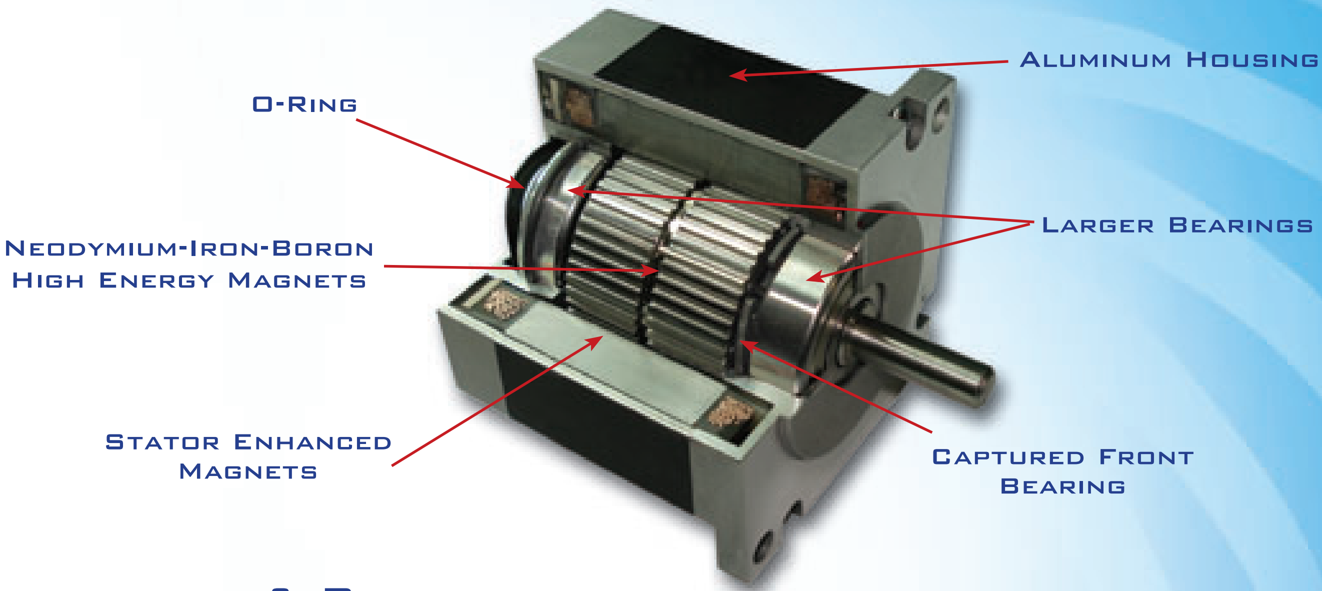
h3 HYBRID STEPPER MOTORS

If you're looking for higher performance in a smaller package, this is it. The h3 provides a torque output increase while reducing the package size and weight within your application. Higher duty cycles can be achieved through superior heat dissipation, made possible by the unique aluminum housing design of the motor. Learn more about our One Giant Leap In Stepper Technology.

Portescap
A Danaher Motion Company

Why an High-Torque Housed Hybrid Stepper Motor



Innovation & Performance

The Stepper (High-Torque Housed Hybrid) innovates the traditional hybrid stepper motor by offering several unique design enhancements that expand the possibilities of the motor's applications. motors incorporate innovative cooling technology (patent pending), high torque magnetic design, rugged and captured bearings, and optimized torque density through enhancing magnets.

The Portescap engineering team provides quick prototype delivery and optimization of windings based on application requirements. Higher-level customization is also available to reduce customer assembly time and inventory levels. Thanks to the combination of features on the Stepper, it's able to provide best in class performance.

Portescap can customize the Stepper to provide an easier manufacturing process, with options including shaft modifications, windings, connectors, shaft adders (gear/pinions), and encoders. Let Portescap work with your design engineers to create the ideal motion solution for your application needs.

