Oklahoma Drinking Water State Revolving Fund
Green Project Reserve Checklist

Applicant: Chandler Municipal Authority

Project Number: P40-1020702-01

Date: 3-27-2012

The Green Project Reserve (GPR) includes four types of projects: Green Infrastructure, Water Efficiency, Energy Efficiency and Environmentally Innovative. All GPR projects must meet DWSRF eligibility requirements. Please check all green components or activities that are applicable to your project. Additional information concerning categorically green and business cases is available in the Oklahoma DWSRF Green Project Reserve Guidance Document (DW-621). Please submit this checklist and all applicable attachments (business case, cost estimate with each green component highlighted, etc.) to your DWSRF Project Engineer.

Green Infrastructure

Green stormwater infrastructure includes a wide array of practices at multiple scales that manage wet weather and that maintains and restores natural hydrology by infiltrating, evapotranspiring and harvesting and using stormwater. On a regional scale, green infrastructure is the preservation and restoration of natural landscape features, such as forests, floodplains and wetlands, coupled with policies such as infill and redevelopment that reduce overall imperviousness in a watershed. On the local scale, green infrastructure consists of site- and neighborhood-specific practices, such as bioretention, trees, green roofs, permeable pavements and cisterns.

☐	Pervious or porous pavement	Categorically Green
☐	Bioretention	Categorically Green
☐	Green roofs	Categorically Green
☐	Rainwater harvesting/cisterns	Categorically Green
☐	Gray water use	Categorically Green
☐	Xeriscape	Categorically Green
☐	Landscape conversion programs	Categorically Green
☐	Retrofitting or replacing existing irrigation systems with moisture and rain sensing equipment	Categorically Green
☐	Other green infrastructure	Business Case Required

RECEIVED
APR 09 2012
WATER QUALITY DIVISION
CONSTRUCTION PERMITS

REGISTERED PROFESSIONAL ENGINEER
ROBERT K. MULLINS
20457
OKLAHOMA
3-30-12

WL000041120167-R
City of Chandler -Lincoln County
WATER CONST. PERMIT FILE: FACILITY # CLIP # ___

Water Efficiency

EPA's WaterSense program defines water efficiency as the use of improved technologies and practices to deliver equal or better services with less water. Water efficiency encompasses conservation and reuse efforts, as well as water loss reduction and prevention, to protect water resources for the future.

☐	Installing or retrofitting water efficient devices such as plumbing fixtures and appliances	Categorically Green
☐	Installing any type of water meter in previously unmetered areas, if rate structures are based on metered use	Categorically Green
☐	Replacing existing broken/malfunctioning water meters with Advanced Meter Reading systems (AMR)	Categorically Green
☐	Retrofitting/adding AMR capabilities or leak equipment to existing meters (not replacing the meter itself).	Categorically Green
☐	Recycling and water reuse projects that replace potable sources with non-potable sources,	Categorically Green
☐	Retrofit or replacement of existing landscape irrigation systems to more efficient landscape irrigation systems, including moisture and rain sensing controllers	Categorically Green
☐	Projects that result from a water efficiency related assessments (such as water audits, leak detection studies, conservation plans, etc) as long as the assessments adhered to the standard industry practices referenced above	Categorically Green
☐	Distribution system leak detection equipment, portable or permanent.	Categorically Green
☐	Automatic flushing systems (portable or permanent).	Categorically Green
☐	Pressure reducing valves (PRVs).	Categorically Green
☐	Internal plant water reuse (such as backwash water recycling).	Categorically Green
☐	Water meter replacement with traditional water meters	Business Case Required
☐	Distribution pipe replacement or rehabilitation to reduce water loss and prevent water main breaks	Business Case Required
☐	Storage tank replacement/rehabilitation to reduce water loss	Business Case Required
☐	New water efficient landscape irrigation system (where there is currently not one)	Business Case Required

Energy Efficiency

Energy efficiency is the use of improved technologies and practices to reduce the energy consumption of water quality projects, use energy in a more efficient way, and/or produce/utilize renewable energy.

☐	Renewable energy projects, which are part of a public health project, such as wind, solar, geothermal, and micro-hydroelectric that provide power to a utility (http://www.epa.gov/cleanenergy). Micro-hydroelectric projects involve capturing the energy from pipe flow.	Categorically Green
☐	National Electric Manufacturers Association (NEMA) Premium energy efficiency motors	Categorically Green
☑	Energy efficient retrofits, upgrades, or new pumping systems and treatment processes (including variable frequency drives (VFDs)).	Business Case Required
☐	Pump refurbishment to optimize pump efficiency (such as replacing or trimming impellers if pumps have too much capacity, replacing damaged or worn wearing rings/seals/bearings, etc.).	Business Case Required
☐	Projects that result from an energy efficiency related assessments (such as energy audits, energy assessment studies, etc), that are not otherwise designated as categorical.	Business Case Required
☐	Projects that cost effectively eliminate pumps or pumping stations.	Business Case Required
☐	Projects that achieve the remaining increments of energy efficiency in a system that is already very efficient.	Business Case Required
☐	Upgrade of lighting to energy efficient sources (such as metal halide pulse start technologies, compact fluorescent, light emitting diode, etc).	Business Case Required
☐	Automated and remote control systems (SCADA) that achieve substantial energy savings	Business Case Required

Environmentally Innovative

Environmentally innovative projects include those that demonstrate new and/or innovative approaches to delivering services or managing water resources in a more sustainable way.

