



WELCO



PRECISION MOTOR SOLUTIONS

Vari-Hertz® PERMANENT MAGNET AC SYNCHRONOUS MOTORS OFFER MANY MONEY-SAVING ADVANTAGES

Patented Vari-Hertz permanent magnet ac synchronous motors eliminate the requirement for external feedback devices yet maintains perfect speed control.

Vari-Hertz Motors Save Money Through:

- Reduced energy consumption
- Lower current consumption
- Reduced PWM drive size
- Lower capital expenditures
- Elimination of costly peripherals such as gears, pulleys and speed feedback devices
- Reduced downtime

Superior Engineering Means High Performance:

- Welco's standard motor can be operated at constant torque up to 200Hz; this means our 3hp motor nominally rated for 1800rpm can run at 10hp at 6,000rpm, and still meet the class B temperature rise

Vari-Hertz Motors Give You The Technical Advantage:

- When precise preset speed control must be attained even though voltage, temperature, and load fluctuate constantly

- When two or more units of operating equipment must be synchronized
- For fiber, glass, food and paper processing industries
- On precision applications in fiber processing, transfer machine tools, wire drawing, printing processes and packaging and folding machines
- For open-loop speed regulation with similar results as closed-loop control

Higher Reliability Through:

- Cast iron frames
- Inverter duty insulation
- Class B temperature rise with Class H insulation



Vari-Hertz Is The Solution For Fiber Processing.

Vari-Hertz PM Synchronous Motors Are Cost-Competitive With Synchronous Reluctance Motors.

HIGHEST QUALITY MEDICAL X-RAY TUBE ANODE STATORS FOR THE LATEST IMAGING TECHNOLOGY

Welco has been a long-time leader in the design and manufacture of medical x-ray tube anode stators for medium- and high-power x-ray tubes and CAT scanners. The company supplies these parts to OEM tube manufacturers as well as after-market tube loading facilities. Welco medical x-ray tube anode stators are recognized throughout the industry for highly engineered materials, durable designs, custom mounting configurations, and the necessary high standards of cleanliness tailored to the needs of the medical x-ray tube market.

Engineered Materials And Durable Designs Extend Operational Life:

X-ray tube components frequently operate in hostile environments: bombarded with radiation, bathed in dielectric mineral oils, exposed to vacuum, cleaned in solvents and other aqueous solutions, as well as exposed to high-voltage electric current and voltage spikes. Welco stators are engineered to thrive in these hostile conditions.

Electrical insulating materials are selected for compatibility with solvents and oils, as well as durability under x-ray exposures. Stators are built to withstand the destructive mechanical forces inherent in x-ray and CAT scan operations.

