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Franklin Application/Installation Data (AID) ... For The Professional Driller-Installer

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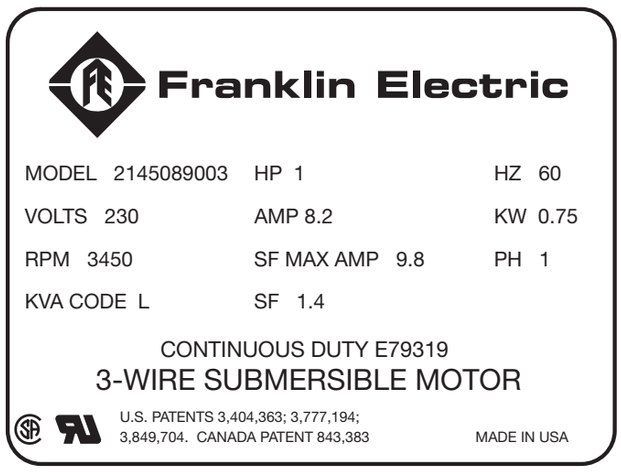
SERVICE FACTOR AND SERVICE FACTOR AMPS: CLEARING SOME THINGS UP

Decades ago, when the electric motor industry was still in its infancy, a game of "one-upsmanship" played out between the various motor manufacturers. That is, one manufacturer would make its motor slightly more powerful than competitors' motors of the same rating. In response, a competitor would increase the power of its motor, and so forth. It eventually became very difficult to compare motors from different manufacturers, and in time, standards were established and became known as service factor. Today, the National Electrical Manufacturers Association (NEMA) specifies service factors for electric motors, and different horsepower ratings carry different service factors.

The concept of service factor is simple and applies to most electric motors manufactured for North America. It is simply a multiplier that indicates the amount of additional load the motor can handle above its nameplate horsepower. Sometimes abbreviated SF, service factor is indicated on the motor's nameplate. To calculate the actual horsepower capability of the motor, simply multiply the rated horsepower by the service factor. As an example, let's use a Franklin Electric 1 hp 60 Hz submersible motor. Service factor on this motor, from either the nameplate or page 13 of the Franklin Electric AIM Manual, is listed at 1.4:

1 horsepower x 1.4 = 1.4 horsepower



What does this all mean to the professional water systems contractor on a day-to-day basis? Actually, it doesn't mean all that much. That's because, as mentioned above, pumps are designed to take advantage of the service factor built into electric motors. In the field, service factor is almost transparent since all motors that meet NEMA specifications have the same service factor.

TYPE	MOTOR MODEL PREFIX	RATING					FULL LOAD		MAXIMUM (S.F. LOAD)		WINDING (1) RES. IN OHMS	EFFICIENCY %		POWER FACTOR %		LOCKED ROTOR AMPS	KVA CODE
		HP	KW	VOLTS	HZ	S.F.	(2) AMPS	WATTS	(2) AMPS	WATTS	M=MAIN RES. S=START RES.	S.F.	F.L.	S.F.	F.L.		
4" 3-WIRE	214508	1	0.75	230	60	1.4	Y8.2 B8.2 R0	1210	Y9.8 B9.8 R0	1600	M2.2-2.7 S9.9-12.1	65	62	74	63	41.8	L

That is, our 1 horsepower Franklin motor is actually capable of 1.4 horsepower, and pump manufacturers certainly take this into account when designing their pumps.

Service factor sometimes leads to confusion, however, when considering Full Load Amps (FLA) and Service Factor Maximum Amps (SFMA). FLA represents how

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much current the motor is designed to draw or "pull" at the rated horsepower. Going back to our 1 horsepower example and page 13 of the AIM Manual, we see that Full Load Amps are 8.2. That means that at the rated voltage of 230 volts, this motor will pull 8.2 amps when asked to do 1 horsepower of work. Since we already know that almost all pumps will use the service factor that is built into the motor though, the concept of Full Load Amps is not particularly meaningful.

What does have meaning is Service Factor Maximum Amps (SFMA). This term can be expressed in various ways, including Maximum Service Factor Load (Max SF Load) or simply Service Factor Amps (SFA). They all mean the same thing, and for our discussion, we'll use the expression Service Factor Amps and abbreviate it using "SFA". SFA is the current the motor will draw if the entire service factor is used. In our 1 horsepower example, service factor is 1.4 and SFA are 9.8. Therefore, when this motor is asked to supply 1.4 horsepower, it will pull 9.8 amps of current.

SFA is sometimes referred to as the "speed limit" or the "redline" of an electric motor. This is because long-term, the motor is not designed to handle any more current than SFA, and chronically exceeding SFA can shorten its life.

That’s a good analogy, but unfortunately it's not quite that simple. We can’t forget that the amount of current a motor pulls depends on the voltage supplied to the motor. This means that Service Factor Amps are different at different voltages. Furthermore, even though a motor may be nameplated and designed to operate at 230 volts, we all know that the voltage supplied to the motor is seldom exactly 230 volts. So how do we take this into account?

To accommodate normal power fluctuations, all Franklin Electric submersible motors are designed to operate within 10 percent of the nameplate voltage. Therefore, our 230 volt motor will operate reliably between 207 and 253 volts. Now, we could specify what the Service Factor Amps should be at every voltage between 207 and 253 volts, but this would require several pages. For simplicity’s sake, we choose a representative voltage, and the one that makes the most sense is the nameplate voltage of 230V.

By definition then, Service Factor Amps are given for the nameplate voltage. In our 1 horsepower example, the SFA value of 9.8 amps "goes with" the nameplate voltage of 230 volts. If you change the voltage in either direction, the amp draw of the motor will change slightly as well. Depending on the motor, the amount of change should be fairly small, generally less than 1 amp. Another variable to consider is the difference between supply voltage and nameplate voltage. The supply voltage is what the power company "supplies" at the service entrance. In most residential applications, this is 240V. Submersible motors and many other appliances, however, account for a 5% voltage drop between the supply and the device. In the case of a submersible motor, most of that 5% may be taken up by the resistance in the drop cable. Hence, the motor is nameplated 230V. But, if the drop cable is less than the maximum length specified or of a larger gauge than is needed, the voltage drop will be less than 5%.
Going back to our Service Factor Amps discussion, we probably don't know exactly what the voltage is at the motor down in the well. Only with the maximum specified drop cable and a supply voltage close to 240V do we know that the voltage at the motor is very close to 230V.

At the end of the day, what really matters is having a good supply voltage and running the motor at the appropriate load. Taking care of these two factors will go a long way toward maximizing the life of your installation.

Hopefully this discussion cleared some things up about service factor and service factor amps. As always, if you have any questions, contact your Franklin Electric Territory Manager, Field Service Engineer, or our Technical Service Hotline at 800.348.2420.

TOLL-FREE HELP FROM A FRIEND

Contact Franklin's toll-free SERVICE HOTLINE for answers to your questions on submersible installations. When you call, a Franklin expert will offer assistance in troubleshooting submersible systems and provide answers to your water systems questions.

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QUALITY IN THE WELL

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