

Bulletin No.210

Stirrer Drives for Parr Reactors

Matching the best stirring package with your Parr reactor and application.

Parr offers a wide selection of magnetically coupled stirrer drives, motors, transmission systems and internal stirrers to match the capabilities of the reactor to the reaction, reactants, and products of the process contained in the reactor. For best results, it is critical that all four components be matched to take full advantage of the overall system. For example, high viscosity systems require not only mag drives designed for high torque, but also more powerful motors, transmission systems capable of multiplying the motor torque and stirrers to move these slow moving materials.

Magnetic Drives

All PARR stirred reactors are equipped with a magnetic drive to provide a trouble-free linkage to an internal stirrer, thereby avoiding the leakage problems which can arise with a packed gland stirrer drive. There are no rotating seals with a Parr magnetic drive. The drive turns freely and the system remains gas-tight, permitting long, continuous runs at pressures up to 5000PSI (345BAR) with little or no attention to the seal and drive.

PARR drives are assembled with specially designed permanent magnets which have excellent temperature stability and can be depended upon to operate for long periods with little or no flux degradation. Magnets for the inner rotor to which the stirrer shaft is attached are enclosed in a stainless steel (or other alloy) housing, permanently sealed and supported by graphite-filled, PTFE bushings to provide a long life, chemically inert stirring system. Magnets for the outer drive are also fully enclosed and supported by twin; high quality sealed ball bearings for smooth operation and long life. A water cooling sleeve protects the components from excessive heat arising from the reactor.

Two Styles of Magnetic Drives

PARR offers a choice of two styles of magnetic drives. They are the general purpose series and the footless series magnetic drives.

General Purpose Magnetic Drives

The general purpose magnetic drives use small diameter stirrer shafts which require a lower guide or "foot" bearing to stabilize the stirrer shaft. These general purpose drives are intended for high speed stirring for applications involving liquid-liquid or gas-liquid mixing.



PARR general purpose magnetic drives are made in four sizes, designed to match the full range of Parr reactor sizes and to provide alternate drives for high viscosity loads, higher stirring speeds and other special requirements. Each drive is assembled in a sealed housing which threads directly into the reactor head.

The A1120HC and A1180HC series are the general purpose magnetic drives normally furnished with the PARR reactor sizes listed in the adjoining table. The A1750HC2 model is a special high torque drive intended primarily for heavy loads and high viscosity applications. When it is used to replace the standard magnetic drive, the motor and drive system will have to be changed to provide the higher torque which the A1750HC2 drive is capable of transmitting. The A3040 series magnetic drive was designed for the 5500 Series Compact reactors and is also used on other small capacity custom design reactors.

Footless Magnetic Drives

The footless magnetic drives employ a larger diameter stirrer shaft designed to operate without this lower guide or “foot” bearing. They were originally designed for digesting ores where the abrasive solids would get caught in the PTFE foot bearing and wear away the stirrer shaft. They are also recommended for slower speed internal stirrers such as the anchor,

Part Number	Style	Designation	Coupling Poles	Coupling Torque In-lb*	Installed As Standard Drive on	Available As Optional Drive on
A1120HC Series	Gen. Purpose	General Purpose	4	16	All 25mL thru 2000mL Reactors	None
A1180HC Series	Gen. Purpose	Heavy Duty	6	60	1 and 2 Gallon Reactors	1000mL and 2000mL Reactors
A1750HC	Gen. Purpose	General Purpose	6	60	10-Liter and 5-Gal Reactors	1000mL and 2000mL Reactors
A1750HC2	Gen. Purpose	Extra Heavy Duty	12	120	None	1000mL thru 5 G Reactors
A3040HC	Gen. Purpose	Compact	4	2.5	All 5500 Compact Reactors	None
A2140HC	Footless	General Purpose	4	16	None	300mL thru 2000mL Reactors
A2160HC	Footless	Heavy Duty	6	60	None	1000mL thru 5 G Reactors
A2170HC	Footless	Heavy Duty	6	60	None	1000mL thru 5 G Reactors
A2160HC2	Footless	Extra Heavy Duty	12	120	None	1000mL thru 5 G Reactors
A2170HC2	Footless	Extra Heavy Duty	12	120	None	1000mL thru 5 G Reactors

* In-lb = 0.11 Newton Meter

paddle, or spiral stirrers. Footless drives can be used for stirrer speeds up to 1000 rpm. It is also important to select the appropriate motor which can handle the increased drag associated with the larger diameter footless magnetic drive shafts.