- **Higher Torque**
  Neodymium-Iron-Boron High Energy Magnets → Optimized torque density
- **Cooler**
  Aluminum Housing → Superior heat dissipation for improved torque output, allowing heat to be distributed along the length of the motor
- **Quieter**
  O-Ring → Prevents bearing spinout and decreases motor noise by minimizing contact between bearing and end bell
- **Enhanced Torque**
  Stator Enhanced Magnets → Deliver up to 40% more torque in the same package through optimized torque density
- **Mechanical Stability**
  Captured Front Bearing → Minimized motor noise, prevents spinout and eliminates shaft axial play from bearing axial movement

Standard Features

- **Holding torque**
  NEMA 17 up to 73 oz-in/0.51 N-m
  NEMA 23 up to 524 oz-in/3.7 N-m
  NEMA 34 up to 1,613 oz-in/11.39 N-m
- **UL and CE agency certified**
- **RoHS Compliant**

Your Custom Motor

- **Available in sizes NEMA 17, 23 and 34**
- **Unipolar and bipolar windings available**
- **Various stack lengths available in each frame size**
- **Shaft modifications, including hollow shafts**
- **Lead length modifications and connectors**
- **Encoders**

How to select your motor

PRODUCT RANGE CHART	NEMA 17		NEMA 23		NEMA 34	
	Standard	Enhanced	Standard	Enhanced	Standard	Enhanced
Short Stack	✓		✓	✓		
1 Stack	✓		✓	✓	✓	✓
2 Stack	✓		✓	✓	✓	✓
3 Stack			✓	✓	✓	✓
Short Stack Linear Actuator	✓		✓	✓		
1 Stack Linear Actuator			✓	✓		
2 Stack Linear Actuator	✓					
3 Stack Linear Actuator						

Motor Designation

17 H 0 18 D 10 B

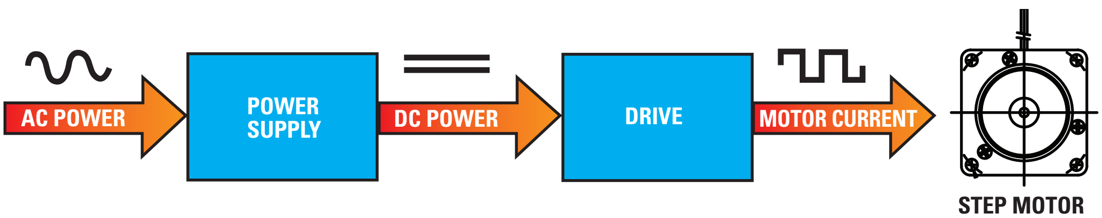
- 17 — Frame size
- H — H = Hybrid Stepper Motor
- 0 — Motor Lengths (see drawing)
  0 = Short Stack
  1 = 1 Stack
  2 = 2 Stack
  3 = 3 Stack
- 18 — 18 = 1.8˚ Per Step With 2 Phases Energized
- D — D = Neodymium Rotor Magnet
  E = Enhanced
- 10 — Rated Current Per Phase
  05 = .5 A, 10 = 1.0 A, 15 = 1.5 A,
  20 = 2.0 A 30 = 3.0 A, 50 = 5.0 A
- B — B = Bipolar Coil
  U = Unipolar Coil

Basic Stepper Motor Operation

series step motors have two windings (two phases) that are energized with DC current. When the current in one winding is reversed, the motor shaft moves one step, or 1.8°. By reversing the current in each winding, the position and speed of the motor is easily and precisely controlled, making these motors extremely useful for many different motion control applications.

For even finer resolution and smoother operation, micro-stepping drives divide each step into many increments by controlling the magnitude of the current in each winding.

The performance of hybrid step motors is highly dependent on the current and voltage supplied by a drive. Stepper motors are available with a variety of windings so they can be used with drives that have a broad range of voltage and current ratings. Performance curves are included in this catalog for many common motor drive combinations.



