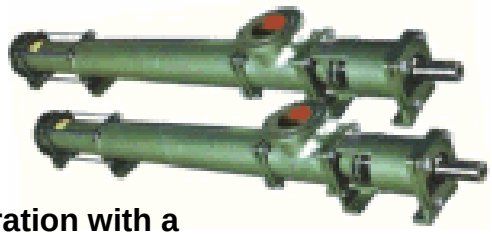
Techsys Corporation

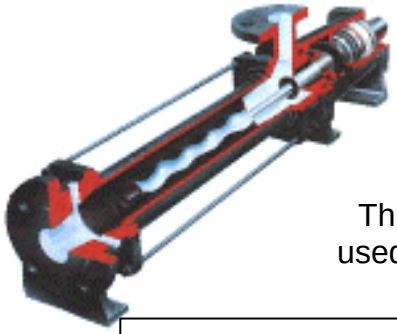
APPLICATIONS BULLETIN

ULTIMATE 1 PUMP SYSTEMS WITH HELICAL ROTOR PUMPS

A Helical Rotor pump has different characteristics than a centrifugal, vertical turbine or most other pump in the feature that Helical Rotor pumps require a minimum TORQUE to get started. This is called the breakaway torque and can present problems if motors are sized for running performance only.

All helical rotor pumps nominate a breakaway torque as part of their characteristics, which should be used to determine the size of motor used with that pump.





When a drive is selected for operation with a helical rotor pump the main consideration is the initial breakaway torque.

This figure is provided by the pump manufacturer and must be used to determine the ability of the VFD to start the pump.

DATA REQUIRED TO CALCULATE VFD SIZE

Available torque from motor - see formula below……. τ
FLA (motor full load current)……..I_{FLA}
Pump breakaway torque…… τ_b

Techsys Corporation VFD systems are all designed with a maximum of 150% of starting torque capacity. In order to check that a VFD is suited to a pump a calculation of torque is required.

All motors provide torque based on the following formula:

$$\tau = \frac{9550 \times P_n}{rpm}$$

P_n = rated motor power (kW)
rpm= revolutions per minute
τ = torque (Newton meters)

AVAILABLE MOTOR TORQUE POR VARIOUS COMMON MOTOR SIZES*

*typical only - check specific motor when designing

	6 POLE		4 POLE	
Power	**Rated speed**	**Available Motor Torque (τ)**	**Rated speed**	**Available Motor Torque (τ)**
kW	rpm	nm	rpm	nm
1.1	920	11.4	1400	7.5
1.5	930	15.4	1400	10.2
2.2	935	22.5	1420	14.8
3	960	29.8	1425	20.1
4	960	39.8	1420	26.9
5.5	960	54.7	1445	36.3
7.5	960	74.6	1440	49.7
11	965	109	1460	72.0
15	970	148	1460	98.1
18.5	975	181	1470	120.2
22	975	215	1470	142.9
30	980	292	1470	194.9
37	980	361	1480	238.8
45	985	435	1480	290.4
55	985	533	1480	354.9
75	985	727	1485	482.3

In order to determine the correct VFD size for operation with a helical rotor pump, divide the required **break away torque** by **available motor torque** to get a %.

$$\frac{\tau_b}{\tau}$$

As current draw is directly proportional to torque for variable speed operation this figure will give the maximum current draw on startup when it is multiplied by the motor FLA (full load current).

$$I_{max} = \frac{\tau_b \times I_{FLA}}{\tau}$$

I_{max} = maximum current draw
τ_b = break out torque - from pump manufacturer
I_{FLA} = Motor full load amps
τ = Motor torque available

To select the correct VFD I_{max} should not be any more than 150% of the rated current of the VFD.

Eg If **I_{max}** is **23 amps** then the minimum VFD size is 23/1.5 = **15.3** amps

----------Therefore use a 16 amp VFD----------

Always be sure to check that the VFD will still be suitable for full load operation when the pump is at the worst case situation.

TABLE OF BREAKOUT TORQUE FOR SOUTHERN CROSS HELICAL ROTOR PUMPS

PUMP	1 Stage	2 Stage	4 Stage
RMAA01xxxxxx	1.6	2.8	
RMAA02xxxxxx	3.4	5.9	11.2
RMAA03xxxxxx	10.7	19.3	36.4
RMAA04xxxxxx	24.8	45.6	84.1
RMAA05xxxxxx	47.8	86.1	163
RMAA06xxxxxx	82.3	149	280
RMAA07xxxxxx	115	220	
RMAA08xxxxxx	195	350	
RMAA09xxxxxx	245	271	
RMAA10xxxxxx	378	680	

PUMP	1 Stage	2 Stage	4 Stage
RMAA54xxxxxx	19.6	39.3	78.4
RMAA56xxxxxx	34.3	78.5	137
RMAA58xxxxxx	58.9	118	245
RMAA60xxxxxx	88.3	177	363
RMAA62xxxxxx	169	334	
RMAA64xxxxxx	255	520	
RMAA66xxxxxx	353	716	
RMAA68xxxxxx	530	1010	
RMAA70xxxxxx	687	1374	
RMAA72xxxxxx	1079		

PUMP	1 Stage	2 Stage
MRAB02xxxxx	1.9	3.4
MRAB03xxxxx	5.7	10.2
MRAB04xxxxx	14.1	25
MRAB06xxxxx	22.3	40.1
MRAB07xxxxx	92.9	167
MRAB08xxxxx	113	

Break out torque for the SX-Roto range of pumps The basic break out torque is for cold clean water. However, where viscous product, sludge's etc are concerned, the break out torque can often be at least twice the basic break out torque figure. Consequentially, each application has to be treated on its merits. More often than not, the motor selection for industrial helical rotor applications is based on break out torque, rather than pump duty or even non-overloading power.

Always take into account the losses associated with gear boxes if used as these losses need to be added to the equation when sizing the VFD.

$$I_{max} = \frac{\tau_b \times I_{FLA}}{\tau} + \text{(current draw due to losses)}$$

(The general gearbox loss is in the order of 5-10% of transmission power)

Consult the pump manufacturer office for detailed information regarding the actual torque characteristics for the specific pump being used.