MET330
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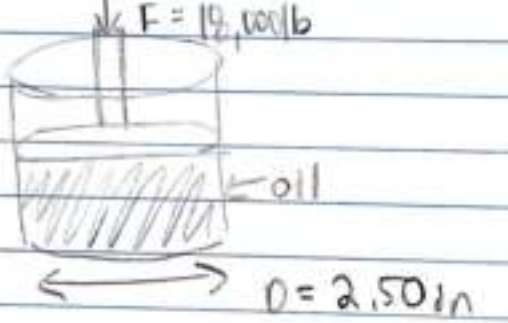
1.48. A coining press is used to produce commemorative coins with the likenesses of all the U.S. presidents. The coining process requires a force of 19,000lb. The hydraulic cylinder has a diameter of 2.50in. Compute the required oil pressure.

Purpose:
Compute the required oil pressure produced by hydraulic cylinder at 19,000lb and 2.50in diameter

Drawing:



Sources:
Mott, Robert L; Untener, Joseph A., Applied Fluid Mechanics 7th - 2015. Pearson Education NY, NY

Design Considerations:
1) Incompressible Fluid
2) Isothermal Process

Data and Variables
F = 19,000lb
D = 2.50in

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Procedure:

$p = \frac{F}{A}$

$A = \frac{\pi}{4} \cdot D^2$

Calculations:

$A = \frac{\pi}{4} \cdot (2.50)^2 = 4.909 in^2$

$p = \frac{F}{A} = \frac{18,000 lbf}{4.909 in^2} = 3,666.73 lbf/in^2 = psi$

$\boxed{p = 3,666.73 psi}$

Summary:

The pressure exerted/required by the hydraulic cylinder is 3,666.73 psi.

Materials:
Oil

Analysis:
1) If piston diameter increases, pressure decreases
2) If applied force increases, pressure increases.

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1.107 Alcohol has a specific gravity of 0.79. Calculate its density in both slugs/ft^3 and g/cm^3

Purpose:
To calculate density of alcohol with sg of 0.79 in slugs/ft^3 and g/cm^3.

Drawing:
N/A

Sources:
Mott, Robert L., Untener, Joseph A., Applied Fluid Mechanics, 7th -2015. Pearson Education. NY, NY
endmemo.com (converter)

Design Considerations:
1) Incompressible fluid
2) Isothermal process

Data and Variables:
SG = 0.79
$SG = \frac{\rho_s}{1000 kg/m^3}$
$SG = \frac{\rho_s}{1.94 \text{ slugs}/ft^3}$

$1 kg/m^3 = 0.001 g/cm^3$

Summary: Alcohol at 0.79 sg is equivalent to 1.533 slugs/ft^3 and 0.79 g/cm^3

Procedure:
N/A

Materials:
Alcohol

Analysis:
1) The higher the sg, the higher the equivalent value

Calculations:

$0.79 = \frac{\rho_s}{1.94 \text{ slugs}/ft^3}$

$\rho_{alcohol} = 1.533 \text{ slugs}/ft^3$

$0.79 = \frac{\rho_{alcohol}}{1000 kg/m^3} \cdot \frac{1 kg/m^3}{0.001 g/cm^3}$

$\rho_{alcohol} = 0.79 g/cm^3$

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2.18 Appendix D gives dynamic viscosity for a variety of fluids as a function of temperature. Using this appendix, give the value of the viscosity for the following fluids

Water at 40°C

Purpose:
Find dynamic viscosity of water at 40°C

Drawing:
See Appendix

Sources:
Mott, Robert L.; Untener, Joseph A, Applied Fluid Mechanics, 7th - 2015. Pearson Education. NY, NY

Design Considerations:
1) Incompressible Fluid
2) Isothermal Process

Materials:
Water

Data and Variables:
Temperature = 40°C

Analysis:
The higher the temperature, the lower the viscosity.

Procedure:
N/A

Calculations:
Approx 6.5×10^{-4} N·s/m² or Pa·s

Summary:
Water at 40°C has a dynamic viscosity of 6.5×10^{-4} N·s/m³

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2.27 Appendix D gives dynamic viscosity for a variety of fluids as a function of temperature. Using this appendix, give the value of the viscosity for the following fluids:

Hydrogen at 40°F

Purpose:
Find dynamic viscosity of hydrogen at 40°F

Drawing:
See Appendix

Sources:
Mott, Robert L.; Untener, Joseph A, Applied Fluid Mechanics, 7th, 2015. Pearson Education. NY, NY.

Design Considerations:
1) Incompressible fluid
2) Isothermal process

Materials:
Hydrogen

Analysis:
The higher the temperature, the higher the viscosity.

Data and Variables:
Temperature = 40°F

Procedure:
N/A

Calculations:
Approx 1.85×10^{-7} lb·s/ft²

Summary:
Hydrogen at 40°F has a dynamic viscosity of 1.85×10^{-7} lb·s/ft²