



Application note 101: 22" OD ,15" ID large bore hollow shaft servo motor/encoder

This note describes the design and manufacture by Allied Motion of a large bore hollow shaft motor with an integral 18 bit absolute encoder. This motor is to be used on the "Centrifuge Accomodation Module" of the International Space Station for microgravity reseach with a required effective life of 15 years. The overriding reason for the selection of Allied Motion for this project was the combination of motor, encoder and integration design skills as well as manufacturing facilities.

Due to the special nature of the application, and in addition to the "normal" design criteria, the centrifuge drive motor needed to be ultra reliable, exceedingly efficient, quiet (NC-40 or less), exhibit no or very low cogging, generate no EMI (DC or AC), should not susceptible to shock and have a low weight.

The design chosen was the EMOTEQ "Megaflux" architecture, 80 pole, exhibiting outstanding torque characteristics and efficiency. A few salient specifications of the motor are:

- 1000 Nm maximum torque
- a motor constant of 8 Nm/sqrtW
- a temperature rise of only 9 deg. C to spin a 1m60 diameter centrifuge of 2,500 Kg at 52 RPM.

Samarium Cobalt magnets were used due to the volatile nature of neodymium.

The integral feedback device is an optical 18 bit absolute encoder which supplies precise information for the sinusoidal motor drive as well as commutation and start-stop position signals. The challenge was to package a 20" OD glass disk with a large aperture in such a way that the tight mechanical tolerances required for a high resolution encoder were maintained under all circumstances such as shock, vibration and temperature range. This challenge was met by an innovative encoding technique and the development of a unique disk manufacturing process.

The unit was shipped on February 21, 2004, for initial test and qualification.

For further information and assistance, please contact:

COPI	(800) 340 0404 technical assistance, sales@opticalencoder.com
EMOTEQ	(800) 221 7572 technical assistance, sales@emoteq.com