☐	Utility Sustainability Plan consistent with EPAs SRF sustainability policy	Categorically Green
☐	Greenhouse gas (GHG) inventory or mitigation plan and submission of a GHG inventory to a registry (such as Climate Leaders or Climate Registry), as long as it is being done for a facility which is eligible for DWSRF assistance.	Categorically Green
☐	Source Water Protection Implementation Projects	Categorically Green
☐	Construction of US Building Council LEED certified buildings, or renovation of an existing building, owned by the utility, which is part of an eligible DWSRF project.	Categorically Green
☐	Projects, or components of projects, that result from total/integrated water resources management planning (including climate change) consistent with the Decision Criteria for environmentally innovative projects and that are DWSRF eligible.	Business Case Required
☐	Application of innovative treatment technologies or systems that improve environmental conditions and are consistent with the Decision Criteria for environmentally innovative projects, such as projects that significantly reduce or eliminate the use of chemicals in water treatment; or treatment technologies or approaches that significantly reduce the volume of residuals, minimize the generation of residuals or lower the amount of chemicals in residuals; or trenchless or low impact construction technology; or use of recycled materials	Business Case Required
☐	Educational activities and demonstration projects for water or energy efficiency (such as rain gardens).	Business Case Required
☐	Projects that achieve the goals/objectives of utility asset management plans	Business Case Required

Form completed by:

Daniel Turley
Typed or Printed Name

Engineer Intern
Title

(405) 848-5578
Phone Number

dturley@mb-eng.com
E-mail Address

Attachments:

- ☑ Business Case(s)
- ☐ Project Cost Estimate with Green Components marked or highlighted
- ☐ Other _____

Chandler Municipal Authority
5th and Oak Pump Station Rehabilitation

Summary

- Water system improvements project for the City of Chandler, OK includes the rehabilitation of the 5th and Oak pump station with three pumps and motors with VFDs.
- Loan Amount= $2,406,810.00
    - Costs of Pumps, VFDs and Controls = $250,000.00
- Energy Efficiency Green Portion of Loan= 12%
- The increased wire-to-water efficiency is 53.0%. This level of efficiency is greater than the 20% recommended minimum for pumps and motors.
- Annual Cost Savings = 44% or $4,876 per year.
- The total present worth savings over 10 years is approximately $41,593.

Background

- A high service pump station is being reconditioned in the water system. This includes three new pumps and motors with VFDs for slow on/off cycling.
- High efficiency pumps and motors with VFDs will be installed to conserve energy.
- The pumps will be rated at 300 gpm at 322 TDH with a rated efficiency (water to wire) of 80%.

Results

- The proposed new pumps will have a rated efficiency of 79%
- The proposed new motors will have a rated efficiency of 91%.

Calculated Energy Efficiency

- Comparison pumps on the market have average efficiency ratings of 51%.
- Comparison motors on the market have average efficiency ratings of 92%.
- The comparison system would use 121,702 kW-hr annually.
- The efficiency (wire-to-water) of standard pumps and motors=51%*92%=47% (pump efficiency times motor efficiency).
- The efficiency (wire-to-water) of the proposed pumps and motors=79%*91%=72%.
- To compare the efficiency of proposed pumps and motors with standard pumps and motors, divide the total efficiency of the proposed components by the efficiency of the standard components: 72%/47%=1.53.
- Thus, the increased wire-to-water efficiency is 53%. This level of efficiency is greater than the 20% recommended minimum for pumps and motors.

SELECTED PUMPS

- The efficiency (wire-to-water) of the Selected pumps and motors

$$Motor\ Effeciency\ \times Pump\ Efficiency = Wire\ to\ Water\ Efficiency$$

$$91\% \times 79\% = 72\%$$

Energy Use for Selected Pumps:

Power Usage = (BHP * 0.746)/Motor Eff. * 8 * 365

$$\frac{(31\ BHP\ \times\ 0.746) \times\ 8\frac{hours}{day} \times 365\frac{days}{yr}}{0.91} = 67{,}528\frac{kW \cdot hr}{yr}$$

- Pumping Costs for Selected Pumps:

$$67{,}528\frac{kW \cdot hr}{yr} \times \$0.09/kW \cdot hr\ = \$6{,}077/yr$$

Cost of Selected Pump Station = $250,000

COMPARISON PUMPS

- The efficiency (wire-to-water) of the Comparison pumps and motors

$$Motor\ Effeciency\ \times Pump\ Efficiency = Wire\ to\ Water\ Efficiency$$

$$92\% \times 51\% = 47\%$$

- Energy Use for Comparison Pumps:

Power Usage = (BHP * 0.746)/Motor Eff. * 8 * 365

$$\frac{(51.4\ BHP\ \times\ 0.746) \times\ 8\frac{hours}{day} \times 365\frac{days}{yr}}{0.92} = 121{,}702\frac{kW \cdot hr}{yr}$$

- Pumping Costs for Comparison Pumps:

$$121{,}702\frac{kW \cdot hr}{yr} \times \$0.09/kW \cdot hr\ = \$10{,}953/yr$$

- Cost of Comparison Pump = $250,000

EFFICIENCY AND COST SAVINGS

- Increase in efficiency (wire-to-water) of the Comparison pumps and motors

$$\frac{72\%}{47\%} = 1.53$$

- Increase in efficiency

$$Percent\ Increase = \frac{121{,}702\ \frac{kW \cdot hr}{yr} - 67{,}528\ \frac{kW \cdot hr}{yr}}{121{,}702\ \frac{kW \cdot hr}{yr}} \times 100 = 44\%$$

- Cost Savings

$$Cost\ Savings = \$10{,}953/yr - \$6{,}077/yr = \$4{,}876/yr$$

Cost of Comparison Pump Station = $250,000

PRESENT WORTH

$$Present\ Worth\ of\ Savings = A \times \frac{(1+i)^n - 1}{i \times (1+i)^n}$$

A = Annual Cost = $4,876
i = inflation = 3%
n = term = 10 years

$$Present\ Worth\ of\ Savings = \$4{,}876 \times \frac{(1+0.03)^{10} - 1}{0.03 \times (1+0.03)^{10}}$$

$$Present\ Worth\ of\ Savings\ From\ Decreased\ Energy\ Use = \$41{,}593$$

Conclusion

- By using the energy efficient high service pumps instead of a standard pump and motor, the efficiency is increased by 44% or 54,174 kW-hr per year.
- The increased wire-to-water efficiency is 53%. This level of efficiency is greater than the 20% recommended minimum for pumps and motors.
- At 9 cents per kW-hr, energy reductions from the more efficient pumps and motors will save up to $4,876 per year.
- Due to the energy Efficiency of the high efficient pumps cost approximately $4,876 less to operate than the existing pumps.
- The total present worth savings over 10 years is approximately $41,593.
- The cost for the energy efficient pump station and the comparison pump station are the same at $250,000.