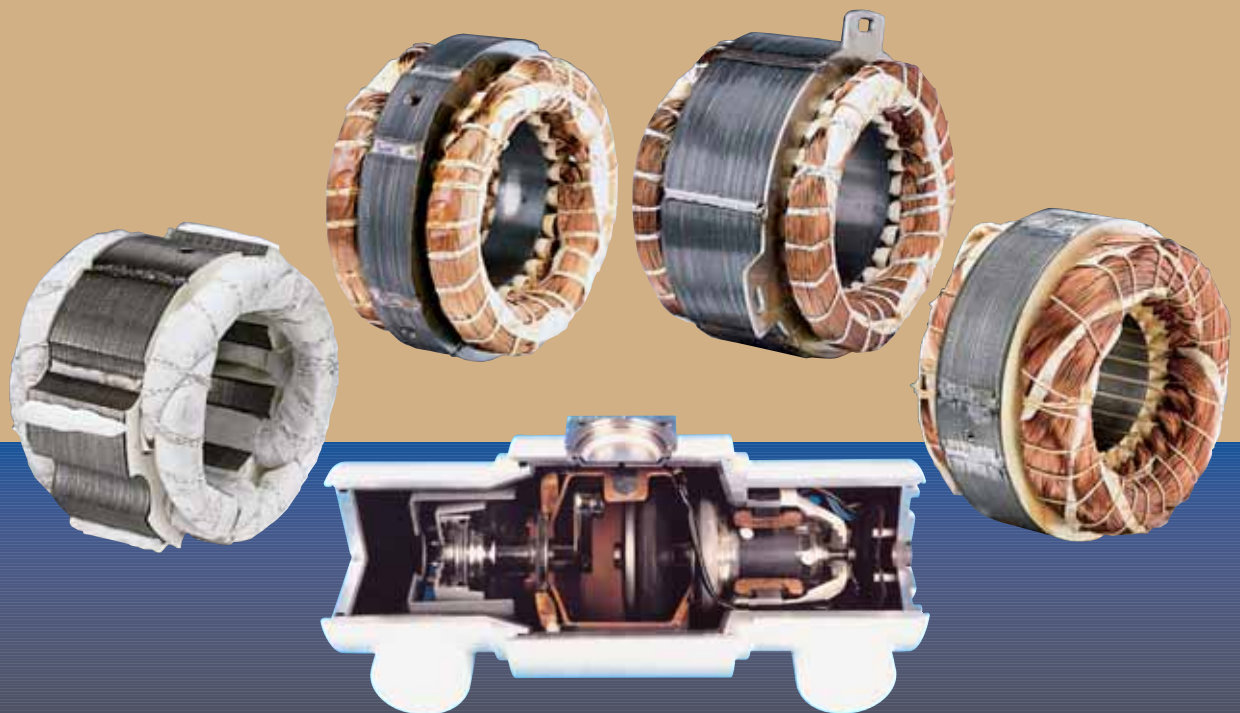
Custom Mounting Configurations Increase Flexibility In Use:

Welco constructs x-ray tube anode stators with a variety of mounting configurations, including setscrews, integral-mounting laminations,

welded mounting brackets and formed metal flanges. Welco stators are precision-engineered to withstand the lateral forces and vibration from constant stop-start cycles, as well as CAT scan rotational "G" forces.

High Standards Of Cleanliness Prevent Premature Failures:

By the very nature of their application, x-ray tube anode stators and rotors are exposed to very high-voltage electrical currents during operational cycling of the x-ray tube. Any foreign particles released by the tube components can provide a ground path for this current, which can and does lead to premature failure. Welco fully understands the cleanliness needs of the industry and builds components accordingly. Welco's high standards help prevent contamination through a combination of certain pre-washing operations, in-process cleaning, individual packaging and "white-glove" handling when required.



PATENTED Vari-Hertz AC SYNCHRONOUS MOTORS GIVE YOU BENEFIT-BASED FEATURES:

Higher Efficiency and Power Factor

These two performance characteristics provide multiple advantages. Energy requirements are reduced so basic utility costs are lower. With the 30 to 50% lower current; the wiring, switchgear, and inverter needs become smaller and less expensive.

Higher Energy Density

Use of rare earth magnets allows the PM motors to be smaller than reluctance motors, often saving a whole frame size. This reduces both weight and size. Rare earth magnets with a high coercive force are used to prevent the motors from demagnetizing in an over-voltage and/or over-temperature conditions.

Precise Open-loop Speed Control

Maintained without the expense of peripheral equipment such as tachometers, regulators or expensive closed-loop systems.

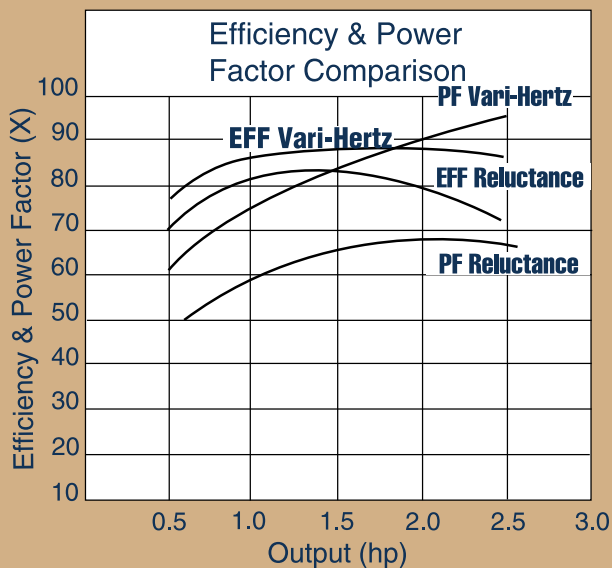
Stable Operation

Achieved over a wide frequency range. In many cases this eliminates the need for gears or belts and pulleys.

