

---

---

# **CSU IAC Case Study Example 2: Plant 582: A Beverage Container Manufacturer**

# CSU IAC PLANT 582

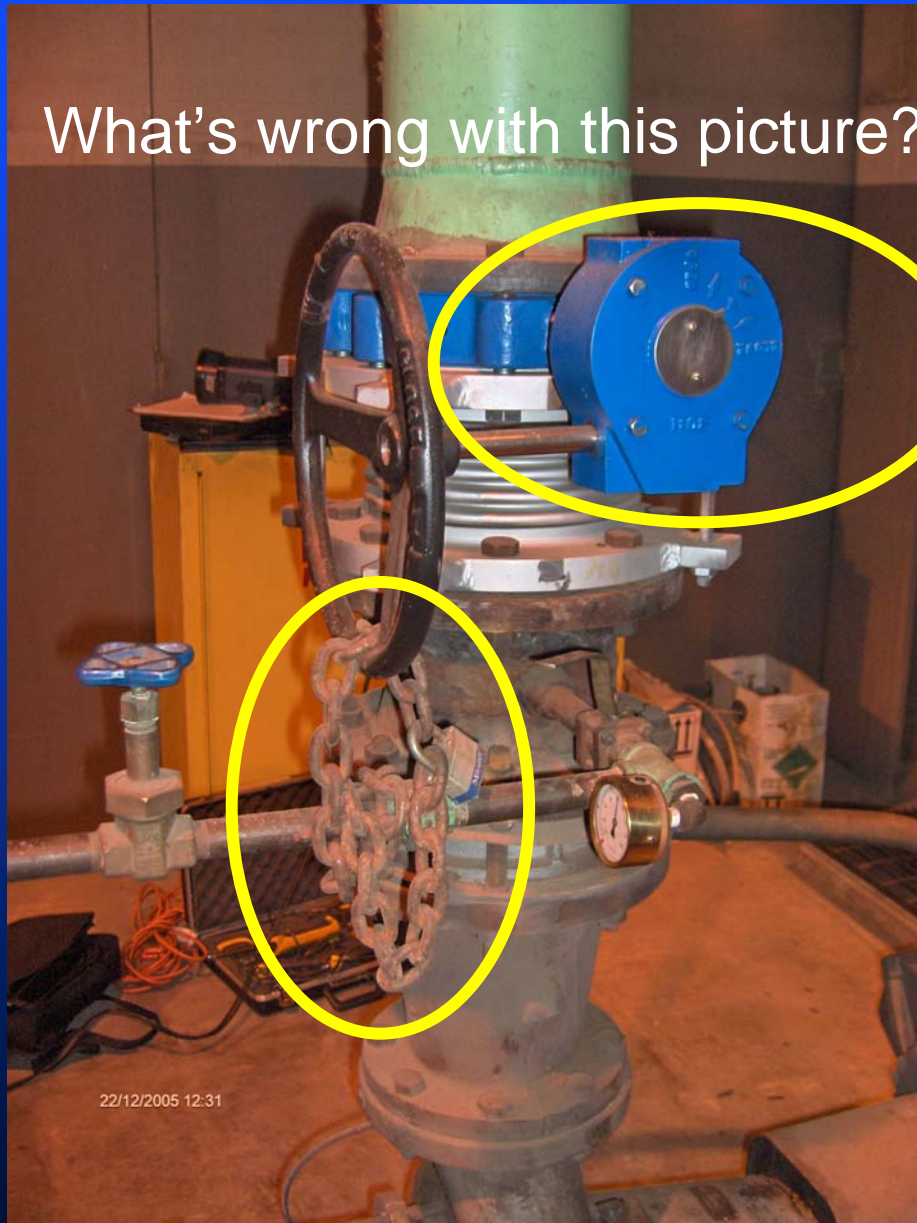
---

---

- **Manufacturer of beverage containers**
- **Plant area: 336,000 ft<sup>2</sup>**
- **100,000,000 kW annual energy consumption**
  - **about 11 MW peak demand**
- **Annual electricity costs: \$4.6 million/yr**
- **Estimated 10,000 hp of motors**
- **Two 1,000 hp, one 900 hp, and three 700 hp centrifugal air compressors**
- **4 cooling water/tower pumps for air compressors**
  - **60 hp each**

# CSU IAC PLANT 582: COOLING WTR PUMPS

What's wrong with this picture?



# CSU IAC PLANT 582: COOLING WTR PUMPS



Pump No. 1 (M30):

The cooling water pump is powered by a Baldor Super-E 60 hp motor (Cat. No. ECP4314T-4, rated at 460V, 71 A, 1,780 rpm, 94.5% efficiency).