SUPPORTING DOCUMENTS

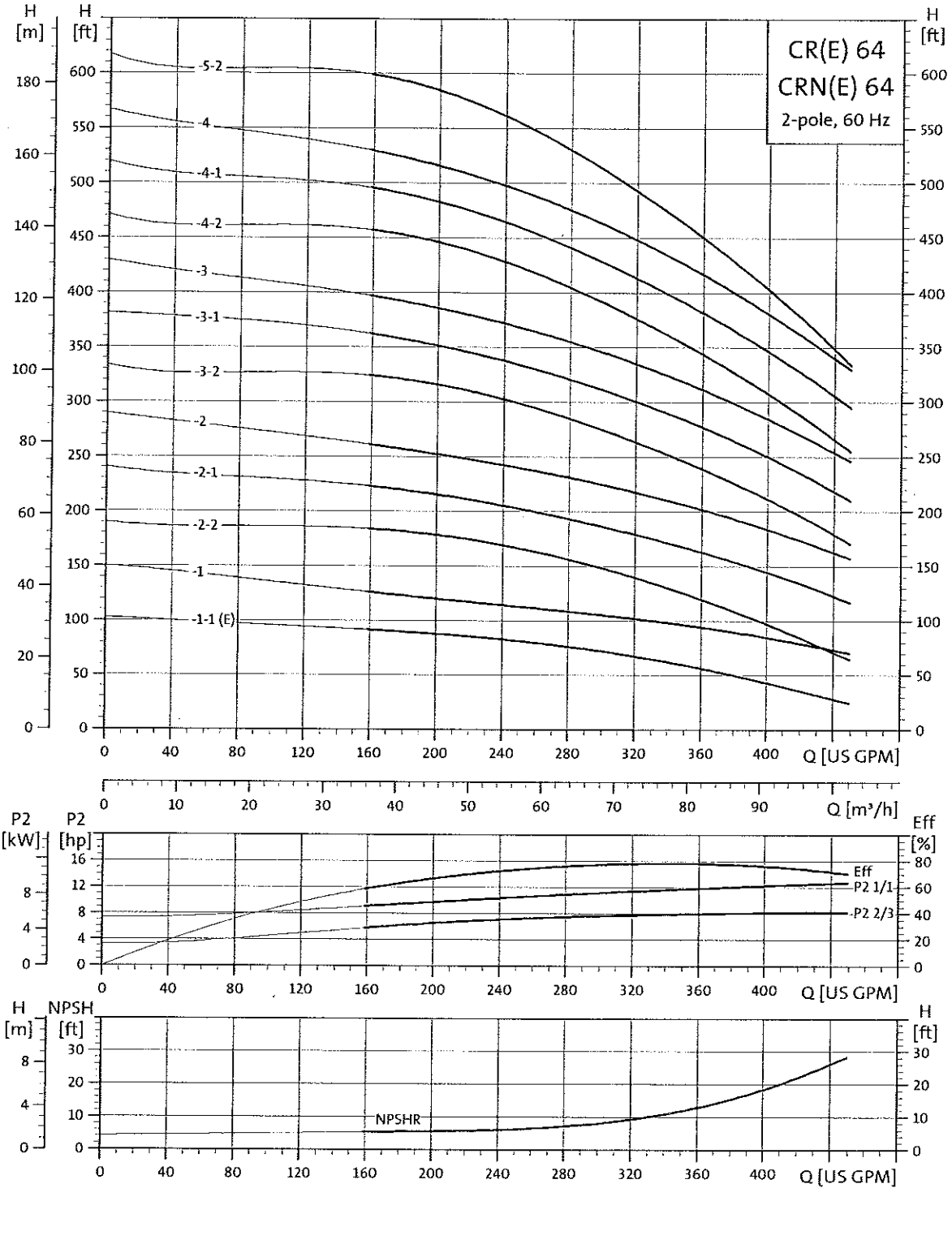
CHANDLER 5th & OAKS PUMP STATION
300 GPM @ 322' TDH

Demonstrating Energy and Cost Savings for Pumps		
USAGE BASED ON 8 HRS/DAY, 365 DAYS/YR OPERATION		
Pump Parameter	New Pump (Proposed Pump, Spec)	New Pump (Proposed Pump, Spec)
Maufacturer	Grundfos CR64-3-1, 31 **BHP**	Peerless 2TU12A2, 51.4 BHP
Voltage/ Phase	460/3	460/3
	SELECTED PUMP	
Motor Efficiency, %	91	92
Pump Efficiency	79	51
Power usage, Kw-Hr/Yr	67,528	121702
Power Cost, $/Yr	0.09	0.09
Operational Cost, $/Yr	6077	10953
Savings, $/Yr	N/A	(4,876.00)
Base Standard Efficiency, %	0.719	0.469

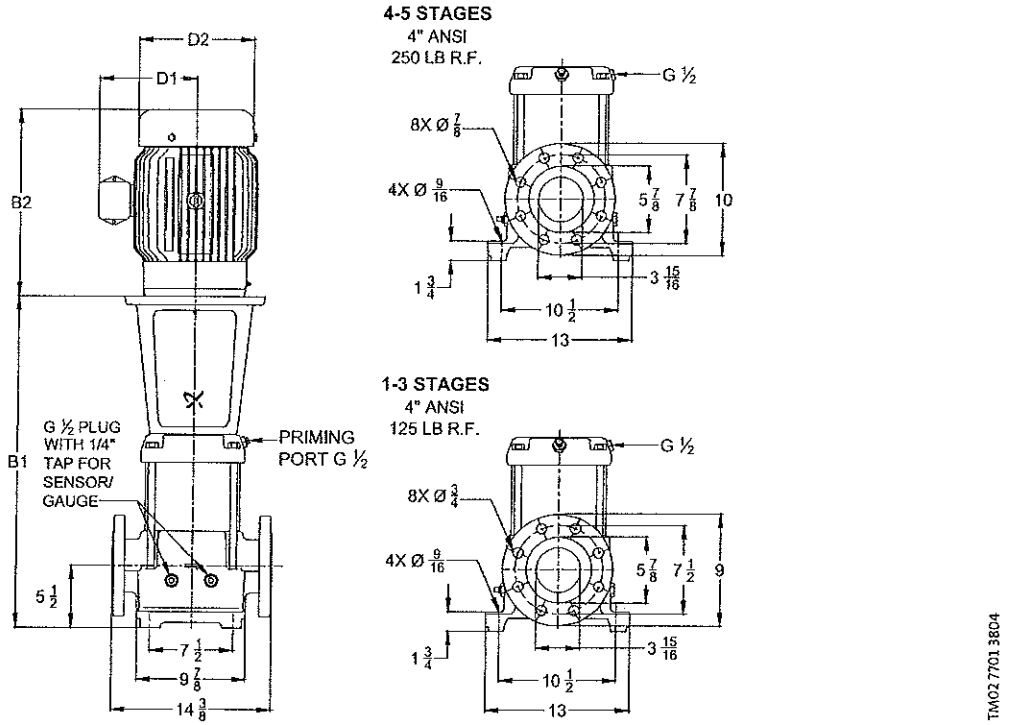
Power Usage = (BHP * 0.746)/Motor Eff. * 8 * 365