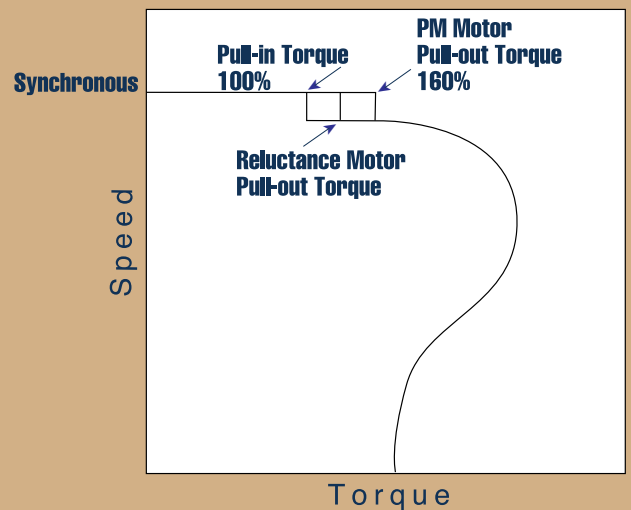
High Reliability/Longer Life

Vari-Hertz motors, as a standard, use Class H insulation (180°C). Because they are designed for Class B use (80°C temp. rise), you receive a better motor for your money.

Vari-Hertz PM Synchronous vs. Conventional Synchronous Reluctance Motor Based on 2hp, 60Hz, 1800rpm



Typical Speed/Torque Curve for Vari-Hertz and Synchronous Reluctance Motor



COMPARE THE Vari-Hertz PM MOTOR TO THE RELUCTANCE MOTOR AND SEE THE WELCO ADVANTAGE

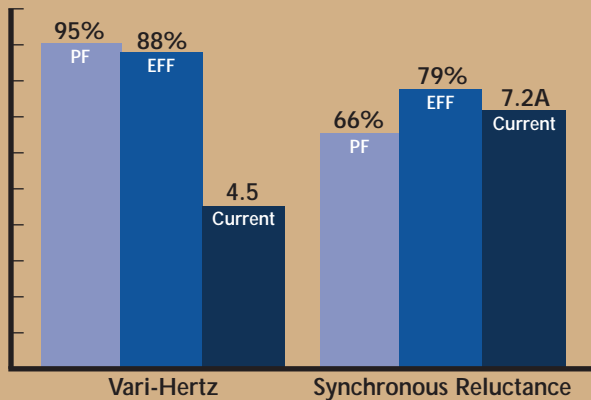
Example	Vari-Hertz	Reluctance	The Welco Advantage
HP at 230V 60Hz	2.0	2.0	-
Frame	145	182	-
Efficiency at Full Load	88%	79%	10%
Power Factor at Full Load	95%	66%	24%
Full Load Amps (FLA)	4.5	7.2	60%
KW Input = (.746 x hp)/EFF	1.695	1.889	10%
KVA Input = (1.732 x 230 x FLA)/1000	1.784	2.861	60%
Annual KW Cost	\$890.89	\$992.86	10%
Inverter Size (based on line start)	5hp	7.5hp	50%
Inverter Cost	\$1,315	\$1,785	36%
Savings based on 100 motors			
Annual KW Cost	\$89,089	\$99,285	(\$10,196)*
Initial Inverter Cost	\$131,500	\$178,500	(\$47,000)

*Other savings not accounted for, such as a reduction in number of air conditioners, wiring, maintenance, and operating cost could be more than \$100,000.

