

MECHANICAL POWER TRANSMISSION

# Dodge® vertical gearmotor (VGM)

## Lower cost, higher efficiency solution



With expertise, and a comprehensive portfolio of products and life-cycle services, we help value-minded industrial customers improve their energy efficiency and productivity.



— The Dodge VGM utilizes proven, high efficiency planetary gearing technology for optimum performance in a compact platform.

### High efficient, cost effective solution for pumping applications

Low-speed vertical pumping applications with high power requirements are found in a wide range of industries to transport, transfer, and control the discharge and flow of liquids from one point to another. These applications include:

- Pumping stations for flood control and wastewater
- Circulating water used as a cooling agent in power plants and industrial processes
- Desalination plants that convert sea water into potable water
- Irrigation systems that provide water for crops
- Pumping systems for residential and commercial water supplies

Large high pole count motors, or a combination of a horizontal motor with a right angle gear reducer, are typically used in these applications. But these can be large and expensive, and often result in a drastic reduction in efficiency and power factor.

The Dodge vertical gearmotor (VGM) provides an alternative to common vertical pump drive technologies and offers significant benefits when compared to the other systems. The VGM is built on a standard low pole count motor platform utilizing proven, highly efficient Dodge planetary gear technology. This results in a smaller, lighter, cost effective, and highly efficient package.

### The Dodge vertical gearmotor benefits versus high pole vertical motors:

- Higher efficiency with low pole induction motors
- Better power factor with low pole induction motors
- Optimized pump speeds through gear ratios for system efficiency
- Smaller physical size reduces facility requirement
- Less weight reduces freight, handling and support structure costs
- Easy to maintain

## Vertical gearmotor advantages

### Lower pole count induction motor

Not only are low pole count motors more readily available, they also improve system performance. This results in increased system up-time.

### Smaller, lighter, and cost effective

- The Dodge vertical gearmotor has a smaller footprint and is lighter than traditional pump drive systems. Weight differential depends on the application, but is typically 10% to 30% less. This reduces support structure and facility costs.
- The ability to use a lower pole count motor offers a significant cost savings opportunity over high pole count motors. The use of standard 4-6 pole motors increases availability.
- Utilizing the reducer to accommodate thrust loading is more cost effective than designing this functionality into the motor.
- Where an anti-rotation device is required, it is easily incorporated into the vertical gearmotor configuration.

### Higher efficiency and power factor

Lower pole count induction motors offer higher efficiency ratings and power factor than high pole count induction motors. A higher power factor

equates to more efficient use of electrical power and less reactive power drawn by the system.

### Optimal pump shaft speed

By using the specific gear reduction ratio required for your application, vertical gearmotors provide the exact output speed needed. Setting the proper output speed means a more efficient design with higher reliability and maximum pump performance.

### Proper pump speed results in:

- Lower vibration levels
- Decreased radial and axial loads
- Optimal discharge pressure
- Reduced maintenance
- Improved reliability

### Advantages of the vertical gearmotor over the traditional horizontal motor and right angle gear reducer

- Offers a complete package
- Eliminates concerns of misalignment between the motor and gear reducer
- Planetary gearing provides a higher efficiency than the bevel gearing required by a right angle reducer

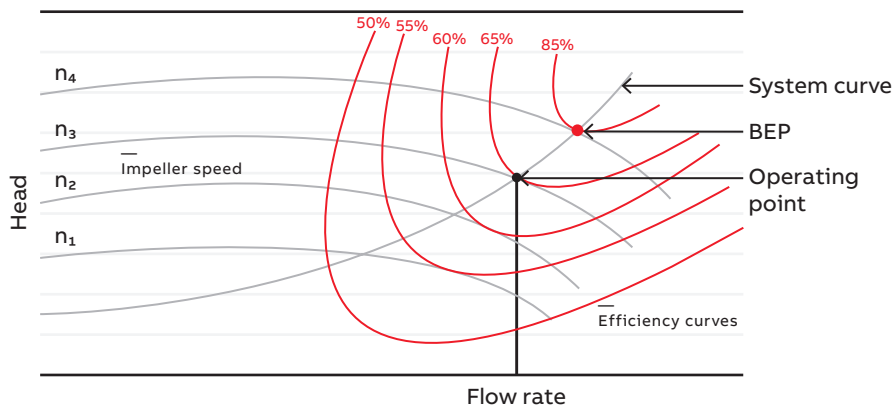
## Reliability and efficiency

Impeller speed is an important factor in determining the operating point of the pump system. Pump performance and reliability is directly related to operation at the Best Efficiency Point (BEP) for the pump. Pumps should be selected to operate at or near the BEP.

Any pump operating higher than the BEP will surge and vibrate, creating bearing and shaft seal problems as well as requiring excessive power.

