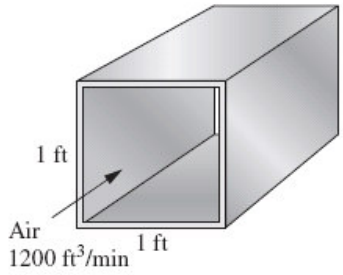
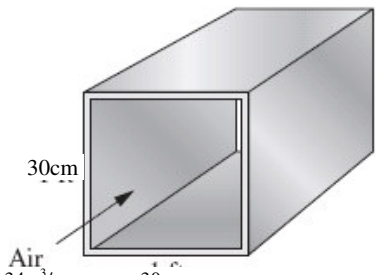

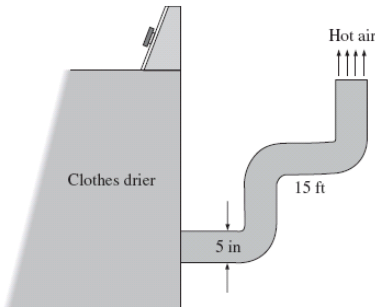
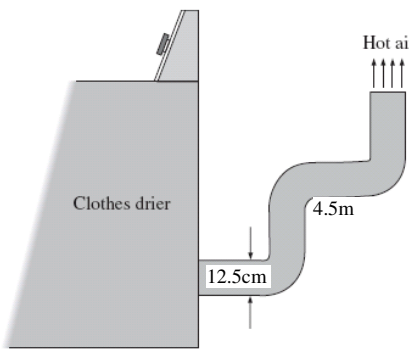
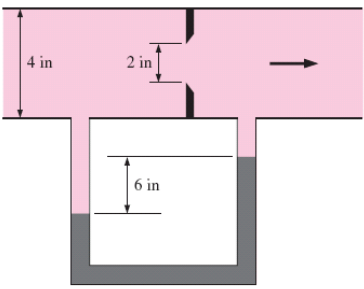
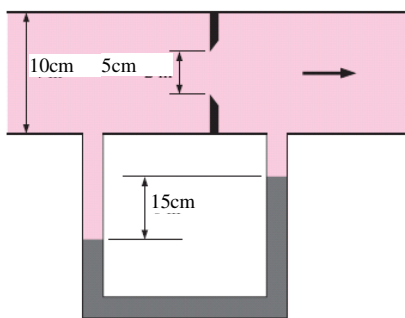
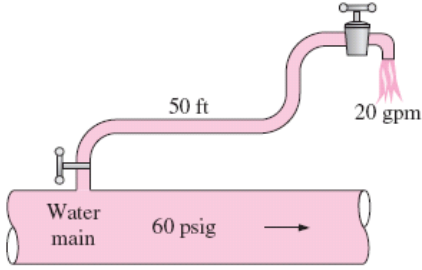
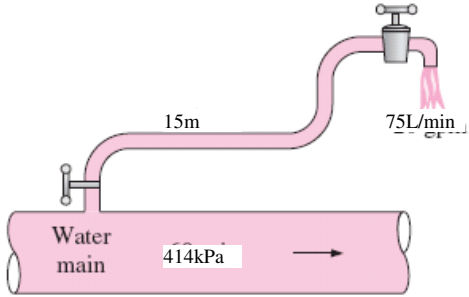
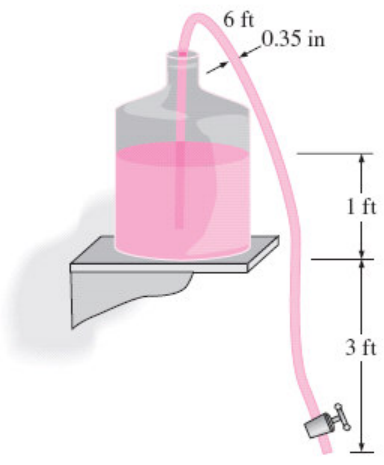
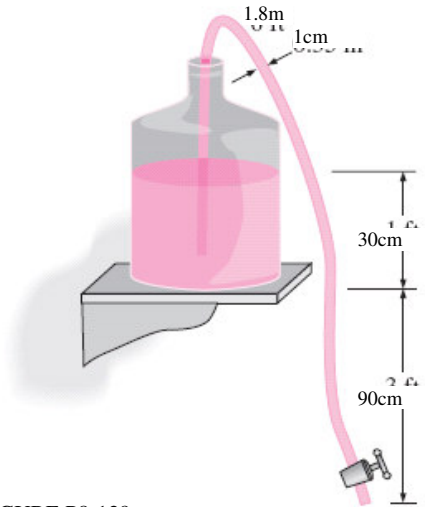



Page No	Current version	Corrected version
387	<p>8-29E Oil at 80°F (<math>\rho = 56.8 \text{ lbm/ft}^3</math> and <math>\mu = 0.0278 \text{ lbm/ft} \cdot \text{s}</math>) is flowing steadily in a 0.5-in-diameter, 120-ft-long pipe. During the flow, the pressure at the pipe inlet and exit is measured to be 120 psi and 14 psi, respectively. Determine the flow rate of oil through the pipe assuming the pipe is (a) horizontal, (b) inclined 20° upward, and (c) inclined 20° downward.</p>	<p>8-29 Oil at 26.67°C (<math>\rho = 909.8 \text{ kg/m}^3</math> and <math>\mu = 0.0413 \text{ N}\cdot\text{s/m}^2</math>) is flowing steadily in a 1.25cm diameter, 36.5m long pipe. During the flow, the pressure at the pipe inlet and exit is measured to be 827kPa and 96kPa, respectively. Determine the flow rate of oil through the pipe assuming the pipe is (a) horizontal, (b) inclined 20° upward and (c) inclined 20° downward.</p>
387	<p>8-33E Heated air at 1 atm and 100°F is to be transported in a 400-ft-long circular plastic duct at a rate of 12 ft<sup>3</sup>/s. If the head loss in the pipe is not to exceed 50 ft, determine the minimum diameter of the duct.</p>	<p>8-33 Heated air at 1 atm and 38°C is to be transported in a 120m long circular plastic duct at a rate of 340L/s. If the head loss in the pipe is not to exceed 15m, determine the minimum diameter of the duct.</p>
