00	(457.2)	
B Retract	stroke +		5.75	(146.1)	
C Mounting	stroke +		5.06	(128.5)	

MF3 RECTANGULAR MOUNTING FLANGES

PARALLEL



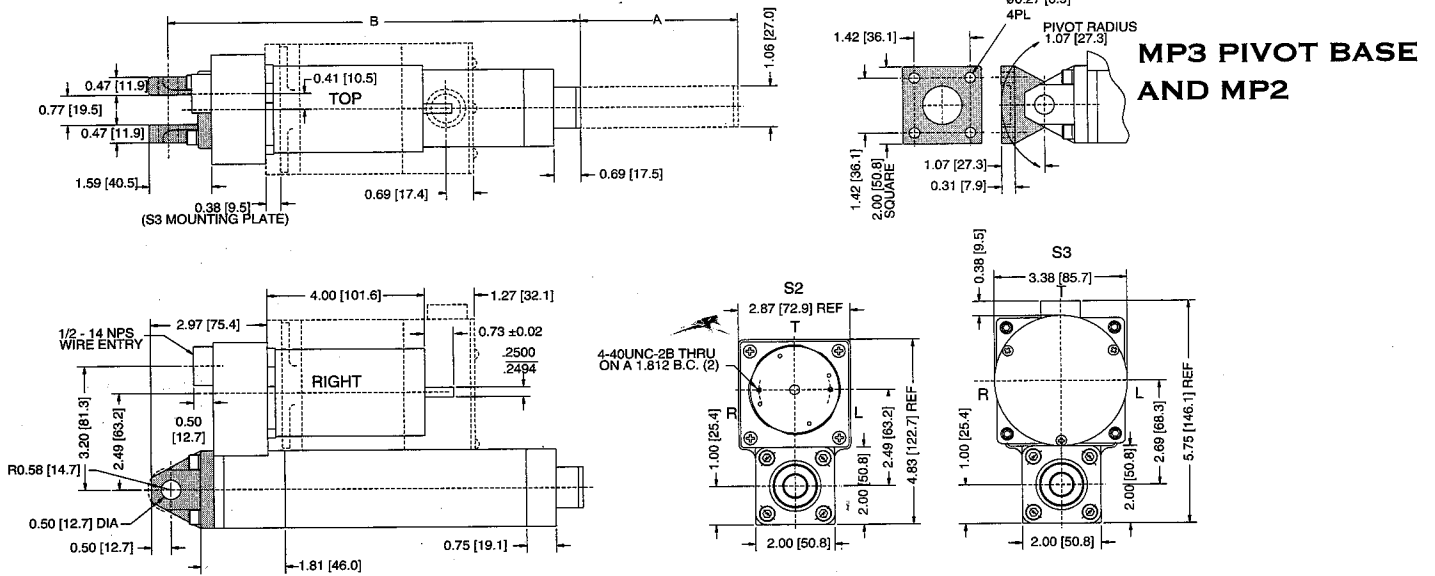
- CAD drawings available on diskette
- Include rod end dimensions, see page 156
- Optional reverse parallel configuration (-RM) dimensions, see page 156

	Inches	(Metric)			
A Strokes	2.00	(50.8)	8.00	(203.2)	24.00 (609.6)
	4.00	(101.6)	12.00	(304.8)	
	6.00	(152.4)	18.00	(457.2)	
B Retract	stroke +		5.75	(146.1)	
C Mounting	stroke +		5.44	(138.2)	

MP2 CAP DOUBLE CLEVIS MOUNTING

PARALLEL

- CAD drawings available on diskette
- Include rod end dimensions, see page 156
- Optional reverse parallel configuration (-RM) dimensions, see page 156

