

## Altitude Considerations With Pump Operations

Altitude may aid or diminish a pump's performance based upon the principals of specific gravity, atmospheric pressure, and oxygen deprivation.

### 1. Specific Gravity & Atmospheric Pressure Based Upon Altitudes

1. Specific gravity suggests water can be pumped from less than or equal to 26 feet down when operating a pump at sea level because of atmospheric pressure. This depth lessens as altitude increases because of decreasing atmospheric pressures. For every 1,000 feet above sea level that a centrifugal pump is operated, subtract an estimated two feet from the depth of 26 feet. Pump operators will be well served to locate their pump as close to the source of water you are pumping as practically possible.

### 2. Elevation Impacts To Suction Lift

Altitude	Suction Lift (Feet)			
Sea Level	10.0	15.0	20.0	25.0
2000 Feet	8.8	13.2	17.6	22.0
4000 Feet	7.8	11.7	15.6	19.5
6000 Feet	6.9	10.4	13.8	17.3
8000 Feet	6.2	9.3	12.4	15.5
10000 Feet	5.7	8.6	11.4	14.3

### 1. Oxygen Deprivation Based Upon Altitude

1. Gasoline and diesel engines lose approximately 3%-3.5% power for every 1,000 feet of elevation above sea level. Lack of oxygen (thinning of the air or decreasing air density) increases proportionately with altitude increase. Combustion engines that rely on specific oxygen contents for optimal fuel burning and power will slow while power decreases at increasing altitudes. The air mass and air-to-fuel ratio decrease, resulting in a decreased discharge flow (GPM) and head. This is a natural trend that cannot be changed by adjusting the engine.

### 2. Elevation Impacts To Flow (GPM) & Head

Altitude	Discharge Flow (% GPM Loss)	Discharge Head (% Foot Loss)
Sea Level	100%	100%
2000 Feet	97%	95%
4000 Feet	95%	91%
6000 Feet	93%	87%
8000 Feet	91%	83%
10,000 Feet	88%	78%

Some manufacturers offer carburetor modifications to alleviate high altitude issues (hard starting, increased fuel consumption, spark plug fouling, increased emissions due to increased fuel enrichment because of the decreasing air fuel ratio) other than the natural power loss with "High Altitude Carburetor Main Jets".