The pump is an Allis-Chalmers Model 2000-391, 6 x 6 x 13 pump.

# CSU IAC PLANT 582: COOLING WTR PUMPS

---

---

Pump No. 2 (M5):

The cooling water pump is powered by a Reliance E-Master 60 hp motor (rated at 460V, 73.4 A, 1,780 rpm, 93.6% efficiency).

The pump is an Allis-Chalmers Type 2000, 6 x 6 x 13 pump.

Note that the discharge valve is wide open – provided a good baseline



# Power, Pressure, Pump Head Data

---

---

## Power:

Motor was fully loaded (stroboscope), so full load power was about  $60 \text{ hp} \times 0.746 \text{ kW/hp} \div 94.5\% \text{ motor efficiency} = 47.4 \text{ kW}$ .

## Flow:

Controlotron 1010WP portable flowmeter on 6" Schedule 40 steel pipe supply piping (25 psig 27" above floor) and 8" Schedule 40 steel discharge pipe (84 psig 29" above floor) showed a consistent **1,010 gpm**.

**Note: 1,030 gpm on M5 pump**

**PSAT calculated 138.4 ft of pump head**

# So What's the Big Deal?

---

---

- One 60 hp pump out of 10,000 hp!!!
- Pump runs 100% of time (8,760 h/yr)
- Valve locked suggests the valve always operates this way

**Let's see if this is a big deal**

# PSAT Results

### Condition A

**Pump, fluid data** End suction ANSI/API

Fixed pump  Yes Speed, rpm 1750  
 specific speed?  No Drive Direct drive

# stages 1 Specific gravity 1.000  
 Fluid viscosity (cS) 1.00

**Motor ratings** Motor hp 60

Existing motor class Energy efficient  
 rpm 1780 Rated voltage 460  
 Estimate >> Nameplate FLA 71.0  
 Motor size margin, % 15

**Duty, cost rate** Operating fraction 1.000  
 Electricity cost, cents/kwhr 6.300

**Required or measured data**

Flowrate, gpm 1010  
 Simple system curve utility Head calc Head, ft 138.4  
 Load estimation method Current  
 Motor voltage 460 Motor amps 71.0

	Existing	Optimal
Pump efficiency, %	58.8	84.6
Motor rated power, hp	60	50
Motor shaft power, hp	60.0	41.7
Pump shaft power, hp	60.0	41.7
Motor efficiency, %	94.1	94.1
Motor power factor, %	84.1	84.4
Motor current, amps	71.0	49.2
Motor power, kWe	47.5	33.1
Annual energy, MWhr	416.5	289.6
Annual cost, \$1,000	26.2	18.2
Annual savings potential, \$1,000		8.0
Optimization rating		69.5

Copy A  
> to B >

Copy B  
< to A <

Retrieve  
defaults

Make the  
current  
data the  
default  
set

### Condition B

**Pump, fluid data** End suction ANSI/API

Fixed pump  Yes Speed, rpm 1750  
 specific speed?  No Drive Direct drive

# stages 1 Specific gravity 1.000  
 Fluid viscosity (cS) 1.00

**Motor ratings** Motor hp 60

Existing motor class Energy efficient  
 rpm 1775 Rated voltage 460  
 Estimate >> Nameplate FLA 74.0  
 Motor size margin, % 15

**Duty, cost rate** Operating fraction 1.000  
 Electricity cost, cents/kwhr 6.300

**Required or measured data**

Flowrate, gpm 1030  
 Simple system curve utility Head calc Head, ft 173.5  
 Load estimation method Current  
 Motor voltage 460 Motor amps 59.0

	Existing	Optimal
Pump efficiency, %	96.3	84.7
Motor rated power, hp	60	75
Motor shaft power, hp	46.9	53.3
Pump shaft power, hp	46.9	53.3
Motor efficiency, %	94.4	94.7
Motor power factor, %	78.8	83.4
Motor current, amps	59.0	63.2
Motor power, kWe	37.0	42.0
Annual energy, MWhr	324.4	367.5
Annual cost, \$1,000	20.4	23.2
Annual savings potential, \$1,000		-2.7
Optimization rating		113.3

# Several Options Considered

---

---

- Trim the pump impeller
- Get a new, smaller pump
- Add a variable speed drive



# Recommendation

---

---

**Install variable speed drive – more conservative, easy to calculate**

**Control manually or by pressure control**

**Estimated installed cost: \$11,500/drive (R. S. Means 2005)**

**Xcel Energy rebate: \$30/hp x 60 hp = \$1,800**

**Estimated Implementation Cost = \$9,700 after rebates**

**Total energy and demand savings: \$7,950/yr**

**Simple payback: 1.2 years**