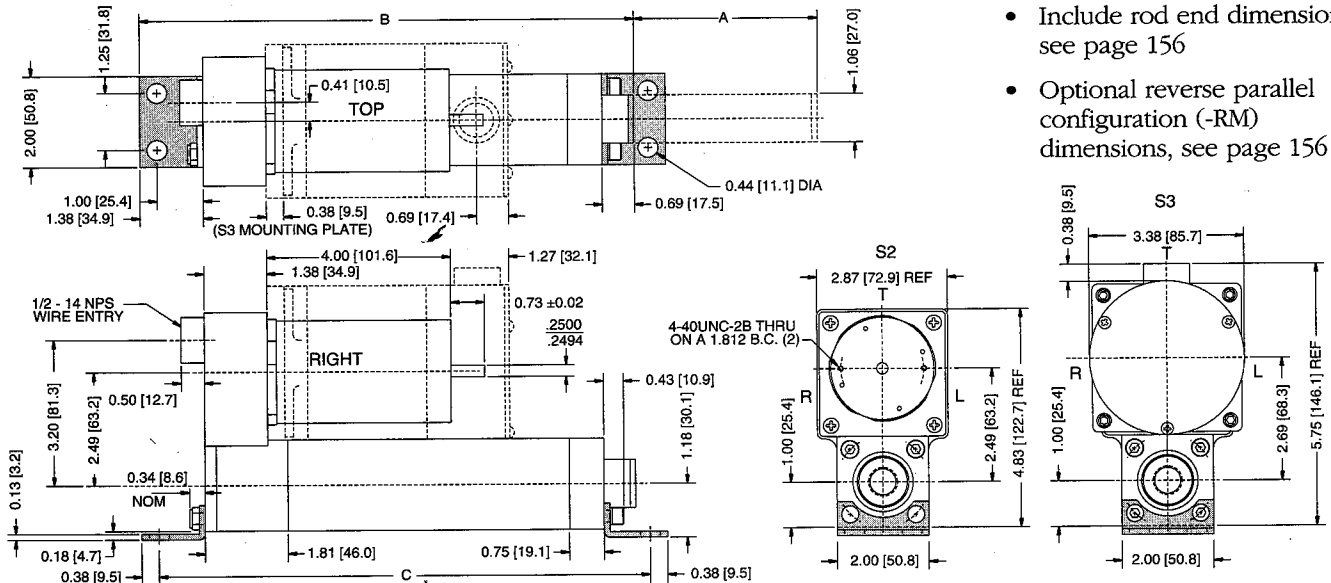


	Inches	(Metric)				
A Strokes	2.00	(50.8)	8.00	(203.2)	B Retract	stroke + 6.47 (164.3)
	4.00	(101.6)	12.00	(304.8)		
	6.00	(152.4)	18.00	(457.2)		

MS1 SIDE END ANGLES MOUNTING

PARALLEL

- CAD drawings available on diskette
- Include rod end dimensions, see page 156
- Optional reverse parallel configuration (-RM) dimensions, see page 156



	Inches	(Metric)					
A Strokes	2.00	(50.8)	8.00	(203.2)	B Retract	stroke + 6.75 (171.5)	
	4.00	(101.6)	12.00	(304.8)		C Mounting	stroke + 6.69 (169.9)
	6.00	(152.4)	18.00	(457.2)			