The magnetic drive is only one third of the total stirring package on a PARR stirred reactor. The PARR footless magnetic drives are made in three sizes. The A2140HC, A2160HC, and A2170HC series are the footless magnetic drives normally furnished with the PARR reactor sizes listed in the adjoining table. The A2160HC2 and the A2170HC2 models are special high torque drives intended primarily for heavy loads and high viscosity applications. When it is used to replace the standard magnetic drive, the motor and drive system will have to be changed to provide the higher torque which the A2160HC2 and the A2170HC2 models are capable of transmitting.

The magnetic drive is only one third of the total stirring package on a PARR stirred reactor. The other two parts are the stirrer motor with its drive system and the actual internal stirrer arrangement in the stirred reactor.

Stirrer Motors

PARR reactors are stirred by three different types of motors. They are variable speed motors, variable speed explosion proof motors, and air motors.

Variable Speed Motor

Variable speed motors can be installed on most of the PARR reactors. They range in size from 1/17HP to 3/4HP. They range in RPM from 0-1800RPM using the variable speed control which can be furnished on PARR reactors.

Variable Speed Explosion Proof Motor

Our variable speed explosion proof DC motors typically carry a North American Electrical Code rating for Class I, groups C and D. They also cover Class II, groups F and G. They range in size from 1/4HP to 3/4HP. They range in RPM from 0-1800RPM using the variable speed control which can be furnished on PARR reactors. We also furnish 3-phase AC motors for the European Community which meet the ATEX classification Ex II 3 G.

Air Motor

Variable speed explosion proof Air-driven motors can be installed on most of the PARR reactors. The horsepower rating, torque, and available speed are all dependent upon the pressure and available volume of the air supply. Maximum torque is delivered at relatively slow speeds and maximum horsepower is delivered at high speeds. The air motors can develop much more power than their corresponding electric motor.

Stirrer Drive Motors

Motor Designation	HP Rating	Explosion Proof	Variable Speed	Standard Pulley		Optional Pulley	
				Max Speed RPM	Max Torque in- lb	Max Speed RPM	Max Torque in- lb
N/A*	1/17	No	Yes	1500	1.5	(Direct coupled)	
-VS.12	1/8	No	Yes	700	11	1800	4
-XP.25	1/4	Yes	Yes	700	22	1800	9
-AM.25	1/4	Yes	Yes	1000	10	2500	15
-VS.25	1/4	No	Yes	700	22	1800	9
-VS.50	1/2	No	Yes	700	45	1800	18
-XP.50	1/2	Yes	Yes	700	45	1800	18
-AM.50	1/2	Yes	Yes	1000	40	2500	30
-VS.75	3/4	No	Yes	700	68	1800	27
-XP.75	3/4	Yes	Yes	700	68	1800	27

*Available for series 5500 High Pressure Compact Laboratory Reactors only.

Drive System Types

PARR reactors are stirred by three different drive system types. They are the direct drive, the belt drive, and the gearbox drive. The choice of drive depends on the application intended.

Belt Drive

Most PARR drive systems contain a set of pulleys and a drive belt that reduces the motor speed by a factor of 2 to 3. This speed reduction produces a corresponding increase in the amount of torque delivered to the drive shaft. Various pulleys are available which will increase the maximum stirrer speed, but increased maximum speeds reduce the maximum available torque accordingly.

Gear Box Drive

If you have a high torque requirement, nothing beats a gear box drive. A geared, direct drive motor can be installed on most floor stand models ranging from 1-Liter to 5-Gallon systems. This is an attractive arrangement for handling heavy stirring loads. Any 1/4HP or larger variable speed or variable speed explosion proof motor can be used with a gear box drive.

