Motor and Gear Box Selection

The motor chosen for our system would be required to open and close the high pressure flow control needle valve. It had the following requirements:

- Sufficient torque
- Water/splash resistant
- Precision control

Base on those requirements, an Anaheim Automation 23Y65 stepper motor was chosen. To deal with the humid environment, the motor chosen was certified to the IP65 splash proof rating.
The motor has a torque output of 175 oz-inches.

23Y65 - IP65 Rated Sealed Stepper Motors

- *NEMA 23 Frame Size*
- *Splashproof IP65 Sealed Stepper Motor*
- *1.8° Step Angle*
- *High Torque - Up to 262 oz-in*
- *High Step Accuracy and Resolution*
- *Low Vibration and Noise*
- *Can be Customized for*
  - *Winding Current*
  - *Shaft Options*
  - *Cables and Connectors*

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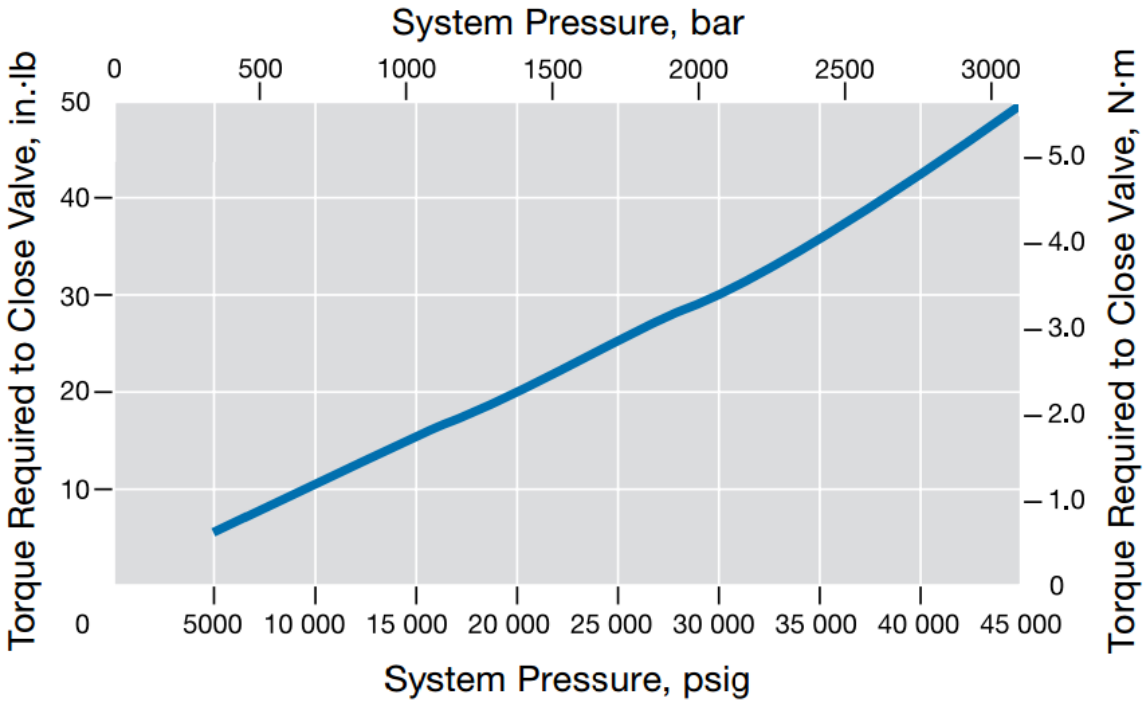
This torque requirement was driven by the opening torque of the valve. This was obtained from the valve manufacturer and is shown below in the following figure:



This plot shows opening torque versus system pressure. At 10000 psi, the opening torque is roughly 175 oz-in, which is equal to the output of our stepper motor.

To increase the torque output and increase the output angular resolution, a 3:1 gear ratio gear box was chosen. This was also manufactured by Anaheim Automation which ensured motor to gear box compatibility.

GBPH-060x-NP - Economy Gearboxes

- *Backlash as Low as 9 arc-min*
- *Gear Ratios from 3 to 100*
- *Available in 1 and 2 Stage Models*
- *Patented Precision Clamping System*
- *Lifetime Lubrication*
- *High Durability*

The 3:1 ratio increased the step resolution from 1.8 degrees to .6 degrees. Also increased was the torque output, which increased from 175 to 525 oz-inches. Both the output torque and step resolution are important for the control of the valve. A

Another important reason for the gearbox was that it increased the radial load capacity of the system. Any side loading from misalignment or other reasons would likely wear out the low load bearing in the motor alone. The gearbox, however, can support much higher radial loads, which ensures the longevity of the system.