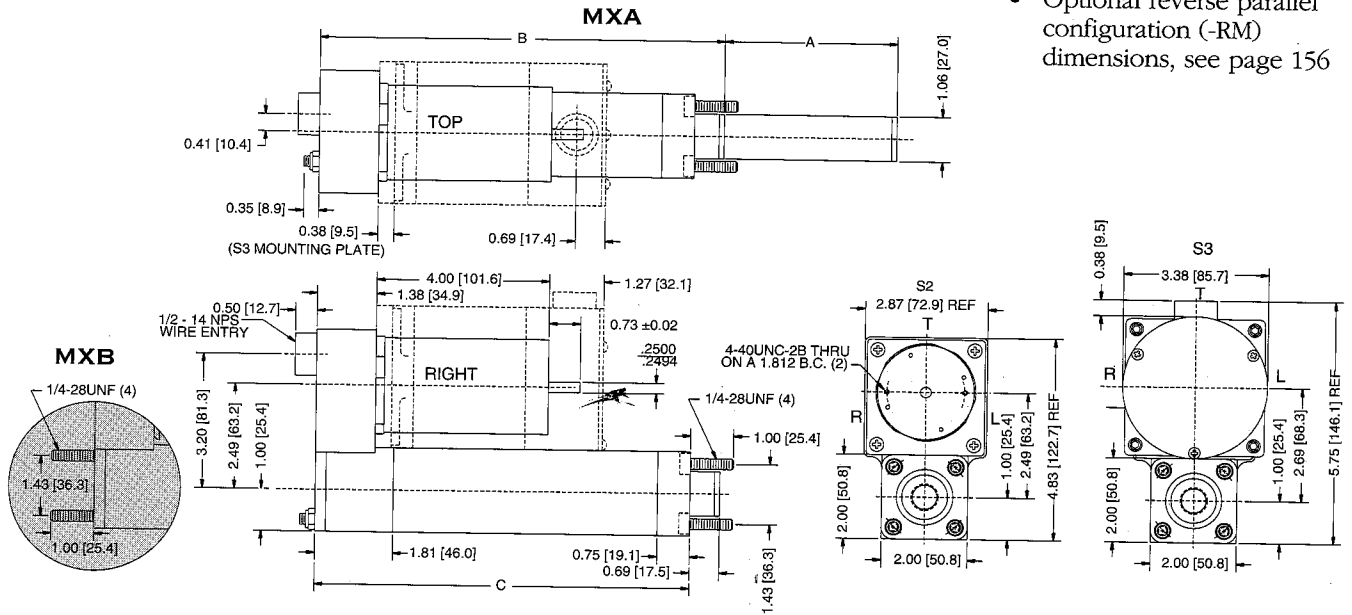
NS SERIES CYLINDERS

MX EXTENDED TIE ROD MOUNTING

PARALLEL

MXA tie rods on rod end;
 MXB tie rods extend on motor end;
 MXC tie rods extend on both ends

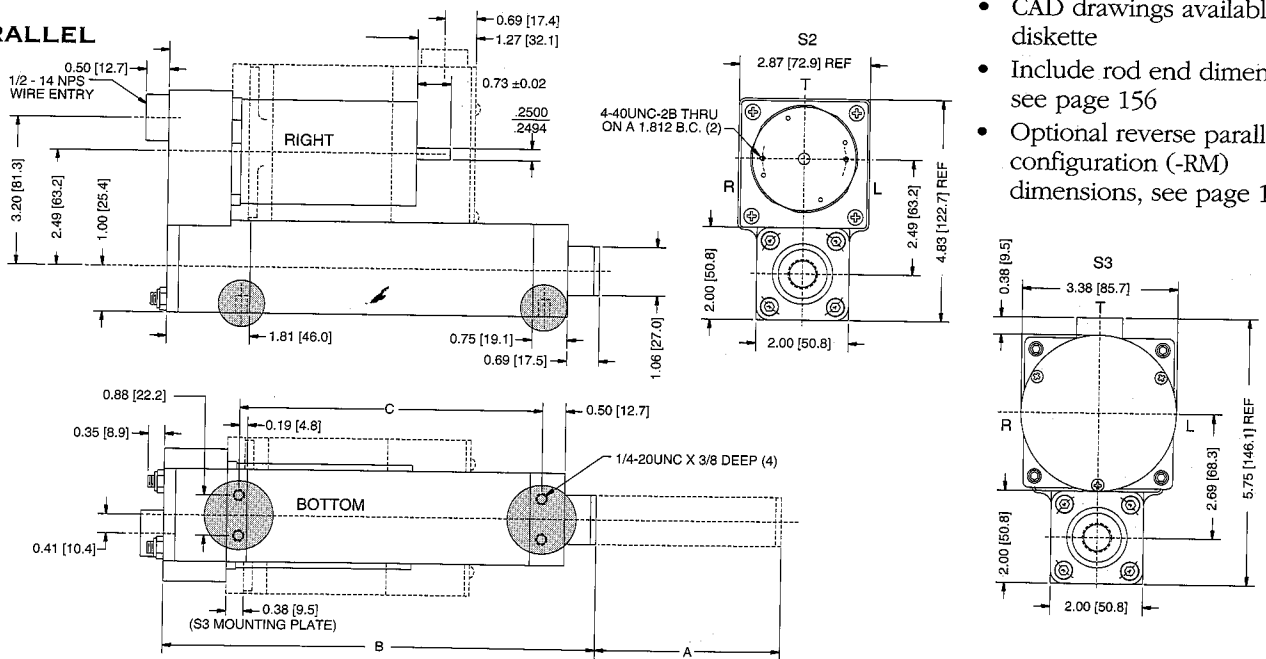
- CAD drawings available on diskette
- Include rod end dimensions, see page 156
- Optional reverse parallel configuration (-RM) dimensions, see page 156



