

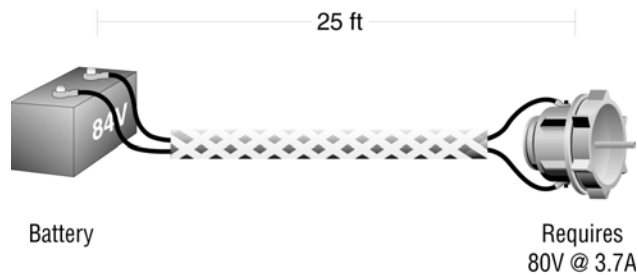
## Voltage Drop, Ampacity and Wire Size Selection.

The following example will describe how to select the correct wire size for your application.

1. First disregard the NEC ampacity tables.
2. These tables refer to the requirements for the safe wiring of buildings with specific types of wire and allow for certain temperature rises. This is generally not valid for most of our customer's applications.
3. It is necessary to know the following:

The acceptable voltage drop  
Current the wire will carry  
The length of the wire

### Example



Using Ohm's law  
Where:

$V=IR$   
 $V=$  Voltage (Volts)  
 $I=$  Current (Amps)  
 $R=$  Resistance (Ohms)

The maximum allowable voltage drop

$$V_{\text{drop}} = V_{\text{source}} - V_{\text{minimum load}}$$
$$= 84V - 80V = 4V$$

The current required is 3.7A

The total length of wire in this case is the distance from the source to the load and back again. In this case it's 25 ft twice giving a total of 50 ft.

Given a current of 3.7A the maximum resistance allowable:

$$V / I = R \quad 4 / 3.7 = 1.08 \text{ Ohms}$$

Find a conductor that will have a resistance equal to or lower than 1.08 Ohms per 50 ft.

Wire tables always give the conductor resistance in Ohms per 1000 feet. We need to convert the 1.08 Ohms per 50 ft to the value of Ohms per 1000 feet.

1.08 Ohms/50 ft where  $1.08/50 = .0216$  Ohms per ft  
 $.0216 \text{ Ohms/ft} \times 1,000 \text{ ft} = 21.6 \text{ Ohms} / 1,000 \text{ ft}$

From the Wire Table, select a conductor with a Resistance lower than 21.6 Ohms/ 1,000 FT.

### WIRE TABLE

AWG	Stranding	DC Resistance (Ohms/M Ft @ 20°C)
20	7/28	9.76
22	19/34	14.8
24	19/36	23.6

Note: M FT = 1,000 FT

Looking at the conductor tables we find that 22 AWG or larger will suffice.

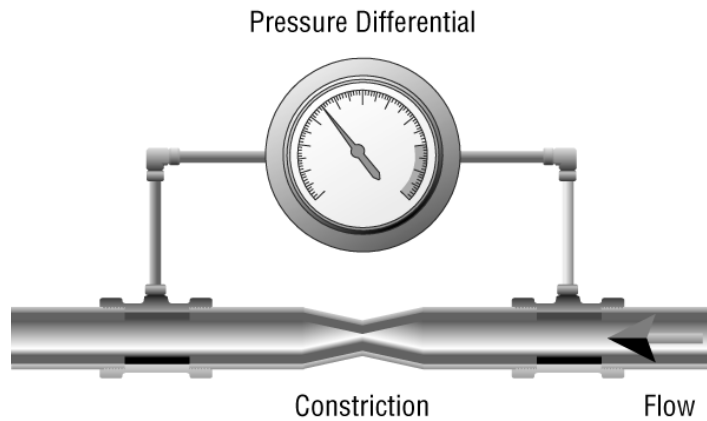
The stranding will be determined by the application.

## Understanding V, I & R in terms of hydraulics

Voltage, Current and Resistance can be thought of in terms of fluids where:

Voltage (V)	=	Pressure
Current (I)	=	Flow Rate
Resistance (R)	=	Constriction

For Example:



## Resistance Question

We have a device to be attached at the end of a cable. It requires at 4.6 to 5.2 VDC supply at 120 mA. The source supplies 5.0V exactly. We need 65 ft of cable between the load and the source. What gage of wire should we be using?

## Answer

1. Acceptable voltage drop across the cable is  $5.0V - 4.6V = 0.4V$
2. Current 0.120A
3. Wire length is 65 feet times 2 (for both ways)
4.  $R=V/I=0.4/.120= 3.3$  Ohms
5. Total Resistance to device and back is 3.3 Ohms per 2 x 65', 3.3 Ohms/130 ft
6.  $3.3 \text{ Ohms}/130\text{ft}= .02564 \text{ Ohms}/\text{ft}$  This is 25.64 Ohms/1,000'
7. From Wire Table find the conductor with a resistance of 25.64 or less.
8. Use 24AWG or Larger.