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60 SECONDS WITH SUMMIT PUMP, Inc

VOLUME 3-1

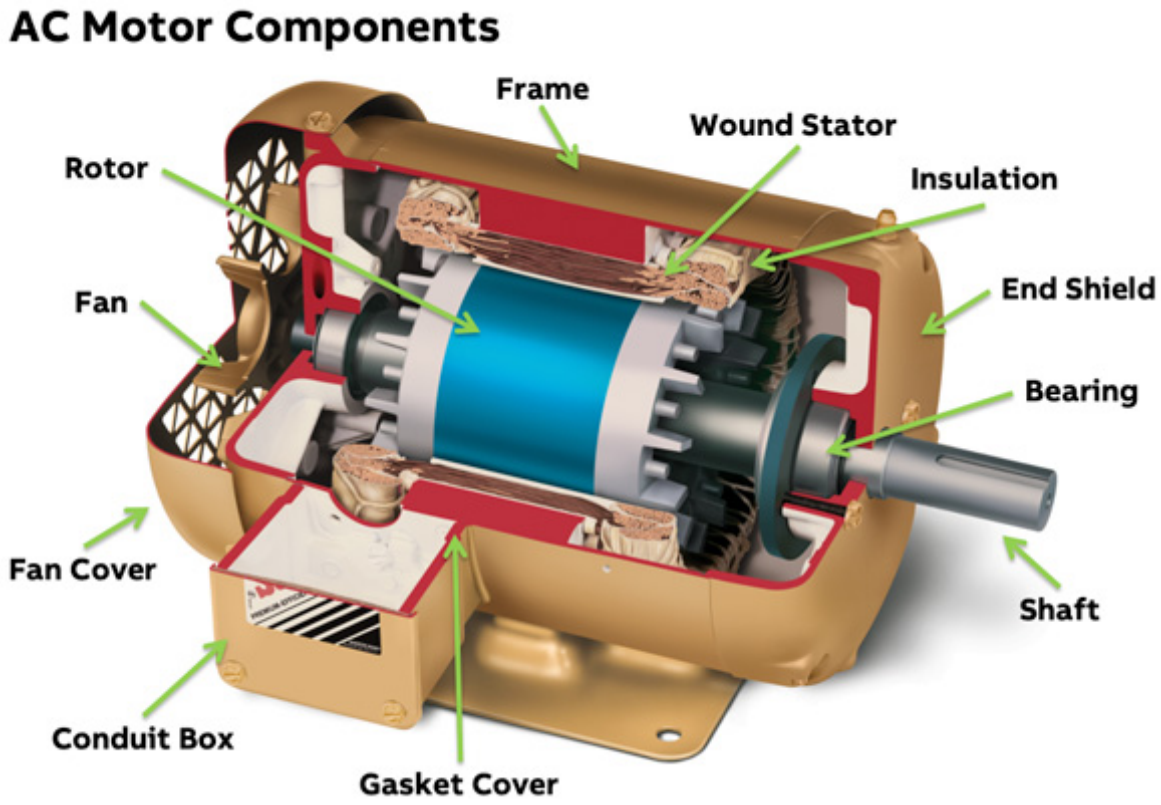
Rolling Stone's front man Mick Jagger's second favorite song verse is "start me up"…"I've been running hot".

Did you also know there are restrictive limits regarding the number of times an induction motor can be started in a given time period? The restrictions are due to ("*running hot*") temperatures and for that singular reason it is always prudent to know the pump's application and duty cycle. This issue doesn't normally come up unless you are troubleshooting or testing a system; but even then, there is never a good time to kill the motor.

Reason for Motor Failure

The biggest number one cause of motor failure is basically an argument, and it depends on if you consider both mechanical and electrical reasons. Regardless, always in the top few electrical reasons, is failure due to the

insulation system.