Gear box drives are typically available in 3:1, 5:1, and 10:1 ratios. The output to the magnetic drive will be the maximum motor RPM reduced by the gear box reduction ratio. The associated torque will be increased approximately by the same ratio.

Direct Drive

A direct drive motor is as its description implies connected directly to the magnetic drive thru some type of coupling. The direct drive has the fewest components and is limited to the motor torque and speed capabilities.

The 5500 Series Compact Reactors is only offered in direct drive arrangement. Other PARR stirred reactors models can range from 1/4HP to 3/4HP in a direct drive arrangement.

Torque vs. Stirring Speed

As a general rule, the magnetic drive coupling installed on each PARR reactor will have a torque rating matched to the torque obtainable from any on the motors offered for use with the apparatus.

The highest torque from any motor and drive combination is obtained at the lower stirring speeds. Increasing the stirring speed reduces the torque in inverse proportion to the speed. For applications involving high viscosity mixtures, the motor size, drive, stirring speed, and type of internal stirrer must be matched to provide an effective mixing system.

Gear Box Torques

Motor HP Rating	3:1 Gear Box		5:1 Gear Box		10:1 Gear Box	
	Max. Speed RPM	Max. Torque in-lb	Max. Speed RPM	Max. Torque in-lb	Max. Speed RPM	Max. Torque in-lb
1/4	600	27	360	45	180	90
1/2	600	54	360	90	180	180
3/4	600	81	360	135	Not Recommended	

Internal Stirrers

The final part of the total stirring package is the interaction of the stirrer in the vessel with the reactants. PARR offers a variety of internal stirrers. The standard internal stirrer is the turbine type impeller(s).

A general rule is as the viscosity of the reactants goes up, then the power and/or torque required to stir them will also go up. At some higher viscosities, the reactants will simply move so slowly that the standard turbine type impellers simple carve "cavitates" in the reactants in the reactor and no longer provide adequate mixing even if there is still sufficient torque available. Therefore, for high viscosity reactants, optional paddle, anchor, or spiral stirrers become appropriate.

Optional internals stirrers include: Bar anchor, flat bladed paddle, 2 and 3-bladed anchor w/PTFE wiper blades, upward and downward spiral, gas entrainment, static and dynamic catalyst baskets. A separate tech note goes into detail on the various PARR Reactor Stirrer Options available.

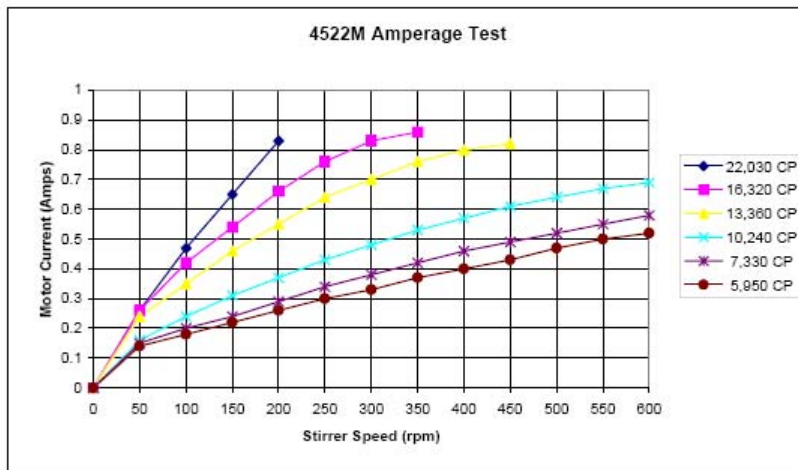


Figure 1

Date: 02-07-90, Model: 4522M, 2-Liter Mag Dr, Heater: N/A, Controller: 4842, Voltage: 115V, Volume: 1/2 Full, Material: "Heavy Tap" Oil at Varying Temperatures, Propellers: (2)A358HC2 Spiral C/C No Dip Tube, T/W + Brkt for Stirrer, Std 0-800 RPM Drive, 1/12 HP VS Motor (64E11ES)