The purpose of this green case study is to find a pump that's 20% wire-to-water higher efficiency than other given pumps that can meet the application. The 51% pump is not categorized as high efficiency; the chosen pump is categorized as 'high efficiency' or the most efficient pump.

Performance curves



Dimensional sketches

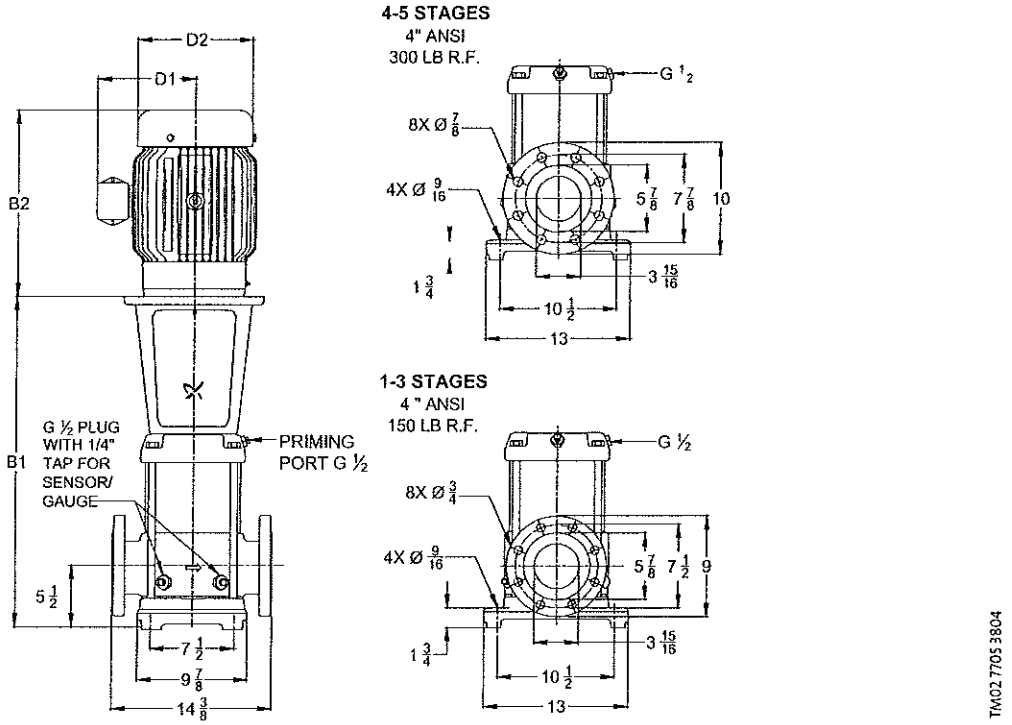


Dimensions and weights

Pump type	Hp	Ph	Voltage	NEMA Frame size	ANSI B1	TEFC D1	TEFC D2	TEFC ANSI B1+B2	ODP D1	ODP D2	ODP ANSI B1+B2	ANSI Ship Wt.[1] [lbs.]	MLE D1	MLE D2	MLE ANSI B1+B2	ANSI Ship Wt.[1] [lbs.]
CR(E) 64-1-1	7 1/2	1	208-230	213TC	22 1/8	10 1/4	7 1/2	37 1/2	-	-	-	299	-	-	-	-
		3	208-230/460	213TC	22 1/8	8 3/4	5 3/8	37 3/4	-	-	-	277	8 3/4	7 1/2	37 1/2	307
CR 64-1	15	3	208-230/460	254TC	26 1/2	10 3/8	8 3/4	43 1/8	10 5/8	7 3/8	42 5/8	339	-	-	-	-
CR 64-2-2	15	3	208-230/460	254TC	29 3/4	10 3/8	8 3/4	46 3/8	10 5/8	7 3/8	45 7/8	348	-	-	-	-
CR 64-2-1	20	3	230/460	254TC	29 3/4	10 3/8	8 3/4	46 1/8	11 1/2	9	47 3/4	391	-	-	-	-
CR 64-2	25	3	230/460	284TSC	29 3/4	13	9 1/2	49 1/2	11 1/2	9	50 3/4	514	-	-	-	-
CR 64-3-2	30	3	230/460	284TSC	33	15 3/8	13 1/8	56	11 1/2	9	54 5/8	569	-	-	-	-
CR 64-3-1	40	3	230/460	286TSC	33	15 3/8	13 1/8	56	13 1/4	12 1/4	56	647	-	-	-	-
CR 64-3	40	3	230/460	286TSC	33	15 3/8	13 1/8	56	13 1/4	12 1/4	56	647	-	-	-	-
CR 64-4-2	40	3	230/460	286TSC	36 1/4	15 3/8	13 1/8	59 1/4	13 1/4	12 1/4	59 1/4	684	-	-	-	-
CR 64-4-1	50	3	230/460	324TSC	36 1/4	17	14 1/8	63 7/8	13 3/8	12 1/4	58 3/4	748	-	-	-	-
CR 64-4	50	3	230/460	324TSC	36 1/4	17	14 1/8	63 7/8	13 3/8	12 1/4	58 3/4	748	-	-	-	-
CR 64-5-2	60	3	230/460	364TSC	39 1/2	19	15	70 1/8	15 1/4	13 1/4	65 1/2	923	-	-	-	-

Weights based on pump with TEFC motor (see price list for individual weights)
All dimensions in inches unless otherwise noted.