388	<p>8-42E Water at 60°F passes through 0.75-in-internal-diameter copper tubes at a rate of 1.2 lbm/s. Determine the pumping power per ft of pipe length required to maintain this flow at the specified rate.</p>	<p>8-42 Water at 15.5°C passes through 2cm internal diameter copper tubes at a rate of 0.54kg/s. Determine the pumping power per meter of pipe length required to maintain this flow at the specified rate.</p>
388	<p>8-48E Air at 1 atm and 60°F is flowing through a 1 ft × 1 ft square duct made of commercial steel at a rate of 1200 cfm. Determine the pressure drop and head loss per ft of the duct.</p>	<p>8-48 Air at 1 atm and 15.5°C is flowing through a 30cm x 30cm square duct made of commercial steel at a rate of 34m<sup>3</sup>/s. Determine the pressure drop and head loss per meter of the duct.</p>
388	 <p style="text-align: center;"><b>FIGURE P8-48E</b></p>	 <p style="text-align: center;"><b>FIGURE P8-48</b></p>
390	<p>8-69E Water at 70°F flows by gravity from a large reservoir at a high elevation to a smaller one through a 120-ft-long, 2-in-diameter cast iron piping system that includes four standard flanged elbows, a well-rounded entrance, a sharp-edged exit, and a fully open gate valve. Taking the free surface of the lower reservoir as the reference level, determine the elevation <math>z_1</math> of the higher reservoir for a flow rate of 10 ft<sup>3</sup>/min. <i>Answer: 23.1 ft</i></p>	<p>8-69 Water at 21°C flows by gravity from a large reservoir at a high elevation to a smaller one through a 36.5m long 5cm diameter cast iron piping system that includes four standard flanged elbows, a well-rounded entrance, a sharp-edged exit, and a fully open gate valve. Taking the free surface of the lower reservoir as</p>

		the reference level, determine the elevation $z_1$ of the higher reservoir for a flow rate of 280L/min.