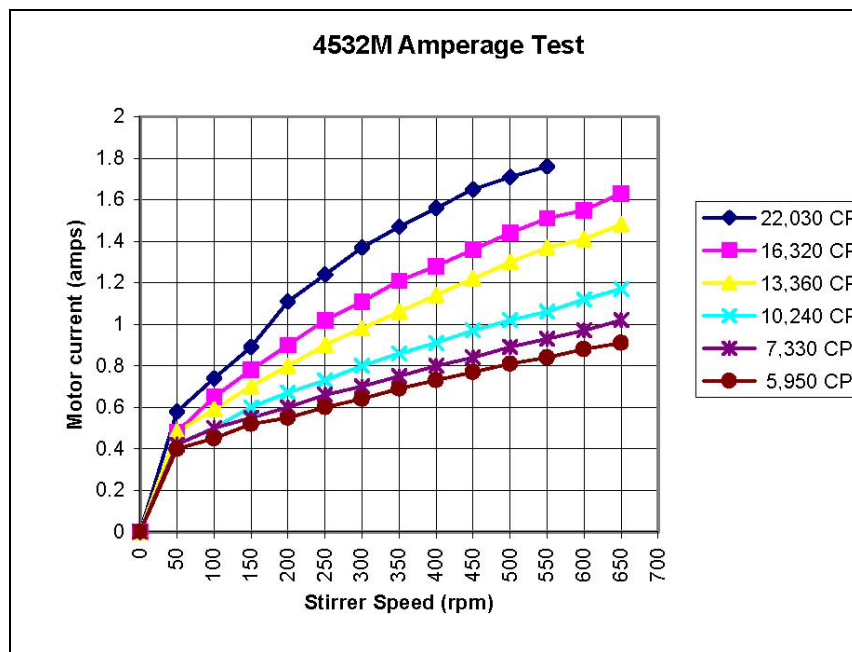


Figure 2

Model: 4532M, 2-Liter Mag Dr, Heater: N/A, Controller; 4842, Voltage: 115V, Volume: 1/2 Full, Mat'l: "Heavy Tap" oil, at varying temperatures, Propellers: (2) A358HC2, Spiral C/C No Dip Tube, T/W + Brkt for Stirrer, Std" 0-800 RPM Drive, 1/4 HP VS Motor (A388EEQ), Note: Mag Drive Torque, Limit was exceeded just after 550 RPM in 22,030, CP Oil