Dimensional sketches



Dimensions and weights

Pump type	Hp	Ph	Voltage	NEMA Frame size	ANSI B1	TEFC			ODP			ANSI Ship Wt.[1] [lbs.]	MLE			ANSI Ship Wt.[1] [lbs.]
						D1	D2	ANSI B1+B2	D1	D2	ANSI B1+B2		D1	D2	ANSI B1+B2	
64-1-1	7 1/2	1	208-230	213TC	22 1/8	10 1/4	7 1/2	37 1/2	-	-	-	299	-	-	-	-
		3	208-230/460	213TC	22 1/8	8 3/4	5 3/8	37 3/4	-	-	-	277	8 3/4	7 1/2	37 1/2	307
CRN(E) 64-1	15	3	208-230/460	254TC	26 1/2	10 3/8	8 3/4	43 1/8	10 5/8	7 3/8	42 5/8	339	-	-	-	-
CRN 64-2-2	15	3	208-230/460	254TC	29 3/4	10 3/8	8 3/4	46 3/8	10 5/8	7 3/8	45 7/8	348	-	-	-	-
CRN 64-2-1	20	3	230/460	254TC	29 3/4	10 3/8	8 3/4	46 1/8	11 1/2	9	47 3/4	391	-	-	-	-
CRN 64-2	25	3	230/460	284TSC	29 3/4	13	9 1/2	49 1/2	11 1/2	9	50 3/4	514	-	-	-	-
CRN 64-3-2	30	3	230/460	284TSC	33	15 3/8	13 1/8	56	11 1/2	9	54 5/8	569	-	-	-	-
CRN 64-3-1	40	3	230/460	286TSC	33	15 3/8	13 1/8	56	13 1/4	12 1/4	56	647	-	-	-	-
CRN 64-3	40	3	230/460	286TSC	33	15 3/8	13 1/8	56	13 1/4	12 1/4	56	647	-	-	-	-
CRN 64-4-2	40	3	230/460	286TSC	36 1/4	15 3/8	13 1/8	59 1/4	13 1/4	12 1/4	59 1/4	684	-	-	-	-
CRN 64-4-1	50	3	230/460	324TSC	36 1/4	17	14 1/8	63 7/8	13 3/8	12 1/4	58 3/4	748	-	-	-	-
CRN 64-4	50	3	230/460	324TSC	36 1/4	17	14 1/8	63 7/8	13 3/8	12 1/4	58 3/4	748	-	-	-	-
CRN 64-5-2	60	3	230/460	364TSC	39 1/2	19	15	70 1/8	15 1/4	13 1/4	65 1/2	923	-	-	-	-

Weights based on pump with TEFC motor (see price list for individual weights)
All dimensions in inches unless otherwise noted.

PEERLESS PUMP®

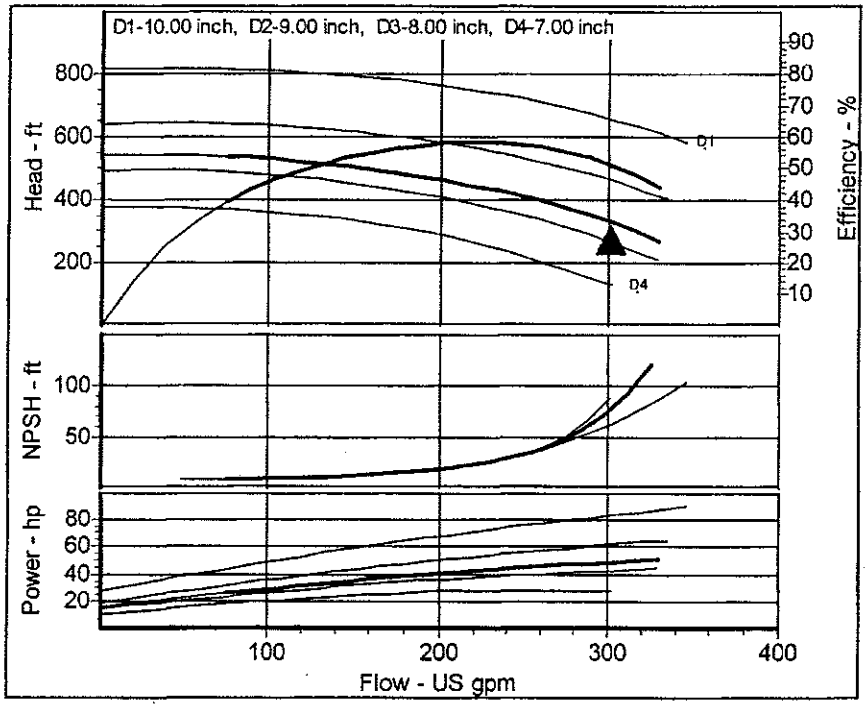
Customer :

Contact :

Project : **Phone :** **Fax :**

Quote No. : US-3690-120 **Page No : 1** **Date :** Friday, January 27, 2012

Type:	**TU - Horizontal Split Case Multi-Stage**	Item :	**1**
Pump Model:	**Peerless - 2TU12A2**	Impeller No.:	2677918/19
Nom. Speed:	**3500 RPM, 60 Hz Electric**	Fluid:	**Water**
Impeller Dia.:	**8.34** inch	Temperature:	**68** °F
Curve No.:	**2880459**	Viscosity:	**1.007** cSt
Market :	**Water**	Sp. Gravity:	**1.000**
		Your Ref. :	



Duty Flow	**300**	US gpm
Duty Head	**322**	ft
Imp. Dia.	**8.34**	inch
Power Required	**48.9**	hp
NPSH Required	**75.7**	ft
Efficiency	**51.4**	%
Peak Power	**51.4**	hp
Closed Valve Head	**541**	ft
Tolerance	**Hyd Inst-Peerless Std**	

Comments

Perf. curve represents typical perf, vel. head is incld. Perf. curves tests are performed in accordance with H.I.Stds.

