NeveRest 40 Motor

FEATURES AND TESTING

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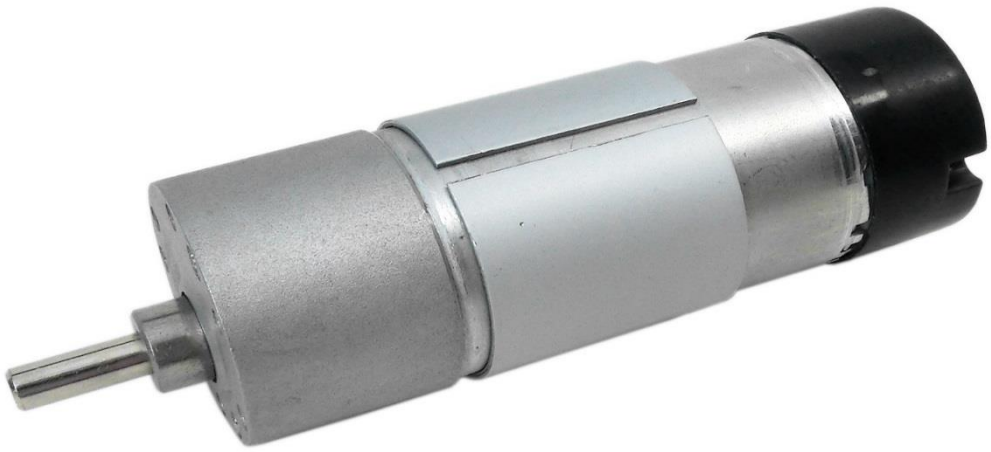
Intro

As the AndyMark staff interacted with the FTC community over the past year, we found teams wanted more motor options. This summer we spent a great deal of time looking for and testing new motors that could bring those new options to the FTC community.

Our first step was to understand the performance of the FTC motors legal in 2013-14 and the concerns that the community raised about those motors. With this information, we looked for a new motor that would address as many of the limitations as possible, while maintaining quality at a low price. This report shows the testing that was conducted and showcases a number of the exciting features in the new NeveRest 40 motor.

In many of the tests we used our motor dynamometer and high capacity power supply. We used a power supply instead of a battery to maintain consistent testing conditions and ensure we were evaluating just the motor and not another element. In order to control the motor, we used the AndyMark Motor Meter (am-2732) and a Talon SR speed controller from Cross the Road Electronics, which we were confident could handle everything the NeveRest 40 and Tetrix motors demanded. After this baseline testing we swapped the Talon and power supply for the HiTechnic motor controller and a battery and found no difference in the performance of the motor.