	Inches	(Metric)			
A Strokes	2.00	(50.8)	8.00	(203.2)	24.00 (609.6)
	4.00	(101.6)	12.00	(304.8)	
	6.00	(152.4)	18.00	(457.2)	
B Retract	stroke +	5.37	(136.4)		
C Mounting	stroke +	4.69	(119.1)		

MS6 SIDE TAPPED MOUNTING

PARALLEL

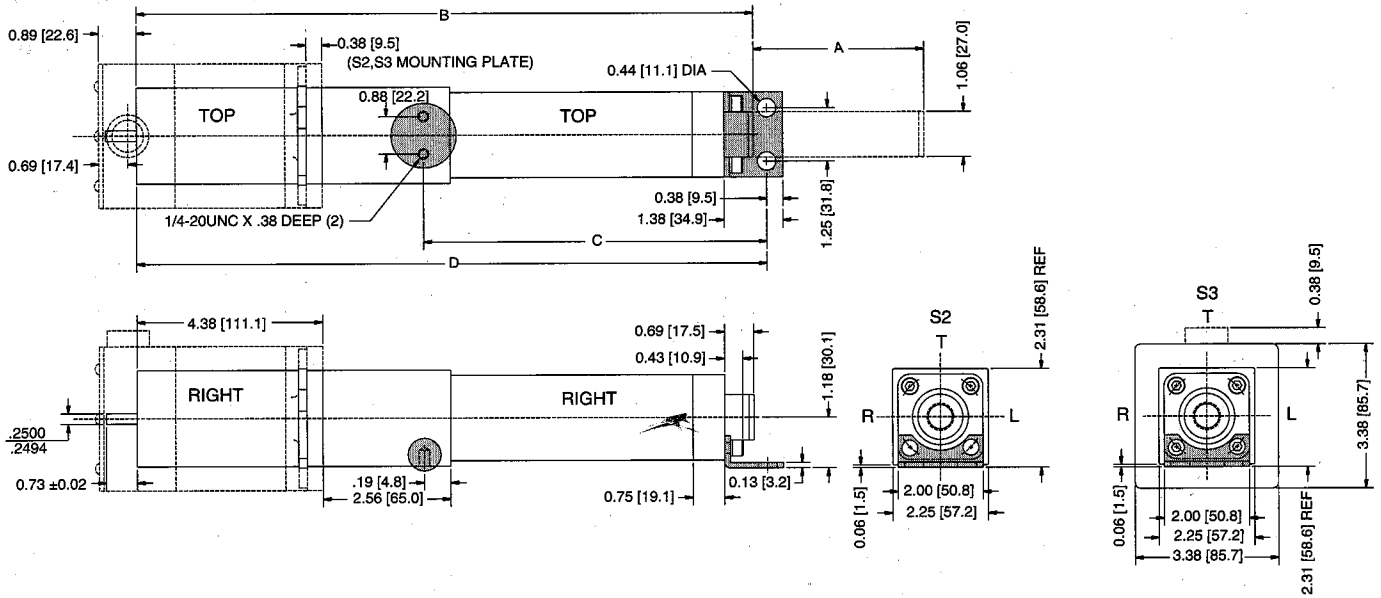


	Inches	(Metric)			
A Strokes	2.00	(50.8)	8.00	(203.2)	24.00 (609.6)
	4.00	(101.6)	12.00	(304.8)	
	6.00	(152.4)	18.00	(457.2)	
B Retract	stroke +	5.37	(136.4)		
C Mounting	stroke +	2.56	(65.0)		

MS1 SIDE END ANGLES MOUNTING

INLINE

- CAD drawings are available on diskette
- Include rod end dimensions, see page 156

