IEC vs. NEMA:

The fight has just begun

The world's dominant motor control standards are slugging it out, and you've got a ringside seat.

In one corner, there's the National Electrical Manufacturers' Association (NEMA) – the reigning U.S. champion. In the opposite corner stands the International Electrotechnical Commission (IEC) - the undisputed international champ, looking to expand its turf.

The fight is a contrast in styles. NEMA is the traditional fighter: large, powerful, and conservative. IEC, on the other hand, is lean and aggressive. It combines small size with speed and finesse.

Until now, no one has dared challenge the supremacy of NEMA in the U.S. For over half a century its members have single-handedly set the standards for U.S. electrical equipment.

But no champion can stay on top forever. Today makers of IEC-approved controls are going toe to toe with NEMA, locked in about for the American marketplace. Relying on their international experience, these IEC manufacturers are serious contenders for the U.S. motor control title.

But you be the Judge. Which motor controls - IEC or NEMA are the quickest, smartest, and toughest against hazards that knock motors out cold? Follow the action and score carefully. The lives of thousands of motors hang in the balance.

Q1

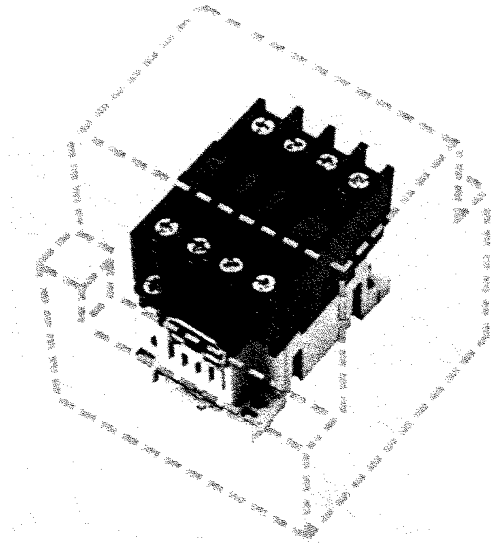
The brand of NEMA motor controls I'm using now does the job just fine. And I'm sure that other NEMA brands work equally well. Why should I switch to IEC controls?

A1

Smaller size and more precise ratings are just two reasons for switching to IEC motor controls. IEC devices are an average of 30 to 70 percent smaller than their NEMA counterparts. The size difference is most dramatic at or below 50 horsepower (HP), where 80 percent of the world's motors are rated.

There are two main factors responsible for this radical size difference. First, IEC devices use sophisticated arc quenching techniques to reduce excess heat on the contacts. NEMA devices rely on a greater mass to dissipate the heat, resulting in a larger physical size.

Sprecher+Schuh Contactor Series	Maximum HP @ 460 Volts	NEMA Contactor Sizes
CA3-9	5	00
	2	
CA3-12	7 ½	*
CA3-16	10	0
	5	
CA3-23A	10	*
CA3-23	15	1
	10	
CA3-30	20	*
CA3-37	25	*
CA3-43	30	2
	25	
CA3-60	40	*
CA3-72	50	*
CA1-55	60	3
	50	
CA1-60	75	*
CA1-100	100	4
CA1-150	150	*
CA1-250	200	5
CA1-480	350	*
CA1-630	500	6
	400	
CA1-800	700	7
CA1-1000	800	*
CA1-1250	900	8



Shown here is a Sprecher + Schuh CA3-16 contactor. The dotted line shows the dimensions of an equivalently rated NEMA device.

Second, IEC devices are more precisely rated than NEMA controls.

Look down the side-by-side ratings table shown here and see for yourself. There are only 10 basic NEMA contactor sizes for motors ranging from 2 to 900 HP IEC manufacturers, however, offer a much greater contactor selection. For instance, Sprecher + Schuh as 20 contactor sizes to cover this same power range.

The fact is NEMA contactors are often overrated for their actual motor application. Typically the mismatch goes unnoticed, since the NEMA devices appear to be doing the job.

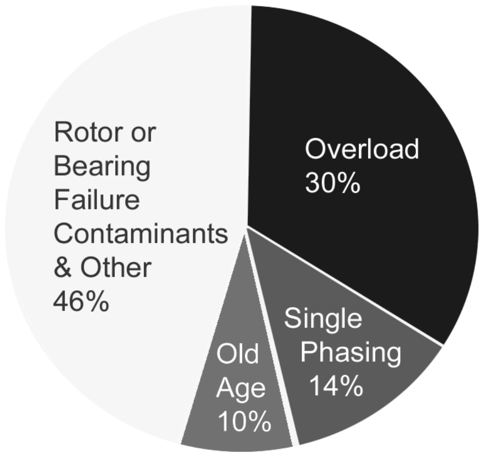
What's overlooked, though, is the fact NEMA controls routinely operate at far below their capacity. This discrepancy costs users both money and control panel space.

Q2

What are the leading causes of motor failure?

A2

Recently the Electrical Research Association studied more than 9,000 damaged motors. From this sample, the group was able to identify the leading causes of motor failure. These causes are shown in pro-portion on the pie chart:



The leading causes of motor failure, as determined by the Electrical Research Association.

Notice only 10 percent of the motors studied died as a result of old age. An astounding 44 percent of the failures can be directly attributed to thermal overload or single-phase conditions. IEC technology directly addresses these issues. IEC overload relays shut down motors twice as fast as standard NEMA controls. Plus, IEC devices detect single-phase conditions and quickly shut down your motors in the event of this hazard.

