# Hydraulic System Pressure Drop

## What Is Pressure Drop?

As related to our business, pressure drop is the difference between the pressure of a fluid as it enters one end of a hydraulic hose assembly and the pressure of that fluid as it leaves the other end. There will be a difference in pressure, and it will be less. How much less depends on what is between the beginning and end of the hose assembly. Here are some examples of things that can influence the amount of pressure drop.

1. FRICTION — This is the rubbing of fluid against the inside walls of the hose assembly.
2. TYPE OF FLUID — Different fluids behave differently under pressure. Thicker fluids are moved with greater difficulty and will exhibit greater pressure drop.
3. TEMPERATURE OF THE FLUID — Warming fluid thins it so it flows more easily, as with automotive oil.
4. LENGTH OF HOSE ASSEMBLY — The longer it is, the more surface there is for friction to decrease pressure.
5. SIZE (I.D.) OF HOSE — Affects the fluid velocity for a given flow rate. Higher velocities result in greater pressure drop. Therefore, a larger I.D. hose will produce less pressure drop.
6. TYPE OF COUPLINGS & ADAPTERS — Any change in bore or change in direction (such as with 45° or 90° elbows) can increase the amount of pressure drop.
7. FLOW RATE — Pressure drop increases with flow rate for same size hose.

## Who Cares About Pressure Drop?

Suppose you need 4,000 psi of output from a hose assembly for hydraulic equipment to run efficiently. There will be some pressure drop and you must allow for it in helping to plumb the system with Gates hose, couplings and adapters. This means that the input pressure to the hose assembly must be equal to the output plus the amount of pressure drop. If the pressure drop in this example is 150 psi, then you will need 4,150 psi of input.

## How Can You Determine The Amount Of Pressure Drop?

That's the easy part of it. Contact your local Gates representative who is trained and equipped to quickly solve such problems for you. He will need input variables and fittings used from you as shown (see below). A Gates Pressure Drop analysis printed below will then be provided for your application.

## Sample Pressure Drop Analysis

**Input Variables:**

Flow Rate: 15 (GPM)

Viscosity: 20.0 (Centistokes)

Specific Gravity: 0.85

Free Hose Length: 20.0 (ft)

**Fittings Used:**

1. Standard Straight Fitting
2. 90-degree Angle Coupling

| Dash Size (1/16") | Velocity (Ft/Sec) | Hose Pressure Drop (psi/Ft) | Total Pressure Drop-Hose & Fittings (psi) | (1) Reynolds Number | (2) Heat Gain (BTUH) | (3) Horse-power Loss |
|---|---|---|---|---|---|---|
| 5 | 62.8 | 28.8 | 789.6 | 7584 | 17483 | 6.87 |
| 6 | 43.6 | 12.2 | 399.1 | 6320 | 8838 | 3.47 |
| 8 | 24.5 | 3.2 | 81.3 | 4740 | 1801 | 0.71 |
| *10 | 15.7 | 1.1 | 31.2 | 3792 | 691 | 0.27 |
| 12 | 10.9 | 0.5 | 12.7 | 3160 | 280 | 0.11 |
| 16 | 6.1 | 0.1 | 2.6 | 2730 | 58 | 0.02 |
| 20 | 3.9 | 0.0 | 0.8 | 1896 | 18 | 0.01 |

*Recommended hose size, based on velocity, pressure drop, heat gain and hp loss.

(1) **Reynolds Number** = $\frac{\text{inertia flow forces}}{\text{friction forces (or viscosity)}}$ indicates the type of flow.

| Reynolds No. Range | Type of Flow |
|---|---|
| 0–2000 | Laminar |
| 2000–3000 | Transient |
| 3000 + | Turbulent |

(2) **Heat Gain** is the total amount of energy converted to heat energy that will raise the fluid temperature if it is not dissipated.

(3) **Horsepower Loss** is a measure of the conversion of mechanical energy to heat energy and is related to system heat gain.