Flow (US gpm)	Head (ft)	Efficiency (%)	Power Required (hp)	NPSH Required (ft)
74.9	539.1	39.6	25.7	9.3
106.8	527.5	47.4	30.0	9.9
138.6	510.7	52.6	34.0	11.8
170.5	489.1	56.1	37.5	15.1
202.4	462.2	58.0	40.7	19.8
234.3	428.8	58.3	43.5	27.6
266.1	387.2	56.4	46.2	42.6
298.0	335.3	51.8	48.8	73.0
329.9	270.0	43.7	51.4	

PEERLESS PUMP®

Chandler Municipal Authority
Clearwell Pump Station Rehabilitation

Summary

- Water system improvements project for the City of Chandler, OK includes the rehabilitation of the Clearwell pump station with three pumps and motors with VFDs.
- Loan Amount= $2,406,810.00
    - Costs of Pumps, VFDs and Controls = $300,000.00
- Energy Efficiency Green Portion of Loan= 14%
- The increased wire-to-water efficiency is 27.0%. This level of efficiency is greater than the 20% recommended minimum for pumps and motors.
- Annual Cost Savings = 23% or $4,796 per year.
- The total present worth savings over 10 years is approximately $40,910.

Background

- A high service pump station is being reconditioned in the water system. This includes three new pumps and motors with VFDs for slow on/off cycling.
- High efficiency pumps and motors with VFDs will be installed to conserve energy.
- The pumps will be rated at 800 gpm at 322 TDH with a rated efficiency (water to wire) of 80%.

Results

- The proposed new pumps will have a rated efficiency of 83.8%
- The proposed new motors will have a rated efficiency of 95.4%.

Calculated Energy Efficiency

- Comparison pumps on the market have average efficiency ratings of 65.9%.
- Comparison motors on the market have average efficiency ratings of 95.4%.
- The comparison system would use 231,167 kW-hr annually.
- The efficiency (wire-to-water) of standard pumps and motors=65.9%*95.4%=62.9% (pump efficiency times motor efficiency).
- The efficiency (wire-to-water) of the proposed pumps and motors=83.8%*95.4%=80%.
- To compare the efficiency of proposed pumps and motors with standard pumps and motors, divide the total efficiency of the proposed components by the efficiency of the standard components: 80%/62.9%=1.27.
- Thus, the increased wire-to-water efficiency is 27%. This level of efficiency is greater than the 20% recommended minimum for pumps and motors.

SELECTED PUMPS

- The efficiency (wire-to-water) of the Selected pumps and motors

$$Motor\ Effeciency\ \times Pump\ Efficiency = Wire\ to\ Water\ Efficiency$$

$$95.4\% \times 83.8\% = 80\%$$

Energy Use for Selected Pumps:

Power Usage = (BHP * 0.746)/Motor Eff. * 8 * 365

$$\frac{(77.9\ BHP\ \times\ 0.746) \times\ 8\frac{hours}{day} \times 365\frac{days}{yr}}{0.954} = 177{,}874\frac{kW \cdot hr}{yr}$$

- Pumping Costs for Selected Pumps:

$$177{,}874\frac{kW \cdot hr}{yr} \times \$0.09/kW \cdot hr\ = \$16{,}009/yr$$

Cost of Selected Pump Station = $100,000

COMPARISON PUMPS

- The efficiency (wire-to-water) of the Comparison pumps and motors

$$Motor\ Effeciency\ \times Pump\ Efficiency = Wire\ to\ Water\ Efficiency$$

$$95.4\% \times 65.4\% = 62.9\%$$

- Energy Use for Comparison Pumps:

Power Usage = (BHP * 0.746)/Motor Eff. * 8 * 365

$$\frac{(101.24\ BHP\ \times\ 0.746) \times\ 8\frac{hours}{day} \times 365\frac{days}{yr}}{0.954} = 231{,}167\frac{kW \cdot hr}{yr}$$

- Pumping Costs for Comparison Pumps:

$$231{,}167\frac{kW \cdot hr}{yr} \times \$0.09/kW \cdot hr\ = \$20{,}805/yr$$

EFFICIENCY AND COST SAVINGS

- Increase in efficiency (wire-to-water) of the Comparison pumps and motors

$$\frac{80\%}{62.9\%} = 1.27$$

- Increase in efficiency

$$Percent\ Increase = \frac{231{,}167\ \frac{kW \cdot hr}{yr} - 177{,}874\ \frac{kW \cdot hr}{yr}}{231{,}167\ \frac{kW \cdot hr}{yr}} \times 100 = 23\%$$

- Cost Savings

$$Cost\ Savings = \$20{,}805/yr - \$16{,}009/yr = \$4{,}796/yr$$

Cost of Comparison Pump Station = $100,000

PRESENT WORTH

$$Present\ Worth\ of\ Savings = A \times \frac{(1+i)^n - 1}{i \times (1+i)^n}$$

A = Annual Cost = $4,796
i = inflation = 3%
n = term = 10 years

$$Present\ Worth\ of\ Savings = \$4{,}796 \times \frac{(1+0.03)^{10} - 1}{0.03 \times (1+0.03)^{10}}$$

$$Present\ Worth\ of\ Savings\ From\ Decreased\ Energy\ Use = \$40{,}910$$

Conclusion

- By using the energy efficient high service pumps instead of a standard pump and motor, the efficiency is increased by 23% or 53,293 kW-hr per year.
- The increased wire-to-water efficiency is 27%. This level of efficiency is greater than the 20% recommended minimum for pumps and motors.
- At 9 cents per kW-hr, energy reductions from the more efficient pumps and motors will save up to $4,796 per year.
- Due to the energy Efficiency of the high efficient pumps cost approximately $4,796 less to operate than the existing pumps.
- The total present worth savings over 10 years is approximately $40,910.
- The cost for the energy efficient pump station and the comparison pump station are the same at $100,000.

SUPPORTING DOCUMENTS

CHANDLER CLEARWELL PUMP STATION
800 GPM @ 322' TDH

Demonstrating Energy and Cost Savings for Pumps		
USAGE BASED ON 8 HRS/DAY, 365 DAYS/YR OPERATION		
Pump Parameter	New Pump (Proposed Pump, Spec)	New Pump (Proposed Pump, Spec)
Maufacturer	Fairbanks-Morse 12B 5-Stage, 77.9 BHP	Peerless M12LDT 6-Stage, 101.24 BHP
Voltage/ Phase	460/3	460/3
	SELECTED PUMP	
Motor Efficiency, %	95.4	95.4
Pump Efficiency	83.8	65.9
Power usage, Kw-Hr/Yr	177,874	231167
Power Cost, $/Yr	0.09	0.09
Operational Cost, $/Yr	16009	20805
Savings, $/Yr	N/A	(4,796.00)
Base Standard Efficiency, %	0.8	0.629

Power Usage = (BHP * 0.746)/Motor Eff. * 8 * 365

The purpose of this green case study is to find a pump that's 20% wire-to-water higher efficiency than other given pumps that can meet the application. The 65.9 % pump is not categorized as high efficiency; the chosen pump is categorized as 'high efficiency' or the most efficient pump.