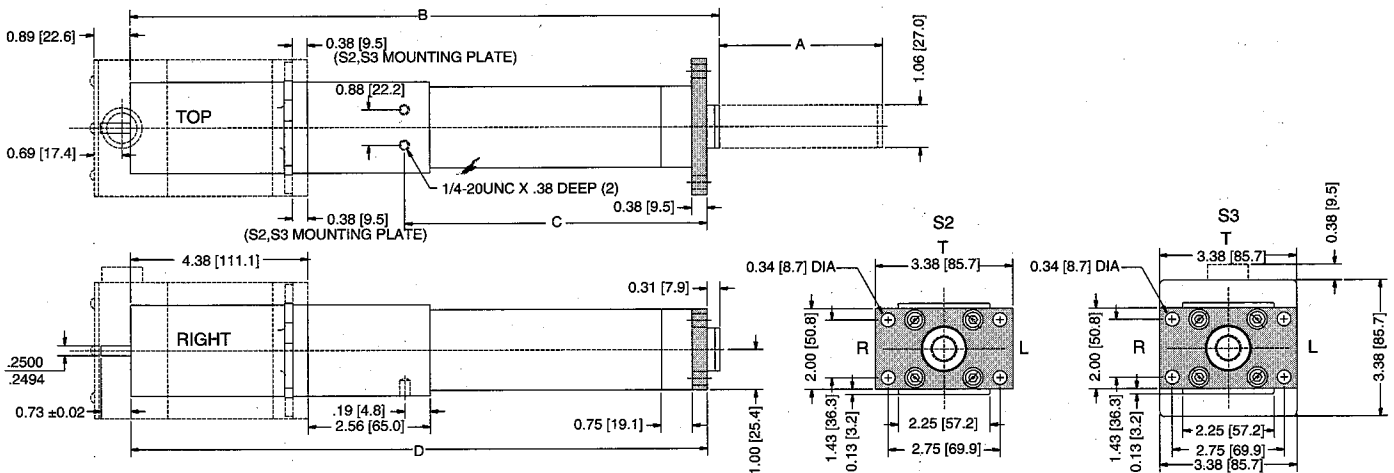


	Inches	(Metric)				
A Strokes	2.00	(50.8)	8.00	(203.2)	24.00	(609.6)
	4.00	(101.6)	12.00	(304.8)		
	6.00	(152.4)	18.00	(457.2)		
B Retract	stroke + 10.50				(266.7)	
C Mounting	stroke + 4.06				(103.1)	
D Overall	stroke + 10.81				(274.6)	

MF1 HEAD RECTANGULAR FLANGE

INLINE

- CAD drawings are available on diskette
- Include rod end dimensions, see page 156



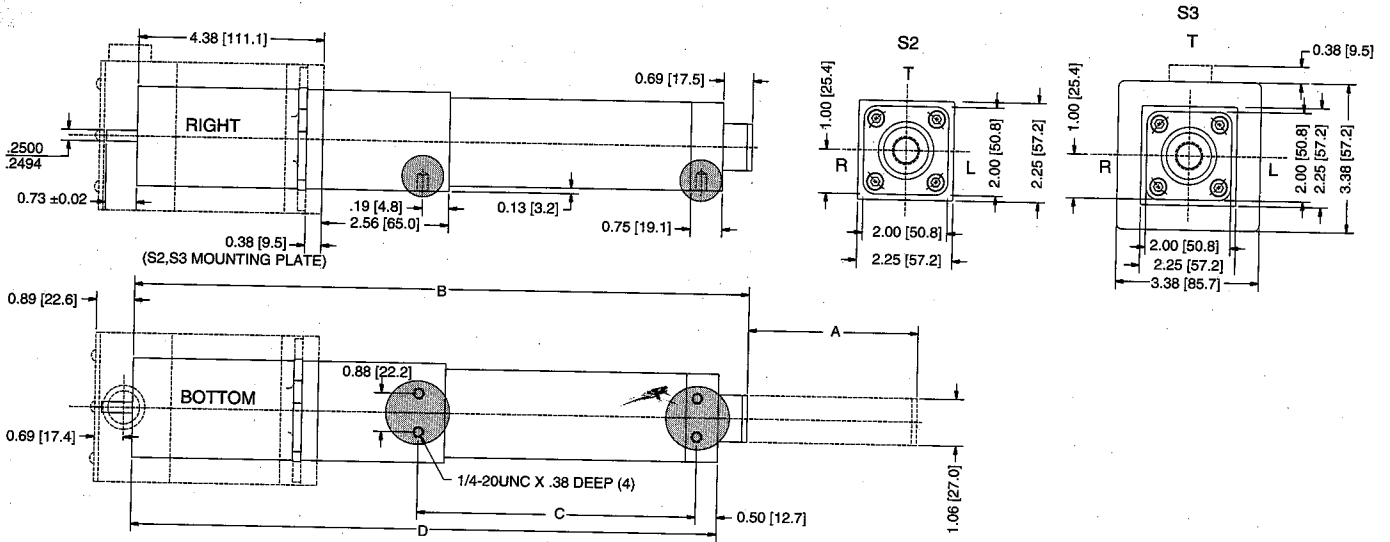
	Inches	(Metric)				
A Strokes	2.00	(50.8)	8.00	(203.2)	24.00	(609.6)
	4.00	(101.6)	12.00	(304.8)		
	6.00	(152.4)	18.00	(457.2)		
B Retract	stroke + 10.50				(266.7)	
C Mounting	stroke + 3.44				(87.4)	
D Overall	stroke + 10.19				(258.8)	