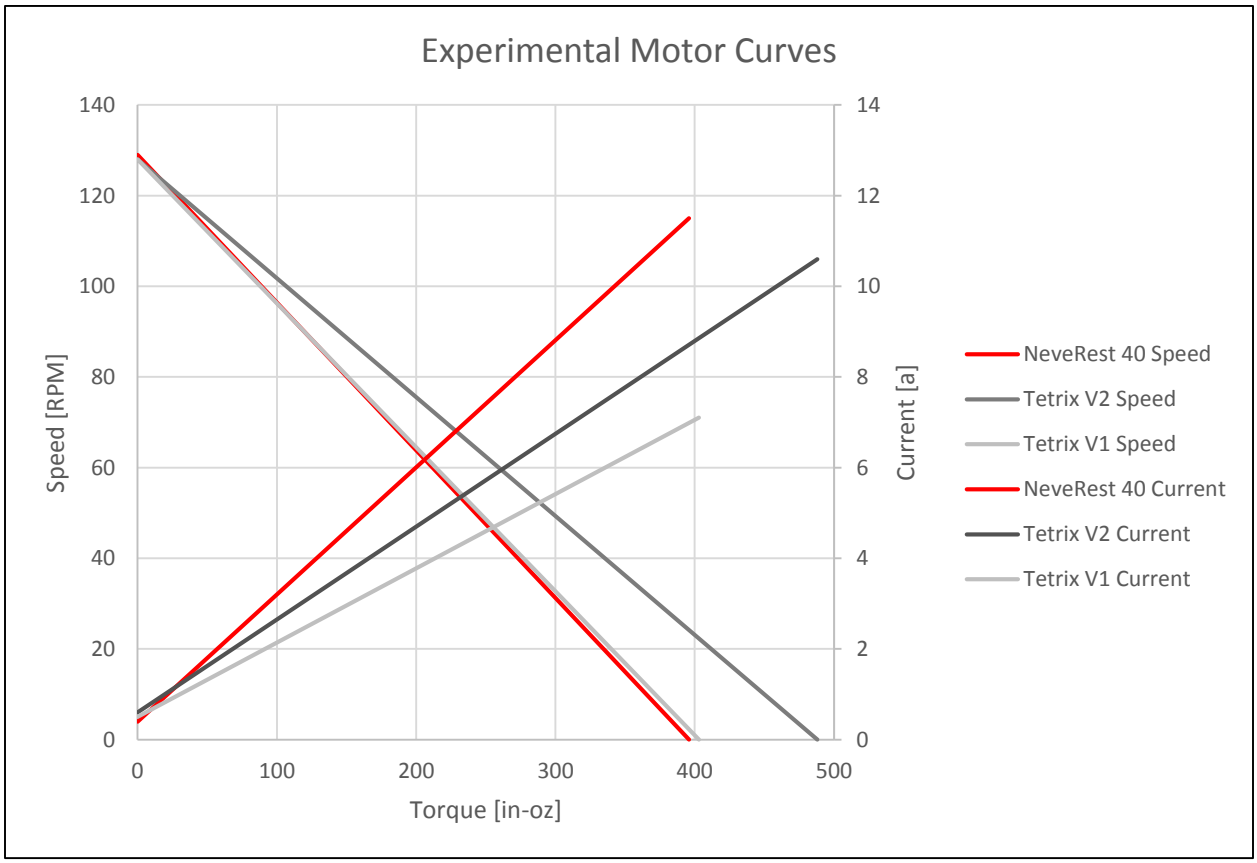


NeveRest 40 Testing

Test 1: Generating Motor Curves

Our first step was to test the existing motors for max power output and max torque. With the data from our motor dynamometer we were able to create an experimental curve for the motor. Each trial consisted of a 20 second build up to the max breaking torque which occurs at the end of the test. The motor started each trial at full speed without any breaking torque applied. Within the dynamometer the motor has to spin a large mass that prevents the motor from reaching its true “no load” speed.

Motor	NeveRest 40	Tetrix V2	Tetrix V1
Minimal Load speed [rpm]	129	128	128
Minimal load current [a]	0.4	0.6	0.5
Stall Current [a]	11.5	10.6	7.1
Stall Torque [in-oz]	396	488	403
Max Power [W]	15	18	12



Test 2: Failure at Stall

For this test we took two brand new motors and tested them in stall conditions. We locked both the motor and output shaft from spinning using the Tetrix motor mount clamp and a motor hub. Using our standard electrical supply each motor was given 12 volts and up to 100 amps. The motors were deemed to have failed when the current draw fell to zero; the time to failure and case temperature at failure are recorded in the table below:

Motor	NeveRest 40	Tetrix V2
Time to failure [min:sec]	2:54	0:07
Temperature at failure [°f]	190	85*

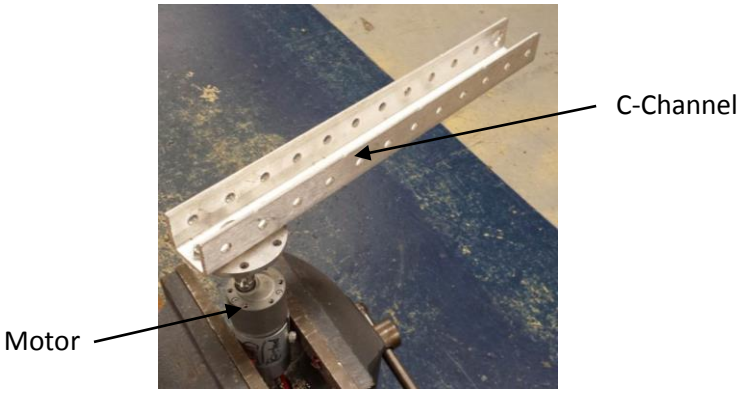
*No change from room temperature

Test 3: Failure of the Gearbox

This test is designed to find the applied torque needed to cause a failure in the gearbox. In this test we secured the motor from spinning with a bolt through the side of the casing. The output shaft was connected to a lever arm where force (F) was applied. With the length of the arm (r) we can find the torque (τ) needed to break the gearbox using the following equation:

$$\tau = (F)(r) \quad (1)$$

The test setup can be seen in the picture below:



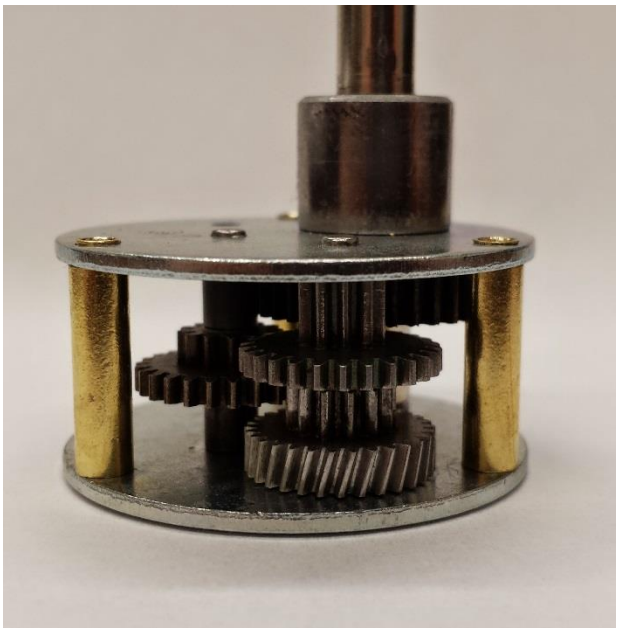
The results from the test are listed in the table below, the force was measured with a force gauge and the torque was calculated using equation (1).