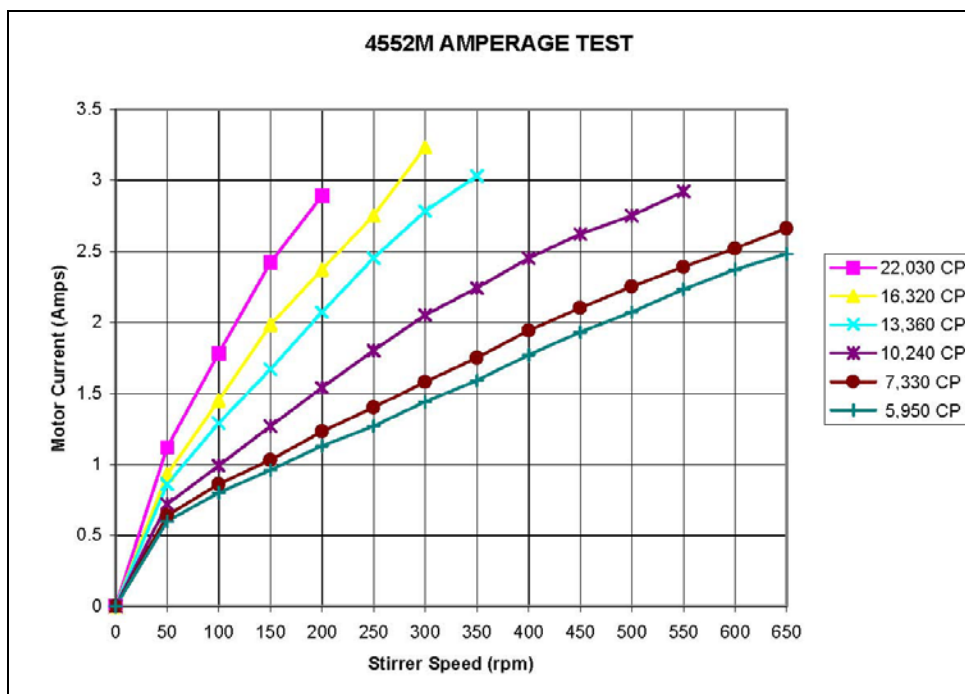


Figure 3

Model: 4552M, 2-Gal Mag Dr, Heater: N/A, Controller: 4842, Voltage: 115V, Volume: ½ Full, Mat'l: "Heavy Tap" Oil, at Varying Temperatures, 60,000CS = -, Propellers (2) 709HC, Spiral C/C No Dip Tube, T/W + Brkt for Stirrer, Std" 0-800 RPM Drive, 1/2HP VS Motor (A388E2ES), Props: (2)709HC, Props: (2) 709HC, Load: 4552M No Dip Tube, T/W + Bracket for Str, "Std" 0-800 RPM Drive, ¼ HP VS Motor, *Motor Circuit, Breaker (801 E2), Load: Tor16, 2.4 D.C. Amps

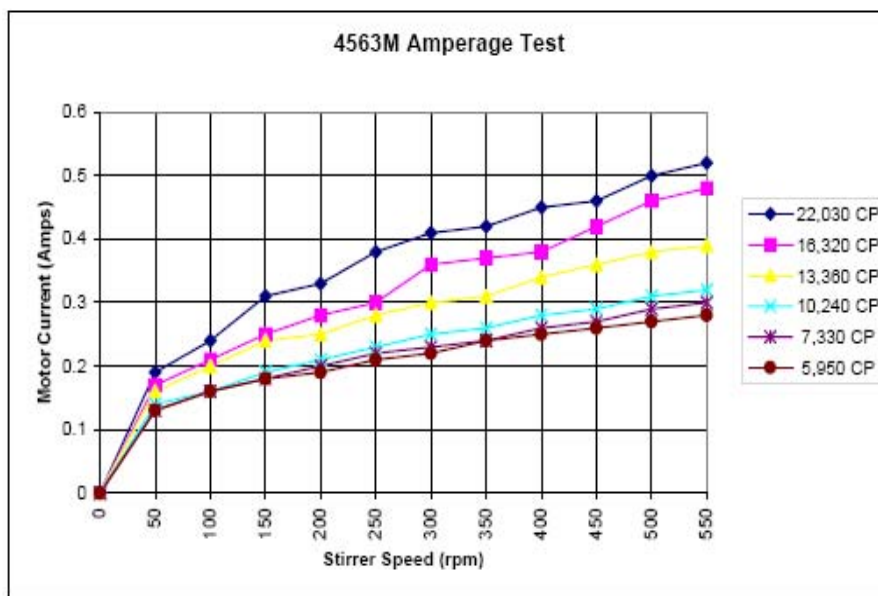


Figure 4

Model: 4563M, 600mL Mag Dr, Heater: N/A, Controller: 4842, Voltage 115V, Volume: ½ Full, Mat'l: "Heavy Tap" Oil, at Varying Temperatures, Propellers: (2) 837HC, Dip Tube, Cooling Loop, & A472E3 Thermocouple, Installed, Std" 0-800 RPM Drive, 1/12HP VS Motor (A64E11ES) Note: 550 Max R.P.M. w/Standard Drive



Figure 5

Model: 4563M, 600mL Mag Dr, Heater: N/A, Controller: 4842, Voltage: 115V, Volume: ½ Full, Mat'l: "Heavy Tap" Oil, at Varying Temperatures, 1771HC Scrapper, Stirrer & A472E3, Thermocouple Installed, Std" 0-800 RPM Drive, 1/12 HP VS Motor (A64E11ES)