NS SERIES CYLINDERS

MS6 SIDE TAPPED MOUNTING

INLINE

- CAD drawings are available on diskette
- Include rod end dimensions; see page 156

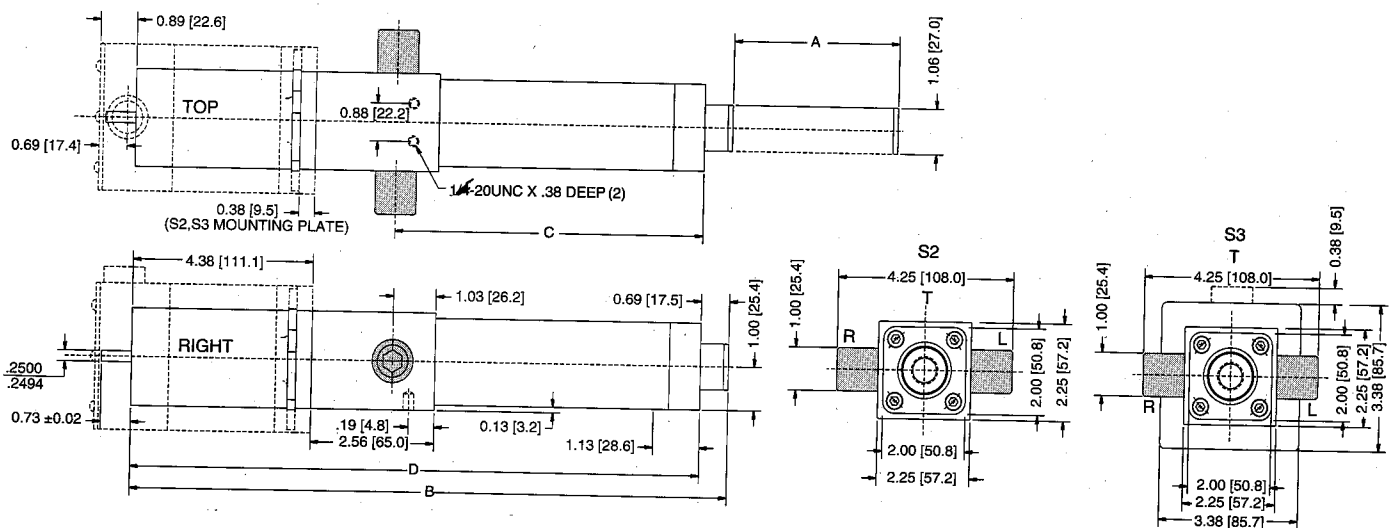


	Inches	(Metric)				
A Strokes	2.00	(50.8)	8.00	(203.2)	24.00	(609.6)
	4.00	(101.6)	12.00	(304.8)		
	6.00	(152.4)	18.00	(457.2)		
B Retract	stroke + 10.50		(266.7)			
C Mounting	stroke + 2.56		(65.0)			
D Overall	stroke + 9.81		(249.2)			

MT2 TRUNNION MOUNTING

INLINE

- CAD drawings are available on diskette
- Include rod end dimensions, see page 156



	Inches	(Metric)				
A Strokes	2.00	(50.8)	8.00	(203.2)	24.00	(609.6)
	4.00	(101.6)	12.00	(304.8)		
	6.00	(152.4)	18.00	(457.2)		
B Retract	stroke + 10.50		(266.7)			
C Mounting	stroke + 3.47		(88.1)			
D Overall	stroke + 9.81		(249.2)			