Vari-Hertz PM synchronous motors are cost-competitive with synchronous reluctance motors... and they are more efficient.

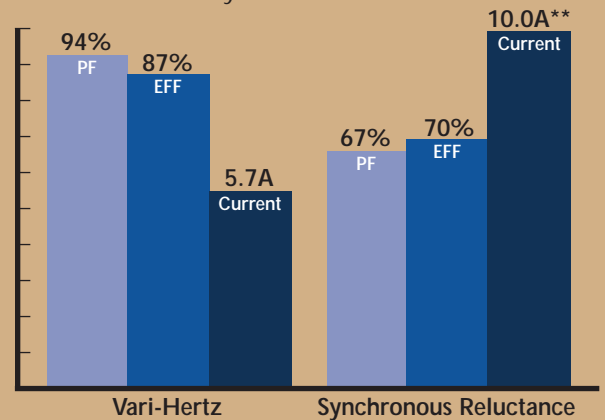
230 V 2hp Motor @ 100% Output

Vari-Hertz vs. Synchronous Reluctance Motor



230 V 2hp Motor @ 150% Output

Vari-Hertz vs. Synchronous Reluctance Motor



** Using a PWM Drive in constant hp mode would require the synchronous reluctance motor to move up to a 7.5hp drive due to the higher current requirements.

Typical performance data at 230 v, 3-phase, 60 Hz, 1800rpm (TEFC)

hp	Frame	Full Load EFF%	Full Load PF%	FLA	LRA	P.O.T.- % of FLT	P.I.T.- % of FLT @ JL/JR = 1.0
.25	143TC	83	88	0.6	5	240	100
.5	143TC	85	95	1.2	10	210	100
1.0	143TC	87	95	2.6	16	180	100
1.5	145TC	88	95	3.6	23	165	100
2.0	145TC	88	95	4.5	26	160	100
3.0***	145TC	89	87	7.3	45	143	100
5.0	184TC	91	95	10.8	64	150	100

*** Only Welco provides a 3shp motor in a 145 frame.

PUMP AND COMPRESSOR MOTORS TO MEET VIRTUALLY ANY DRIVING CONDITIONS

Welco's engineers can adapt and modify a diversity of motor designs and configurations to meet the designer's requirements for pumps and compressors with:

- High pole motor designs (up to 36 poles)
- High efficiency designs
- High power factor designs...

or other alterations to help reduce the motor-drive package size. Welco also offers integrated designs to reduce the overall size of the motor-pump package.



HIGH-PERFORMANCE PARTIAL AND COMPLETE MOTORS FOR PRECISION MACHINE TOOLS

Welco machine tool partial motors (stator and rotor sets) and complete motors require the highest levels of performance for driving this extremely high-accuracy metal cutting equipment.

If your business depends on routing machines, machining centers, high-speed grinders, CNC milling machines, or CNC lathes, depend on Welco. Welco will provide the latest technology for any high-speed spindle motor application, such as:

- Spindles
- Boring Machines
- Milling Machines
- Sanders
- Planers
- Cut-off Saws
- Shapers

CUSTOM-ENGINEERED MOTORS DESIGNED TO YOUR UNIQUE APPLICATIONS

Welco motors have been selected for a variety of applications including: aerospace, airborne and ground support equipment for the military, compressors, generators and cooling systems for specialty support systems.