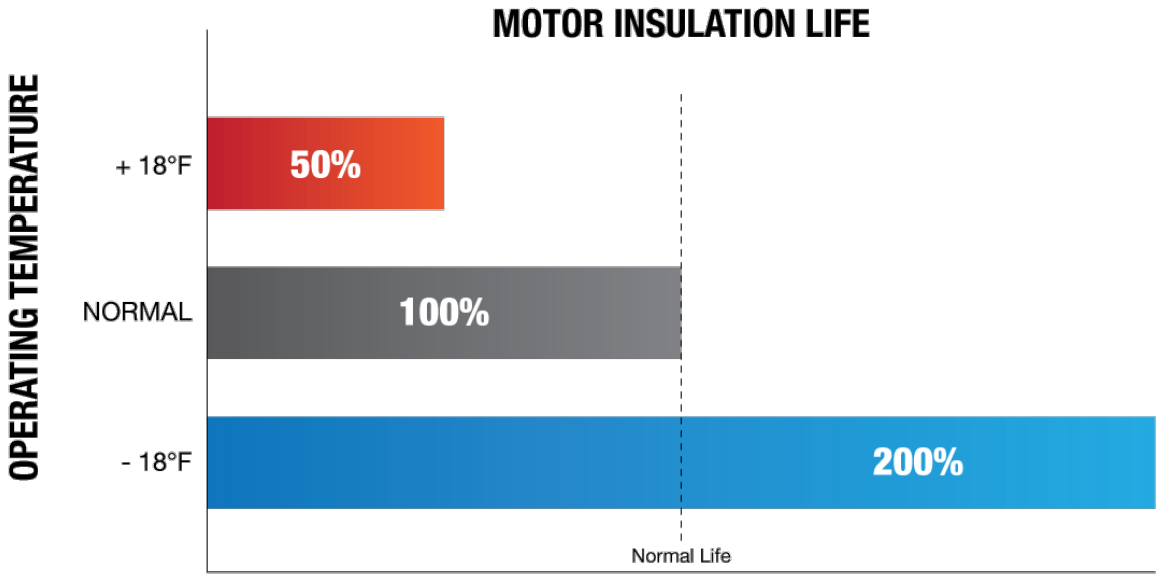


3D Model ©ABB. Used with Permission.

A simple explanation for the motor starting restrictions is to mitigate thermal damage to the insulation system because the life of a motor is directly related to the insulation system. The amount of amps (**I**) (quantity squared) in a unit of time ($\mathbf{I^2T}$) will determine the amount of heat generated and the resulting high temperatures will shorten the insulation life. On average the heating effect of the $\mathbf{I^2T}$ during startup is *over a 100 times* the full load heat effect during normal operations.

Thumb Rules

There is an industry rule for motors, coils and transformers that can be adapted to approximate the relationship between insulation life and total operating temperature. Simply stated, if a motor's total operating temperature is reduced by 10°C (18°F) the thermal life of the insulation system is approximately doubled. The antithesis follows; if the total operating temperature is raised by 10°C (18°F) , the thermal life expectancy of the insulation system is reduced by one half.



Motor startups create copious amounts of heat in the windings. Due to manufacturing variances in motor construction the industry normally simplifies these heating effect factors as $\mathbf{I^2T}$. In reality it is much more complicated.

As a general motor "*thumb rule*" …the more horsepower and speed…the fewer number of starts that are allowed per hour. Just to add more rules and restrictions, there is also a minimum time allowance between starts. And last… it is always a good idea to let the motor run for at least a minute or two once it is started, if at all feasible.

	3600 RPM		1800 RPM		1200 RPM	
HP	Max # Starts per Hr.	Min Time between starts seconds	Max # Starts per Hr.	Min Time between starts seconds	Max # Starts per Hr.	Min Time between starts seconds
1	15	75	30	38	34	33
5	8	83	16.3	42	18.4	37
25	4.4	115	8.8	58	10	51
50	3.4	145	6.8	232	7.7	64
100	2.6	220	5.2	441	5.9	97
200	2	600	4	831	4.5	265
250	1.8	1000	3.7	500	4.2	440

Bonus Section

Sixty seconds is up, but if you want a little extra bonus information please read on.

Lessons from the field

Many cases of recurring motor failure (due to excessive startups) have been incorrectly addressed by increasing the horsepower rating of the motor. Typically this action has the opposite intended effect and actually shortens the time between failures. The root cause analysis later showed the real reason for these failures was the excessive frequency of starts and stops.

Guidelines

As a general guideline for NEMA design **B** motors, use the above chart as a guide. Note that most all of the motors you will encounter for centrifugal pump drivers will be NEMA design **B**.

Always check with the manufacturer to be sure.

& The Summit Pump Team

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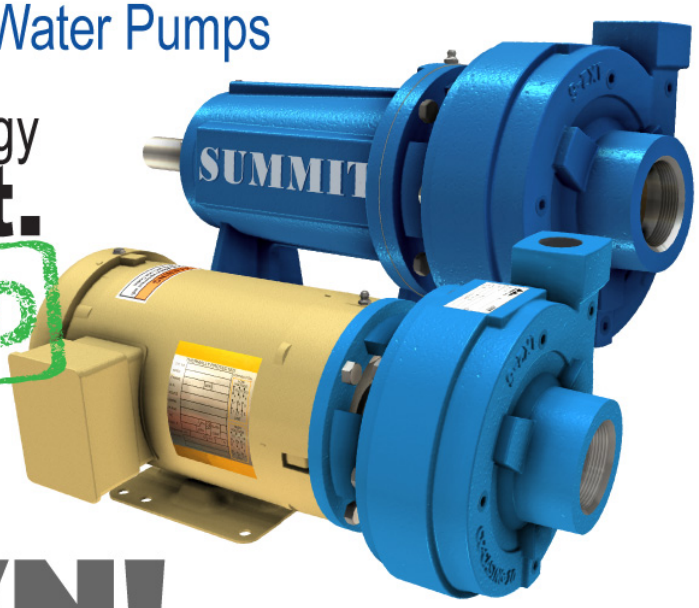

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