Holding Torque

Because motor performance at speed varies greatly with the drive, holding torque is used to rate hybrid step motors. Holding torque specifies the maximum torque that can be applied to a motor shaft and not cause the shaft to rotate. It is measured with the motor at standstill and energized with rated DC current. Since the motor is energized with pure DC current, holding torque is not dependent on specific drive characteristics.

Enhancing Technology

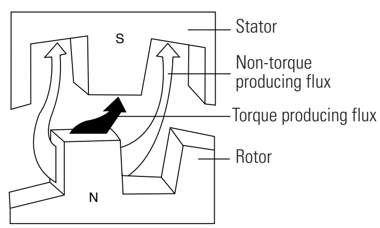
- Smaller drives = Lower system cost
- More torque = Smaller, faster machines
- Higher efficiency = Lower operating costs

Through the use of enhancing technology, Stepper motors provide the maximum performance available. This patent pending technology boosts torque up to 40% across the operating speed range and allows machines to be designed that are smaller and move faster.

Initial system costs are often less with enhanced motors because the additional torque is produced without the need for larger drives or power supplies. The additional output power is produced through higher efficiency. The higher efficiency reduces energy usage by 25% and lowers operating costs.

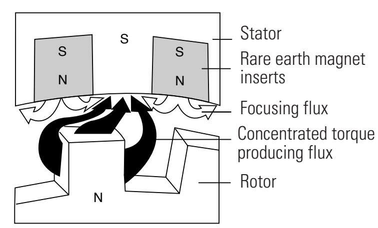
Enhanced motors use additional magnets inserted between each stator tooth. These magnets block the magnet fields from flowing around the stator teeth. This forces more of the magnetic field to flow through each tooth where it produces torque.

Standard Stepper Motor



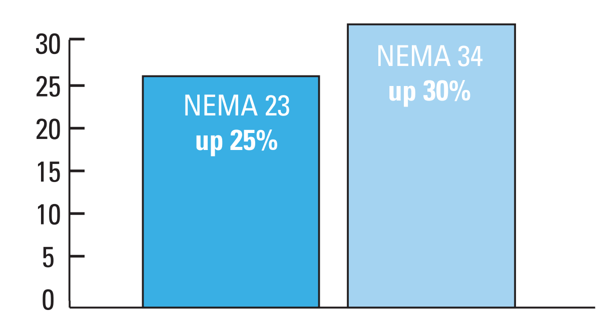
Typical paths of flux transfer in an energized conventional hybrid step motor. Some flux leakage occurs in normal operation.

Enhanced Stepper Motor



Patented enhancing technology redirects magnetic flux to inhibit leakage and optimize torque production.

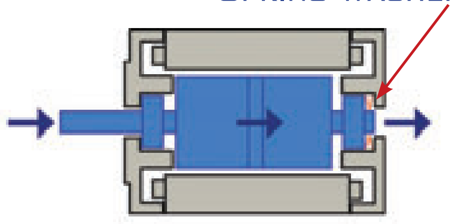
Torque Enhancement Percentages



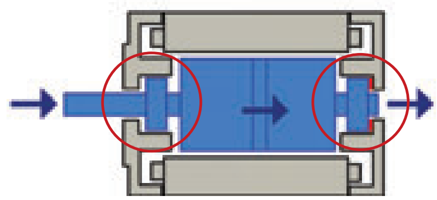
Basic Stepper Motor Operation

- Typical hybrid stepper motors are constructed with a spring washer that pushes on the ball bearings (preloads the bearings). This is done to reduce bearing noise, increase bearing life, and keep the rotor in position.