391	<p>8-76E A farmer is to pump water at 70°F from a river to a water storage tank nearby using a 125-ft-long, 5-in-diameter plastic pipe with three flanged 90° smooth bends. The water velocity near the river surface is 6 ft/s, and the pipe inlet is placed in the river normal to the flow direction of water to take advantage of the dynamic pressure. The elevation difference between the river and the free surface of the tank is 12 ft. For a flow rate of 1.5 ft<sup>3</sup>/s and an overall pump efficiency of 70 percent, determine the required electric power input to the pump.</p>	<p>8-76 A farmer is to pump water at 21°C from a river to a water storage tank nearby using a 38m long, 13cm diameter plastic pipe with three flanged 90° smooth bends. The water velocity near the river surface is 1.8m/s, and the pipe inlet is placed in the river normal to the flow direction of water to take advantage of the dynamic pressure. The elevation difference between the river and the free surface of the tank is 3.65m. For a flow rate of 42L/s and an overall pump efficiency of 70 percent, determine the required electric power input to the pump.</p>
391	<p>8-77E  Reconsider Prob. 8-76E. Using EES (or other) software, investigate the effect of the pipe diameter on the required electric power input to the pump. Let the pipe diameter vary from 1 to 10 in, in increments of 1 in. Tabulate and plot the results, and draw conclusions.</p>	<p>8-77 Reconsider Prob. 8-76. Using EES (or other) software, investigate the effect of the pipe diameter on the required electric power input to the pump. Let the pipe diameter vary from 2.5cm to 25cm, in increments of 2.5cm. Tabulate and plot the results, and draw conclusions.</p>
392	<p>8-86E A clothes dryer discharges air at 1 atm and 120°F at a rate of 1.2 ft<sup>3</sup>/s when its 5-in-diameter, well-rounded vent with negligible loss is not connected to any duct. Determine the flow rate when the vent is connected to a 15-ft-long, 5-in-diameter duct made of galvanized iron, with three 90° flanged smooth bends. Take the friction factor of the duct to be 0.019, and assume the fan power input to remain constant.</p>	<p>8-86 A clothes dryer discharges air at 1 atm and 50°C at a rate of 34L/s when its 12.5cm, well-rounded vent with negligible loss is not connected to any duct. Determine the flow rate when the vent is connected to a 4.5m long, 12.5cm diameter duct made of galvanized iron, with three 90° flanged smooth bends. Take the friction factor of the duct to be 0.019, and assume the fan power input to remain constant.</p>
392	 <p>FIGURE P8-86E</p>	 <p>FIGURE P8-86</p>

393	<p><b>8-100E</b> An orifice with a 2-in-diameter opening is used to measure the mass flow rate of water at 60°F (<math>\rho = 62.36 \text{ lbm/ft}^3</math> and <math>\mu = 7.536 \times 10^{-4} \text{ lbm/ft} \cdot \text{s}</math>) through a horizontal 4-in-diameter pipe. A mercury manometer is used to measure the pressure difference across the orifice. If the differential height of the manometer is read to be 6 in, determine the volume flow rate of water through the pipe, the average velocity, and the head loss caused by the orifice meter.</p>	<p><b>8-100</b> An orifice with a 5cm diameter opening is used to measure the mass flow rate of water at 15.5°C (<math>\rho = 1000 \text{ kg/m}^3</math> and <math>\mu = 0.001121 \text{ N} \cdot \text{s/m}^2</math>) through a horizontal 10cm diameter pipe. A mercury manometer is used to measure the pressure difference across the orifice. If the differential height of the manometer is read to be 15cm, determine the volume flow rate of water through the pipe, the average velocity, and the head loss caused by the orifice meter.</p>
393	 <p style="text-align: center;"><b>FIGURE P8-100E</b></p>	 <p style="text-align: center;"><b>FIGURE P8-100</b></p>
393	<p><b>8-101E</b> Repeat Prob. 8-100E for a differential height of 9 in.</p>	<p><b>8-101</b> Repeat Prob. 8-100 for a differential height of 23cm.</p>
395	<p><b>8-111E</b> The volume flow rate of liquid refrigerant-134a at 10°F (<math>\rho = 83.31 \text{ lbm/ft}^3</math>) is to be measured with a horizontal Venturi meter with a diameter of 5 in at the inlet and 2 in at the throat. If a differential pressure meter indicates a pressure drop of 7.4 psi, determine the flow rate of the refrigerant. Take the discharge coefficient of the Venturi meter to be 0.98.</p>	<p><b>8-111</b> The volume flow rate of liquid refrigerant-134a at -12°C (<math>\rho = 1334.5 \text{ kg/m}^3</math>) is to be measured with a horizontal venturi meter with a diameter of 12.5cm at the inlet and 5cm at the throat. If a differential pressure meter indicates a pressure drop of 51kPa, determine the flow rate of the refrigerant. Take the discharge coefficient of the venturi meter to be 0.98.</p>
395	<p><b>8-115E</b> The velocity profile in a fully developed laminar flow of water at 40°F in a 80-ft-long horizontal circular pipe, in ft/s, is given by <math>u(r) = 0.8(1 - 625r^2)</math>, where <math>r</math> is the radial distance from the centerline of the pipe in ft. Determine (a) the volume flow rate of water through the pipe, (b) the pressure drop across the pipe, and (c) the useful pumping power required to overcome this pressure drop.</p>	<p><b>8-115</b> The velocity profile in a fully developed laminar flow of water at 5°C in a 24m long horizontal circular pipe, in m/s is given by <math>u(r) = 0.8(1 - 625r^2)</math>, where <math>r</math> is the radial distance from the centerline of the pipe in m. Determine (a) the volume flow rate of water through the pipe, (b) the pressure drop across the pipe, and (c) the useful pumping power required to overcome this pressure drop.</p>
395	<p><b>8-116E</b> Repeat Prob. 8-115E assuming the pipe is inclined 12° from the horizontal and the flow is uphill.</p>	<p><b>8-116</b> Repeat Prob. 8-115 assuming the</p>

		pipe is inclined $12^\circ$ from the horizontal and the flow is uphill.