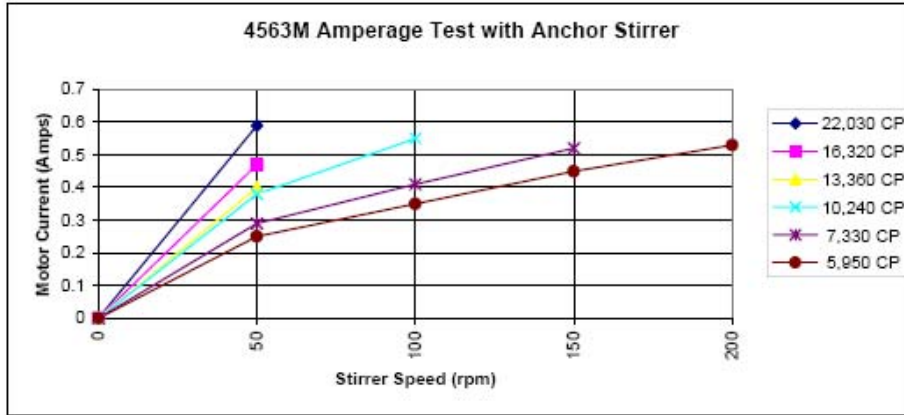


Figure 6

Model: 4563M, 600mL Mag Dr, Heater: N/A, Controller: 4842, Voltage: 115V, Volume: 1/2 Full, Mat'l "Heavy Tap" Oil, at Varying Temperatures, 594HC8 Anchor Stirrer and A472E3 Thermocouple installed, Std 0-800 RPM Drive, 1/12 HP VS Motor (A64E11ES)

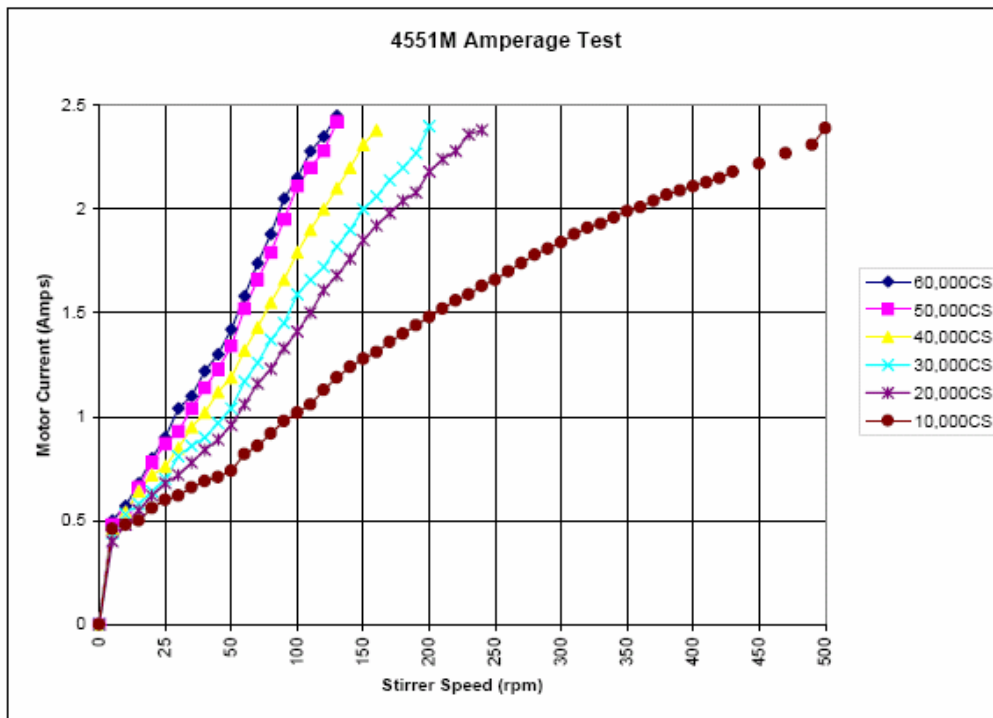


Figure 7

Model: 4551, 1-Gal Packed Drive, Heater; N/A, Controller: 4842, Voltage: 230, Volume: 3/4 Full, Props: (2) 709HC, No Cooling Coil, No Dip Tube, T/W + Bracket for Str, "Std" 0-800 RPM Drive, 1/4 HP VS Motor, * Motor Circuit, Breaker (801E2), Popped at about 2.4DC AMPS