Spring Washer

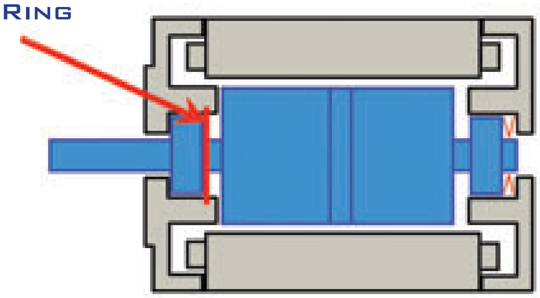


- If the front bearing is not retained, limited axial force can be applied to the front shaft and not cause the rotor to move in the motor.
- As the axial load force becomes greater than the spring washer force, the rotor moves in the stator. This causes whatever is attached to the motor shaft to also shift position.
- This can cause a number of problems. For example, if a leadscrew is attached to the motor shaft the linear load will not be in position.



- To prevent this unwanted shaft movement, all size 23 & size 34 hs series motors are provided with a snap ring behind the front bearing that locks the bearing in place even under very heavy axial loads. This snap ring, combined with the oversized bearings used in the hs series, is a great feature.

Snap Ring



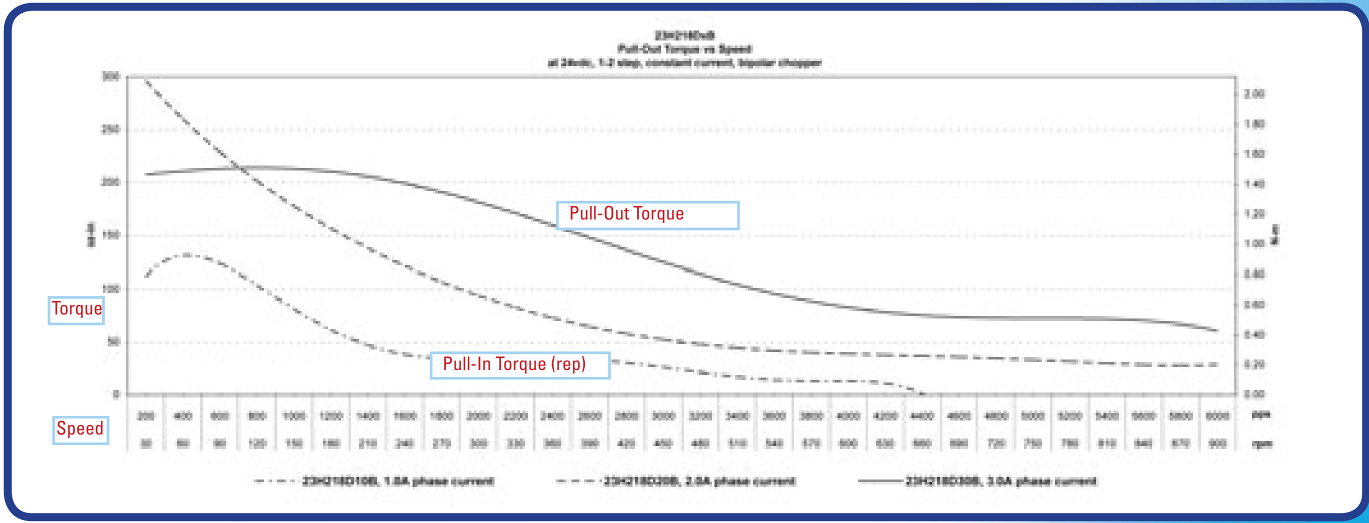
- hs series construction are ideal for leadscrew applications because it often allows the customer to eliminate separate leadscrew thrust bearings and support structures.

- This construction is also very beneficial when the motors are used with encoders. The captured bearing prevents shaft movement that causes the encoder disc to rub and fail.