396	<p>8-125E A water fountain is to be installed at a remote location by attaching a cast iron pipe directly to a water main through which water is flowing at <math>70^\circ\text{F}</math> and 60 psig. The entrance to the pipe is sharp-edged, and the 50-ft-long piping system involves three <math>90^\circ</math> miter bends without vanes, a fully open gate valve, and an angle valve with a loss coefficient of 5 when fully open. If the system is to provide water at a rate of 20 gal/min and the elevation difference between the pipe and the fountain is negligible, determine the minimum diameter of the piping system. <i>Answer: 0.76 in</i></p>	<p>8-125 A water fountain is to be installed at a remote location by attaching a cast iron pipe directly to a water main through which water is flowing at <math>21^\circ\text{C}</math> and 414kPa. The entrance to the pipe is sharp-edged, and the 15m long piping system involves three <math>90^\circ</math> miter bends without vanes, a fully open gate valve, and an angle valve with a loss coefficient of 5 when fully open. If the system is to provide water at a rate of 75L/min and the elevation difference between the pipe and the fountain is negligible, determine the minimum diameter of the piping system.</p>
396	 <p><b>FIGURE P8-125E</b></p>	 <p><b>FIGURE P8-125</b></p>
397	8-126E Repeat Prob. 8-125E for plastic pipes.	8-126 Repeat Prob. 8-125 for plastic pipes.
397	<p>8-129E The drinking water needs of an office are met by large water bottles. One end of a 0.35-in-diameter, 6-ft-long plastic hose is inserted into the bottle placed on a high stand, while the other end with an on/off valve is maintained 3 ft below the bottom level of the bottle. If the water level in the bottle is 1 ft when it is full, determine how long it will take to fill an 8-oz glass (= 0.00835 ft<sup>3</sup>) (a) when the bottle is first opened and (b) when the bottle is almost empty. Take the total minor loss coefficient, including the on/off valve, to be 2.8 when it is fully open. Assume the water temperature to be the same as the room temperature of <math>70^\circ\text{F}</math>. <i>Answers: (a) 2.4 s, (b) 2.8 s</i></p>	<p>8-129 The drinking water needs of an office are met by large water bottles. One end of a 1cm diameter, 1.8m long plastic hose is inserted into the bottle placed on a high stand, while the other end with an on/off valve is maintained 90cm below the bottom of the bottle. If the water level in the bottle is 30cm when it is full, determine how long it will take to fill a 250ml glass (a) when the bottle is first opened and (b) when the bottle is almost empty. Take the total minor loss coefficient, including the on/off valve to be 2.8 when it is fully open. Assume the water temperature to be the same as the room temperature of <math>21^\circ\text{C}</math>.</p>

<p>397</p>	 <p><b>FIGURE P8-129E</b></p>	 <p><b>FIGURE P8-129</b></p>
<p>397</p>	<p>8-130E  Reconsider Prob. 8-129E. Using EES (or other) software, investigate the effect of the hose diameter on the time required to fill a glass when the bottle is full. Let the diameter vary from 0.2 to 2 in. in increments of 0.2 in. Tabulate and plot the results.</p>	<p>8-130 Reconsider Prob. 8-129. Using EES (or other) software, investigate the effect of the hose diameter on the time required to fill a glass when the bottle is full. Let the diameter vary from 0.5cm to 5cm in increments of 0.5cm. Tabulate and plot the results.</p>
<p>397</p>	<p>8-131E Reconsider Prob. 8-129E. The office worker who set up the siphoning system purchased a 12-ft-long reel of the plastic tube and wanted to use the whole thing to avoid cutting it in pieces, thinking that it is the elevation difference that makes siphoning work, and the length of the tube is not important. So he used the entire 12-ft-long tube. Assuming the turns or constrictions in the tube are not significant (being very optimistic) and the same elevation is maintained, determine the time it takes to fill a glass of water for both cases.</p>	<p>8-131 Reconsider Prob. 8-129. The office worker who set up the siphoning system purchased a 3.6m long reel of the plastic tube and wanted to use the whole thing to avoid cutting it in pieces, thinking that it is the elevation difference that makes siphoning work and the length of the tube is not important. So he used the entire 3.6m long tube. Assuming the turns or constrictions in the tube are not significant (being very optimistic) and the same elevation is maintained, determine the time it takes to fill a glass of water for both cases.</p>