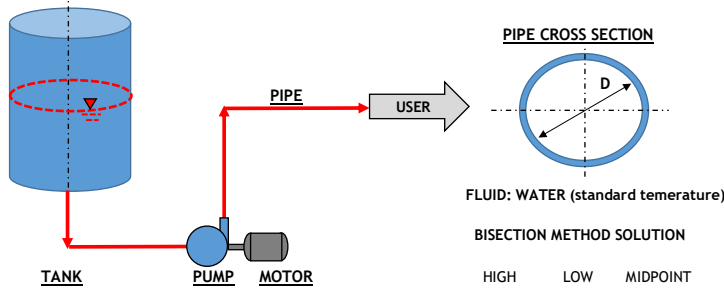
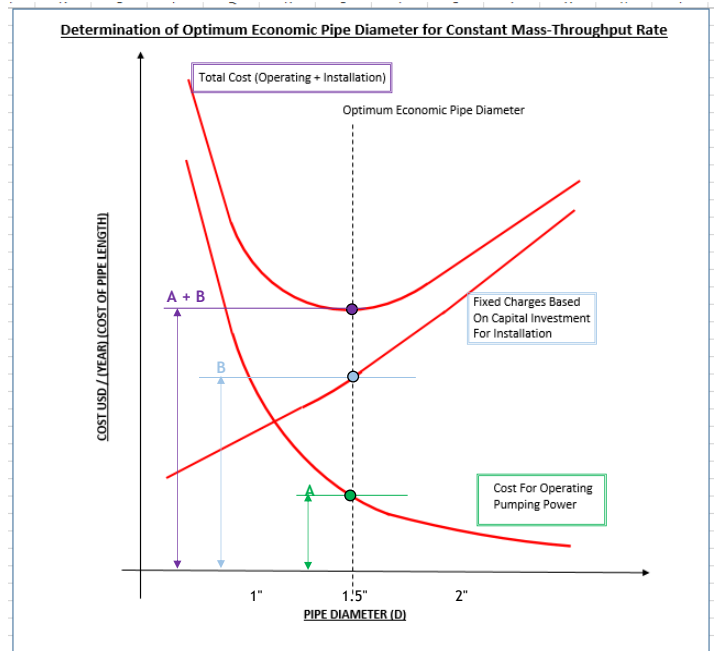


How Pi (π) is used in our Energy Calculations with Fluid Hydraulic Pump Head

NOTE: $\pi = 3.1416...$



Pipe Fluid Flow Velocity	Run # 1			Run # 2			Run # 3			Units
	Run # 1	Run # 2	Run # 3	HIGH INPUT OUTPUT	LOW INPUT OUTPUT	MIDPOINT INPUT OUTPUT	Run # 1	Run # 2	Run # 3	
Constant Flow Rate (Q) (GIVEN)	30	30	30	0.0668	0.0668	0.0668				Cu Ft Sec
Inside Pipe Diameter (d) = (GIVEN)	1	2	1.5	0.0833	0.1667	0.1250				Ft
Pipe Installed Cost/Foot = (GIVEN)	\$15.00	\$30.00	\$22.50							\$/ Ft
Pipe Equivalent Length = (GIVEN)				1,000	1,000	1,000				Ft
Pipe Installed Cost (est) (GIVEN)				\$15,000	\$30,000	\$22,500				\$
Fluid Velocity (v) = $\frac{Q * 4}{\pi D^2}$ (FIND)				12.2	3.1	5.4				Ft Sec
Fluid Density (ro) = (GIVEN)				62.4	62.4	62.4				Lbs Cu Ft
Fluid Viscosity (cP) = (GIVEN)				1	1	1				cP
Reynolds Number (Nre) = $\frac{\text{Lbs}}{\text{Cu Ft}} \frac{\text{CuFt} * 4}{\pi D^2} \frac{D}{\text{Viscosity}}$ (FIND)				9.46E+04	5.91E+03	1.87E+04				N/A
Fluid Specific Gravity (SG) (GIVEN)				1.00E+00	1.00E+00	1.00E+00				N/A
Friction Factor (f) = $1.8 \text{ LOG} \frac{Nre}{7}^{-2}$ (FIND)				0.1055	0.2101	0.1533				N/A
Pressure Drop (Ft/1,000) = $0.0311 f 1,000' Q^2 / d^5$ (FIND)				2952.4	183.8	565.1				Ft/1,000'
Pump Efficiency (ep) = (GIVEN)				0.70	0.70	0.70				N/A
Pump Brake Horsepower (BHp) = $Q^2 \text{Ft}^3 \text{SG} / 3,960 / \text{ep}$ (FIND)				32.0	2.0	6.1				BHp
Motor Efficiency (em) = (GIVEN)				0.65	0.65	0.65				N/A
Pump Motor Horsepower (MHP) = BHp / em = (FIND)				49.2	3.1	9.4				MHp
Pump Motor Horsepower (MHP) = BHp / em = (TABLE)				50	5	10				MHp
Pump Motor Energy (W) = MHP * 745.7 Watts/Hp (FIND)				36,657	2,282	7,016				Watts
Pump Motor Installed Cost = \$ = (TABLE)				\$20,000	\$2,000	\$4,000				\$
Pump Motor Operating Cost = \$ per 1,000 Hrs. = (FIND)				\$2,566	\$160	\$491				\$
System Installed & Operating Cost = \$ = (FIND)				\$37,566	\$32,160	\$26,991				\$
System Carbon Footprint (CFP) = Lbs CO2 / 1,000 Hr = (FIND)				35	2	7				CFP
Most Sustainable (OPTIMUM) = (FIND)				HighCO2	High \$	Yes, CO2+\$				



INPUT DATA:

OUTPUT DATA:

ANSWER:

STANDARD PUMP MOTOR HORSEPOWER & COST (estimated) TABLE

0.25 Hp	\$100	3 Hp	\$1,200	25 Hp	\$10,000	100 Hp	\$40,000
0.5 Hp	\$200	5 Hp	\$2,000	30 Hp	\$12,000	125 Hp	\$50,000
0.75 Hp	\$300	7.5 Hp	\$3,000	40 Hp	\$16,000	150 Hp	\$60,000
1 Hp	\$400	10 Hp	\$4,000	50 Hp	\$20,000	200 Hp	\$80,000
1.5 Hp	\$600	15 Hp	\$6,000	60 Hp	\$24,000	250 Hp	\$100,000
2 Hp	\$800	20 Hp	\$8,000	75 Hp	\$30,000	300 Hp	\$120,000

41.6667