Pump Data Sheet - Fairbanks Morse Pump, 60 Hz

Company: Haynes Equipment Co.
Name:
Date: 1/27/2012

Fairbanks Morse
Pentair Water

Pump:

Size: 12B.3+ (5 stage)

Type: VERT.TURBINE
Synch speed: 1800 rpm

Speed: 1760 rpm
Dia: 9 in

Curve: 18-101

Impeller:

Specific Speeds:

Ns: ---
Nss: ---

Dimensions:

Suction: 8 in
Discharge: 8 in

Vertical Turbine:

Bowl size: 11.3 in
Max lateral: 0.7 in
Thrust K factor: 5.2 lb/ft

Pump Limits:

Temperature: 150 °F
Pressure: 580 psi g
Sphere size: 0.875 in

Power: 344 hp
Eye area: ---

Search Criteria:

Flow: 800 US gpm
Head: 322 ft

Fluid:

Water
Density: 62.25 lb/ft³
Viscosity: 1.105 cP

Temperature: 60 °F
Vapor pressure: 0.2563 psi a
Atm pressure: 14.7 psi a

NPSHa: ---

Motor:

Standard: NEMA
Enclosure: TEFC

Size: 100 hp
Speed: 1800
Frame: 405T

Sizing criteria: Max Power on Design Curve

--- Data Point ---

Flow:	800 US gpm
Head:	324 ft
Eff:	83.8%
Power:	77.9 hp
NPSHr:	11.2 ft

--- Design Curve ---

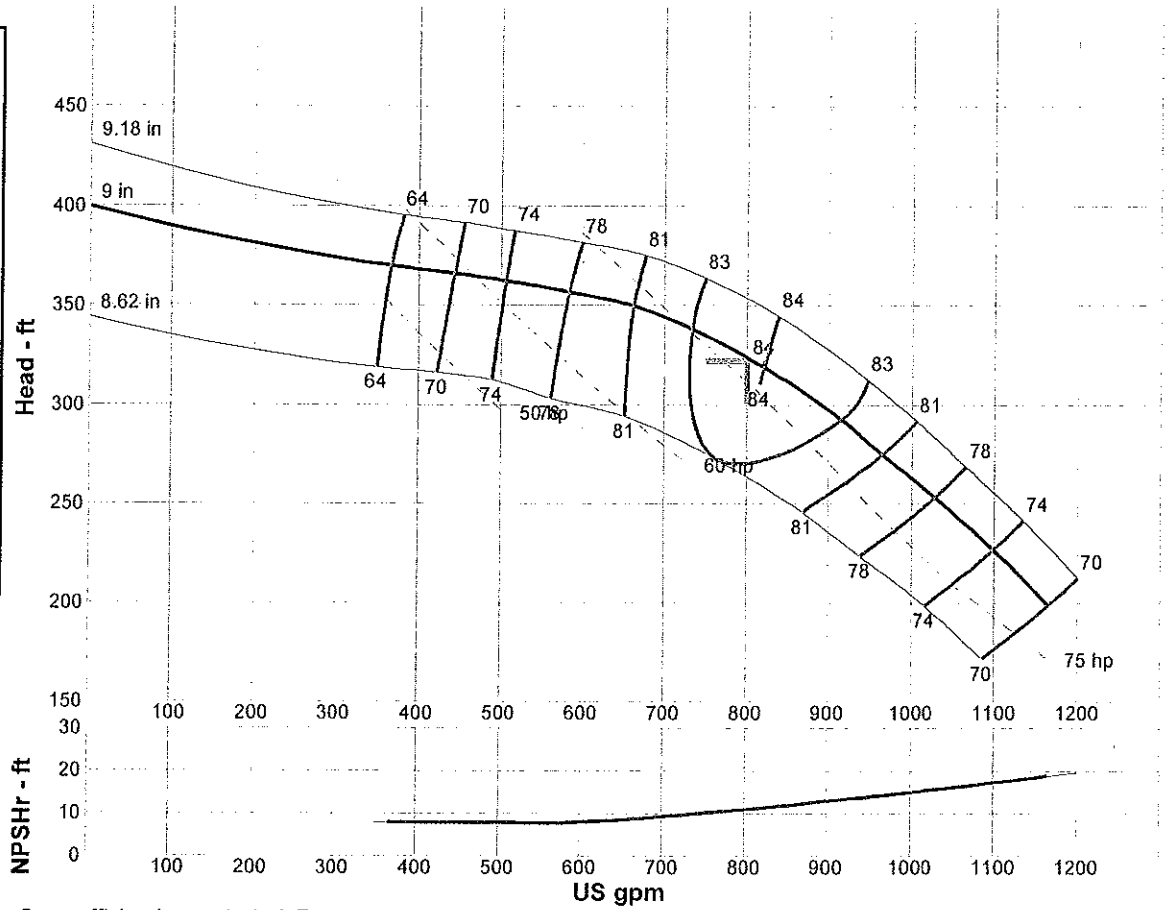
Shutoff head:	400 ft
Shutoff dP:	173 psi
Min flow:	---

BEP: 84% @ 820 US gpm

NOL power:
85 hp @ 1098 US gpm

-- Max Curve --

Max power:
93.5 hp @ 1134 US gpm



Curve efficiencies are typical. For guaranteed values, contact Fairbanks Morse or your local distributor. Las eficiencias en curvas son típicas. Para valores garantizados contacte a Fairbanks Morse o a su distribuidor local.