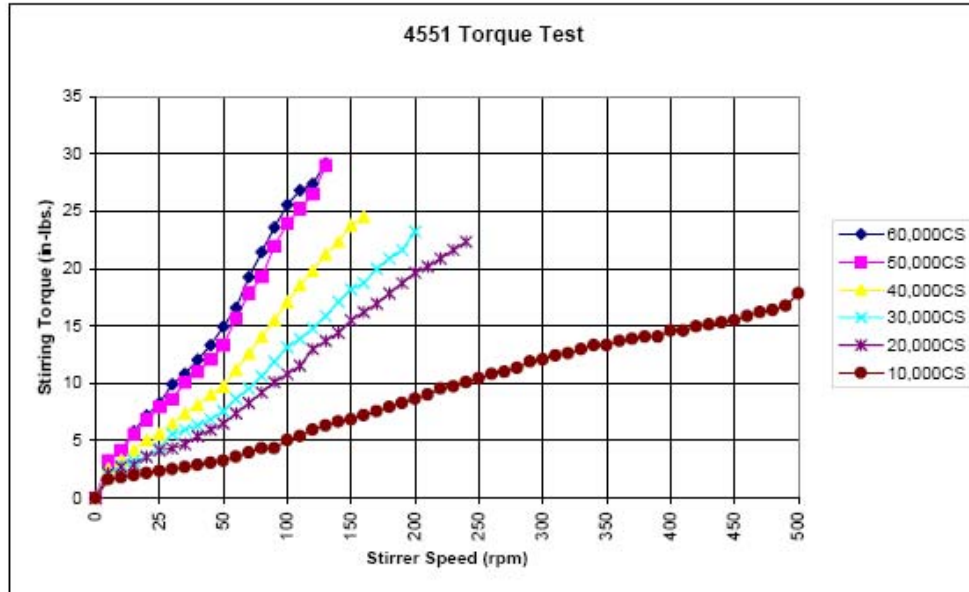


Figure 8

Model: 4551, 1-Gal Packed Drive, Heater: N/A, Controller: 4842, Voltage: 230, Volume: ¾ Full, Props: (2) 709HC, No Cooling Coil, No Dip Tube, T/W + Bracket for Str, "Std" 0-800 RPM Drive, ¼ HP VS Motor, *Motor Circuit Breaker (801E2), Load: TOR16, 2.4DC AMPS

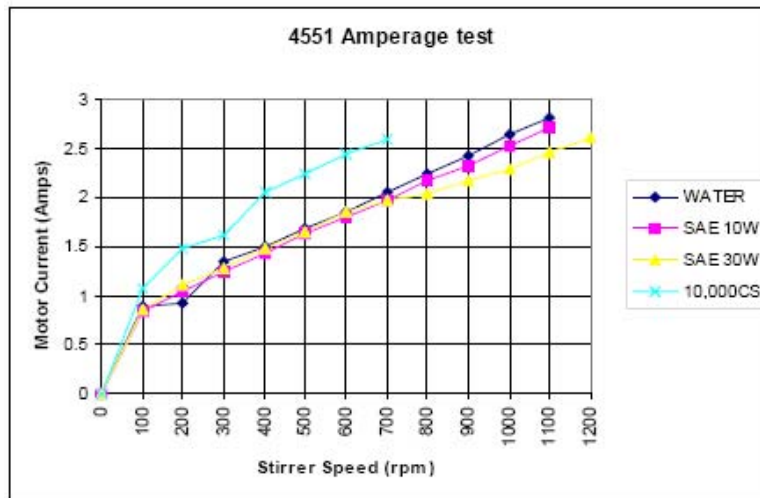


Figure 9

Model: 4551, 1-Gal Packed Drive, Heater: N/A, Controller: 4842, Voltage: 230, Note: Motor Circuit Breaker popped where graphs end.

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