Q3

In terms of motor control, what's the basic difference between T-frame and U-frame motors?

A3

Today's T-Frame motors are smaller and less expensive than older U-Frame models. However, T-Frame motors also have a lower tolerance for thermal overload since they're built with less copper and steel. Consequently, the overload relays used on T-Frame motors must have a faster response time than those used on U-Frames.

Applying that added protection is a must if you want to get the most life from these new motors. Most manufacturers rate the life expectancy of a T-Frame motor at 25 years. However, they will also tell you that each occurrence of a ten degree centigrade increase above the motor's insulation rating will cut that motor's life in half.

NEMA controls were designed for use with U-frame motors and have simply been adapted to T-frame motors. IEC controls are engineered specifically for use with today's advanced motors, but can also be used with the older U-frames.

Q4

How quickly do IEC overload relays trip under hazardous conditions? What about nuisance tripping?

A4

IEC overload relays are all Class 10 devices. They will trip in 10 seconds or less under a locked rotor condition (6 x FLA). Standard NEMA devices are Class. 20; they trip in 20 seconds or less after the onset of locked rotor.

While a 20 second response time may prevent a fire, it won't save a T-frame motor from a costly rewind following a locked rotor. An IEC overload relay will trip the motor before damage occurs.

A common misconception is Class 10 devices trip motors unnecessarily especially during start up and restarts. This phenomenon is known as "nuisance tripping."

While nuisance tripping might occur in some specially designed motors, an IEC overload relay will almost never trip a motor unless there's a fault. And as for starting, virtually all motors come up to speed well before the IO-second tripping time of an IEC device.

Q5

Can ambient temperature affect the tripping time of an overload relay? Is there a way to compensate for ambient temperature changes?

A5

Ambient temperatures can greatly affect the tripping time of an overload relay. Cooler temperatures increase tripping times, while warmer temperatures decrease tripping times.

Most NEMA overload relays have no provision for ambient temperature compensation. While some are equipped with manual compensation, they still cannot react to changing temperatures without constant readjustment.

In either case, users often install larger heaters in warm weather to combat nuisance tripping. With the larger heaters, however, it's easy to see how a Class 20 device's trip time could stretch well beyond 20 seconds on a cool morning.

Most IEC devices are equipped with automatic ambient temperature compensation, allowing them to continually monitor and adjust to surrounding temperatures. As a result, trip times remain constant regardless of conditions.

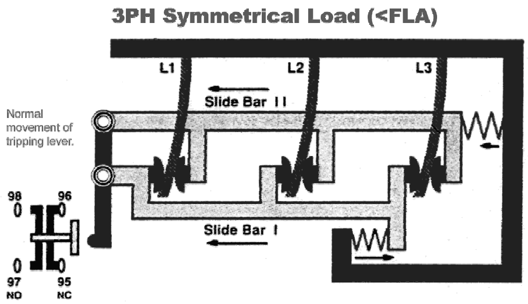
Q6

How do IEC overload relays protect against single phasing?

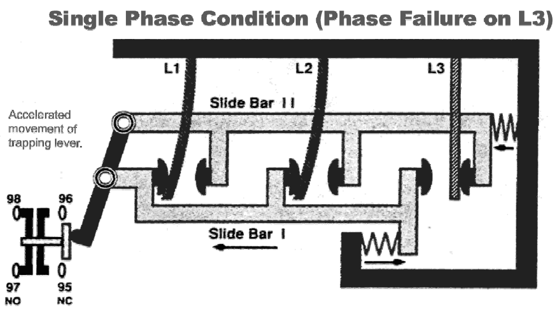
A6

Single phasing occurs when power is lost in one of the three legs supplying a motor. Instantly the current through the two remaining phases jumps significantly. Unless promptly disconnected, the two powered windings can soon be destroyed from over-current.

IEC overload relays detect single phasing and react before motors can be damaged. The bimetal strips in these devices monitor the current drawn through each of the three phases, bending a proportionate distance. If a phase is lost, the bimetal strip will straighten and, using a double slide-bar ripping mechanism, instantly disconnect the motor from power.



Normal operation, with all phases delivering current. The three bimetal strips bend equal distances, moving the two slide bars and the tripping lever proportionately.



Single-phase condition, with bimetal strip L3 straight (cold) due to loss of current. This has caused slide bar II to move to the right, accelerating the movement of the tripping lever and opening the contacts.

Q7

Is the selection process for IEC devices complicated?

A7

Selections of IEC contactors are based on running current, motor application, and required contact life. Overload relay selection is based on full load current. It takes a little more effort, but results in perfectly matched motor control.

At least one IEC manufacturer has made the selection process easier, however. Sprecher + Schuh's entire line of IEC contactors and overload relays carry NEMA-equivalent sizes, including fractional sizes for controls rated between basic NEMA sizes. You're guaranteed a perfect fit no matter which method you use.

As the bell ends the final round, it's time to take a look at your scorecard. Be sure and pay special attention to how you scored those important rounds like tripping speed, size, arc quenching, and motor protection. The battle was well fought by both IEC and NEMA, but now a decision must be reached. Is the challenger worthy of your business, or should you go with the established champion? You're the judge; it's your call. The fate of your motors awaits your decision.

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