Motor	NeveRest 40	Tetrix V2
Force at failure [lbs]	8.8	7.8
Torque [in-oz]	1480	1420

NeveRest 40 Features

All Steel Gears

All four stages of the NeveRest 40 gearbox use steel gears.



Gearbox without housing

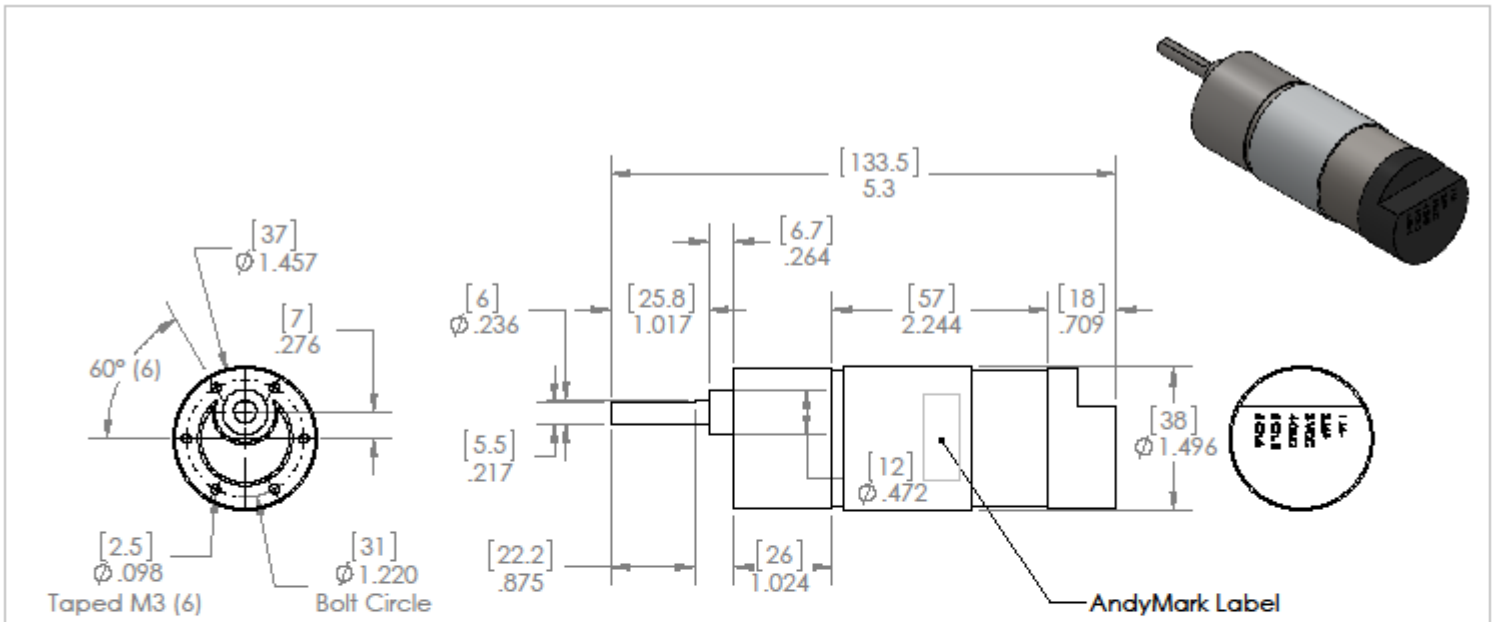
Encoder

Attached Encoder

One of the most exciting features of the NeveRest 40 is its attached encoder. This is built onto the back side of the motor and runs directly off the motor's shaft. Having the encoder mounted to the motor allows us to use an encoder with fewer pulses per revolution (PPR) while still having high resolution at the output shaft. The encoder has 7 PPR; with the 40:1 gearbox, there are 280 PPR of the output shaft. Having a rear mounted encoder frees up a large amount of space on the output shaft for more flexibility with mounting gears and sprockets.

Electrical Connection

The electrical connection to a motor is often an issue, and we worked hard to make sure this motor has a secure and robust connection. The encoder allows us to integrate a wire terminal to secure the wiring for the encoder while the motor's wires will be permanently connected to the motor itself.



Free Speed	160 rpm
Stall Torque	350 oz-in
Stall Current	11.5a
Power	14 W
Gearbox	40:1
Gear material	All Steel
Encoder	520 pulses per revolution

		NAME	DATE
UNLESS OTHERWISE SPECIFIED:			
DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ± ANGULAR: MACH ± BEND ±5° TWO PLACE DECIMAL ±0.010 THREE PLACE DECIMAL ±0.005	DRAWN	DB	7/16/14
	CHECKED		
	ENG APPR.		
	MFG APPR.		
	Q.A.		
INTERPRET GEOMETRIC TOLERANCING PER:	COMMENTS:		
MATERIAL	Dual dimensions are in millimeters		
FINISH			
DO NOT SCALE DRAWING			

AndyMark

TITLE:
NeveRest 40

SIZE	DWG. NO.	REV
A	am-2964	1

SCALE: 1:1.5 WEIGHT: SHEET 1 OF 1

5 4 3 2 1