Explanation of Specifications

MOTOR PART NUMBER			23HX18D10B	EXPLANATION
RESISTANCE PER PHASE, ± 10%	ohms		5.70	Winding resistance dictated by magnet wire diameter and # of turns
INDUCTANCE PER PHASE, TYP	mH		11.15	Winding inductance dictated by magnet wire diameter and # of turns
RATED CURRENT PER PHASE *	amps		1.0	Current rating of motor – motor can be run continuously at this current
HOLDING TORQUE, MIN *	oz-in / N-m		75 / 0.53	When energized, the amount of torque to move from one mechanical step to the next
DETENT TORQUE, MAX	oz-in / N-m		6.0 / 0.042	When un-energized, the amount of torque to move from one mechanical step to the next
THERMAL RESISTANCE	o C/watt		3.99	
ROTOR MOMENT OF INERTIA	oz-in-s2/ kg-cm2		.0026 /0.19	Inertia of the rotor
STEP ANGLE, ± 5% *	degrees		1.80	360 deg / number of mechanical steps of the motor
STEPS PER REVOLUTION *	-		200.00	Number of mechanical steps of the motor
AMBIENT TEMPERATURE RANGE				
OPERATING	o C		-20 ~ +40	Temperature range which the motor will operate
STORAGE			-40 ~ +85	Storage temperature where the motor will operate
BEARING TYPE	-		BALL BEARING	Dual ball bearings
INSULATION RESISTANCE AT 500VDC	Mohms		100 MEGOHMS	
DIELECTRIC WITHSTANDING VOLTAGE	vac		1800 FOR 1 SECOND	
WEIGHT	lbs / kg		1.0 / 0.45	Weight of the motor
SHAFT LOAD RATINGS, MAX	lbs / kg	RADIAL	20 / 9 (AT SHAFT CENTER)	Maximum load that can be applied against the shaft
		AXIAL	50 / 23 (BOTH DIRECTIONS)	Maximum load that can be applied directly down the shaft
LEADWIRES	-		AWG 22, UL 3266	Rating of the lead wires
TEMPERATURE CLASS, MAX	-		B (130°C)	Maximum temperature of the winding insulation
RoHS	-		COMPLIANT	

23H218DxB • Pull-Out Torque vs Speed
at 24vdc, 1-2 step, constant current, bipolar chopper



Definitions

Pull-Out Torque The amount of torque that the motor can produce at speed without stalling

Pull-In Torque The amount of torque that the motor can produce from zero speed without stalling

Speed # of pulses per second provided to the motor, also stated in revolutions per minute

Voltage Voltage applied to the drive

Current Current applied to the drive

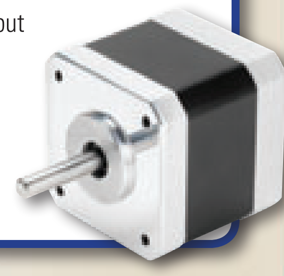
Drive Chopper type drive - current controlled to the motor winding

Where to apply your hs stepper

The hs Stepper (High-Torque Housed Hybrid) is designed to meet the broad spectrum of stepper motor applications in various markets:

Focus on: MEDICAL PUMP

The requirement of the application was to operate smoothly, without resonance, over the entire speed range (1 to 1,000 RPM). A hybrid stepper running roughly would cause the incorrect amount of medicine to be dispensed. Many hybrids were tested, but the hs Stepper provided smooth operation over the entire speed range, a minimal resonance band and higher output torque. Now the medicine dispensing speed can be varied as designed, without need to compensate for motor roughness.



MEDICAL & LAB AUTOMATION

- Peristaltic & syringe pumps
- Analyzers
- Optical scanners
- Pharmacy dispensing machines
- Dental imaging
- Fluid handling & movement systems

TEXTILE

- Yarn monitoring system
- Carpet tufting pattern machine
- Rotor or ring spinning
- Electronic wire winding
- XY garment cutting table

FACTORY AUTOMATION

- Semiconductor equipment
- Electronic assembly
- Packaging equipment
- Conveyors

TELECOMMUNICATION

- Cell phone masts
- GPS
- Antenna positioning
- Radar array

OTHER

- Printer & copier automation
- Ticketing
- Office automation
- Electronic assembly
- Engraving