When a pump operates lower than the BEP, the radial and thrust loading on the rotor increases, causing higher shaft stresses, bearing problems, excessive seal wear, and vibration, resulting in reduced pump life and increased maintenance.

The output speed of the vertical gearmotor is determined by the number of motor poles and the gear reduction ratio. The gear reduction ratio can be selected to provide the optimum output speed when used with the selected motor.



01 VGM planetary gearing provides more pump speed options. This allows the system to operate at or near the Best Efficiency Point resulting in improved performance and increased system efficiency.

## Soft start technology

The start up and shut down sequence of a pump system is often the most demanding condition in the operation of the pump. The resulting hydraulic transient waves create stresses much greater than those experienced by a pump during normal operation. These unstable conditions caused by uncontrolled starts can reduce the pump life by 50%.

Historically, the only methods used to reduce hydraulic instability during startup have been utilization of control valves to slowly prime the system, or the use of variable frequency drives.

Thanks to proven Dodge technology, there is now a better way. Using an optional, hydroviscous clutch, the motor is brought to full speed unloaded, then the pump is slowly engaged using a simple, mechanical, Controlled Start Transmission (CST) system.

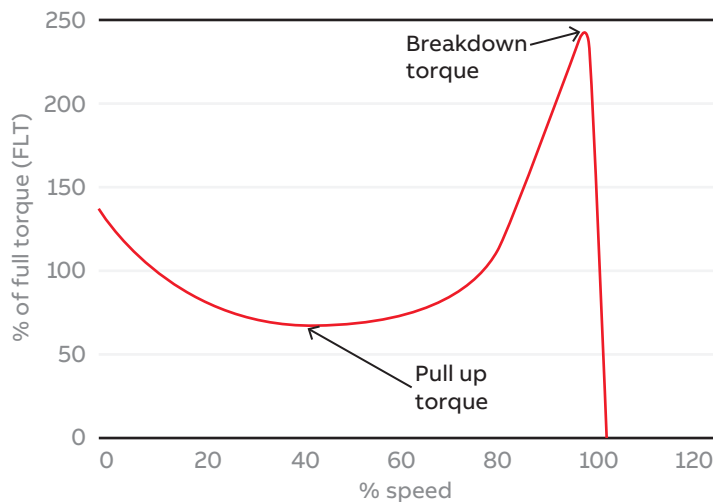
Advantages of the optional CST starting system:

- Reduced surging and lower vibration
- Full breakdown torque of motor is available for starting
- No load starts are easier on the power grid
- Multiple starts are possible by disengaging the clutch and leaving the motor operating
- The clutch acts as a torque limiter to prevent overload damage

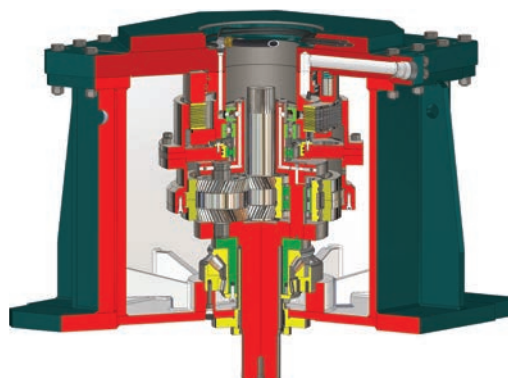
With other soft start systems, the motor must come up to speed while overcoming the pump system inertia load. This means the torque available to start the pump is limited to the pull up torque of the motor. Pull up torque is typically much less than the Full Load Torque (FLT) of a motor.

Using a CST system, the motor comes up to full speed unloaded. When the clutch is engaged the motor moves back up the torque curve and can utilize up to the breakdown torque of the motor. Breakdown torque is normally over 200% of FLT.

02 Using a CST start system, the motor is at full speed prior to loading, therefore the full breakdown torque of the motor is available without a special motor design.



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## Approximate power ratings from 200 kW to 22,000 kW (250 Hp to 30,000 Hp) (Depending on system output speeds)

### Standard Dodge VGM sizes / ratings

VGM size	Torque rating (in.-lbs.)	Torque rating (Nm)	Continuous thrust rating (lbs.)	Continuous thrust rating (Kg)
VGM65	65,000	7,344	6500	2941
VGM300	300,000	34,000	35,000	16,000
VGM550	550,000	62,000	52,000	24,000
VGM1000	1,000,000	113,000	83,000	38,000
VGM1700	1,700,000	192,000	110,000	50,000
VGM2400	2,400,000	271,000	142,000	64,000
VGM4100	4,100,000	463,000	220,000	100,000
VGM7000	7,000,000	790,000	320,000	145,000

Values shown are approximate rating by size.  
 Ratios can be produced to accommodate specific requirements.  
 Approximate design output speed range - 100 to 500 rpm.