- Welco specializes in high power density motor designs allowing a higher hp in a smaller package
- Only Welco provides a 3hp motor in a 145 frame
- Time-proven inverter duty insulation system
- Welco's superior insulation suppresses the effects of IGBT pwm motor drives for unprecedented life and reliability
- Special varnishes for corrosive atmospheres and harsh environments
- Vacuum pressure impregnation (VPI) of stators and rotors for superior protection
- Our engineers are waiting to tackle your application needs



WHATEVER YOUR NEEDS ARE, WELCO CAN PRODUCE A MOTOR TO MEET THEM

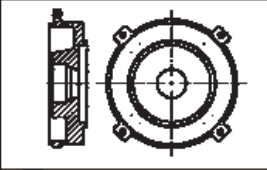
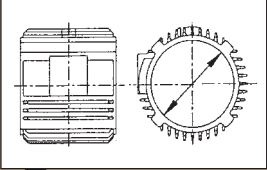
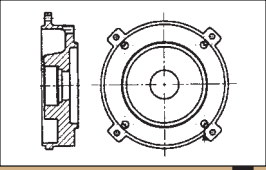
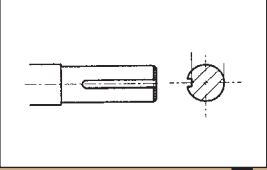
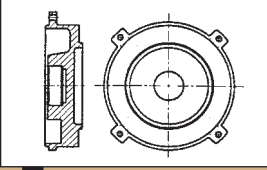
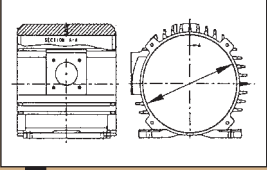
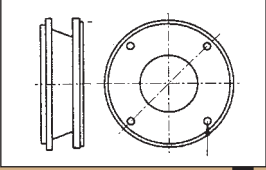
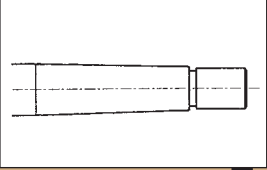
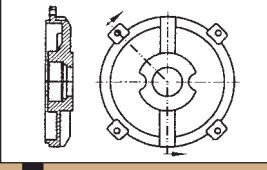
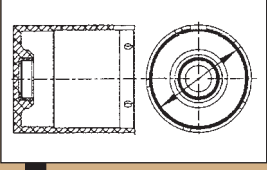
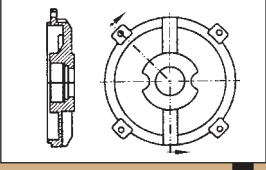
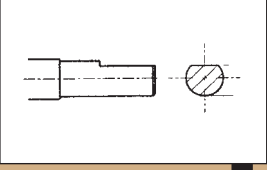
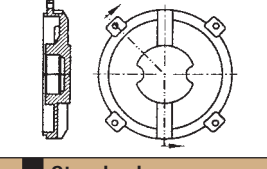
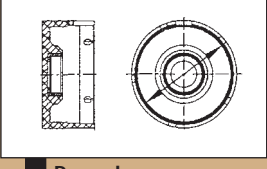
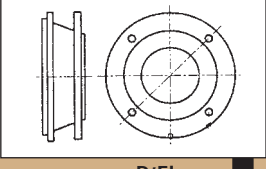
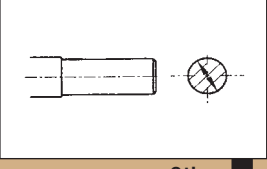
Welco has thousands of custom designs and can produce a custom-engineered motor to your EXACT requirements. This customization capability includes:

- TENV, TEFC and TEFV enclosures
- Water-jacketed enclosures
- More hp in a smaller frame
- Speeds up to 30,000rpm
- Sub-NEMA to 445-NEMA frames
- C-face, C-flange, D-flange and other custom mounting configurations

The Welco Advantage allows you to custom-engineer a motor to your precise application requirements. The table below is a small representation of what Welco can do for you.

Welco's motor selection guide allows you to design motors to fit your needs.

Simply choose the individual components you need.

Front Bracket	Frame Detail	Rear Bracket	Shaft Extension Detail
 C'Face <i>(Use with hood and fan)</i>	 Footless	 C'Face	 Keyed
 C'Face <i>(Use without hood and fan)</i>	 Foot Mounted	 Flanged C'Face	 Taper
 Standard <i>(Use with hood and fan)</i>	 Bucket	 Standard	 Flat
 Standard <i>(Use without hood and fan)</i>	 Pancake	 D'Flange	 Other



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