Performance Evaluation:

Flow US gpm	Speed rpm	Head ft	Efficiency %	Power hp	NPSHr ft
960	1760	276	81.1	82.5	14.4
800	1760	324	83.8	77.9	11.2
640	1760	352	80.2	70.8	8.66
480	1760	364	72.4	60.9	8
320	1760	---	---	---	---

Selected from catalog: Fairbanks Morse Turbine.60 Vers: 3

PEERLESS PUMP

Customer :

Contact :

Project :

Phone : Fax :

Quote No. : US-3690-120 Page No : 1 Date : Friday, January 27, 2012

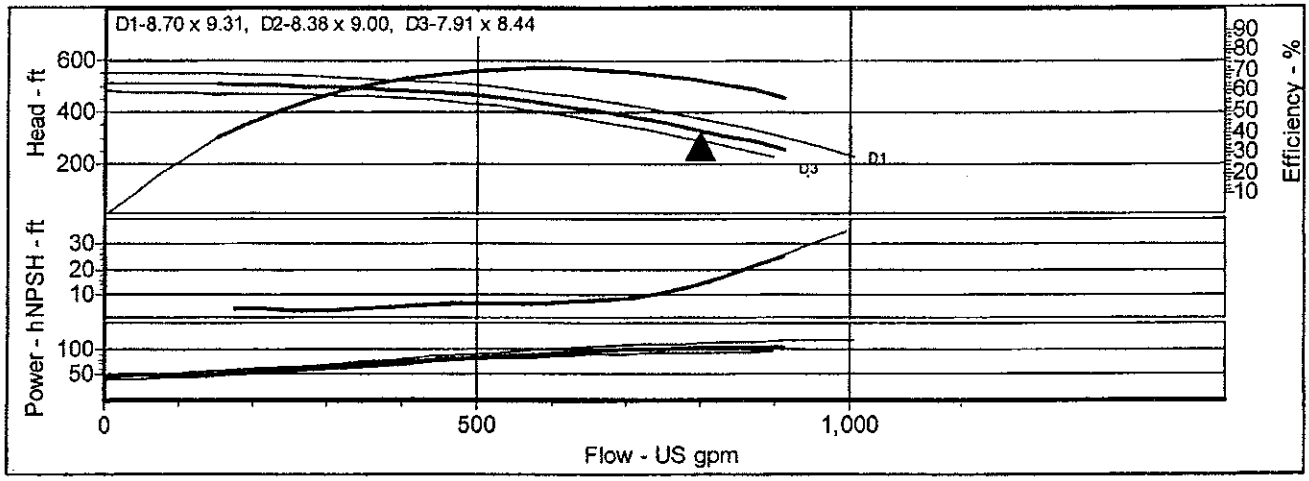
Pump Model: Peerless Vertical - M12LDT (1st Stage M12LDT/FS) 6 Stages
Nom. Speed: 1770 RPM, 60 Hz Electric
Market : Vertical Turbine Pump
Impeller No.: 4602394
Material Spec. Group: A - B: CIE; I: Brz = Standard
Item : 1
Your Ref. :

Fluid: Water
Temperature: 68 °F
Viscosity: 1.007 cSt
Sp. Gravity: 1.000 (base temp. 68 °F)

Stage No.	Trim Status	Imp. Dia. (inch) D2-in x D2-out
1 M12LDT/FS	Full	8.53 x 9.31
2 - 3	Full	8.70 x 9.31
4 - 6	Trimmed	8.00 x 8.57

Flow rate Q:	800	US gpm
Bowl Total Head:	322	ft
Bowl Efficiency:	65.9	%
Bowl Power Required:	101.24	hp
NPSH Required	13.909	ft

Performance curve according to Hyd Inst-Peerless Std



Comments

Refer to factory for all single point bowl performance guarantees. Pumps must be selected with Hydraulic Institute-Peerless Std. See Std Hydraulic Performance document in RAPID for testing tolerances & contractual guarantees.

Flow (US gpm)	Head (ft)	Efficiency (%)	Power Required (hp)	NPSH Required (ft)	Thrust (lb)
0.0	513.7	0.0	45.0		3851.55
114.0	509.6	29.7	49.4		3691.07
228.0	502.5	50.2	57.7		3499.75
342.0	493.7	62.3	68.4	4.0	3234.46
455.9	475.3	68.8	79.5	5.9	2873.28
569.9	441.8	71.2	89.3	6.6	2424.45
683.9	393.0	70.3	96.5	7.8	1873.44
797.9	331.3	66.0	101.2	13.7	1149.12
911.9	257.2	57.0	103.9	25.4	187.96

PEERLESS PUMP

Chandler Municipal Authority
Hiland Pump Station

Summary

- Water system improvements project for the City of Chandler, OK includes the construction of the Hiland pump station with two pumps and motors with VFDs.
- Loan Amount= $2,406,810.00
    - Costs of Pumps, VFDs and Controls = $250,000.00
- Energy Efficiency Green Portion of Loan= 12%
- The increased wire-to-water efficiency is 46%. This level of efficiency is greater than the 20% recommended minimum for pumps and motors.
- Annual Cost Savings = 42% or $3,447 per year.
- The total present worth savings over 10 years is approximately $29,403.

Background

- A pump station is being constructed in the water system. This includes two new pumps and motors with VFDs for slow on/off cycling.
- High efficiency pumps and motors with VFDs will be installed to conserve energy.
- The pumps will be rated at 400 gpm at 200 TDH with a rated efficiency (water to wire) of 73%.

Results

- The proposed new pumps will have a rated efficiency of 80%
- The proposed new motors will have a rated efficiency of 91%.

Calculated Energy Efficiency

- Comparison pumps on the market have average efficiency ratings of 55%.
- Comparison motors on the market have average efficiency ratings of 91%.
- The comparison system would use 90,963 kW-hr annually.
- The efficiency (wire-to-water) of standard pumps and motors=55%*91%=50% (pump efficiency times motor efficiency).
- The efficiency (wire-to-water) of the proposed pumps and motors=80%*91%=73%.
- To compare the efficiency of proposed pumps and motors with standard pumps and motors, divide the total efficiency of the proposed components by the efficiency of the standard components: 73%/50%=1.46.
- Thus, the increased wire-to-water efficiency is 46%. This level of efficiency is greater than the 20% recommended minimum for pumps and motors.

SELECTED PUMPS

- The efficiency (wire-to-water) of the Selected pumps and motors

$$Motor\ Effeciency\ \times Pump\ Efficiency = Wire\ to\ Water\ Efficiency$$

$$91\% \times 80\% = 73\%$$

Energy Use for Selected Pumps:

Power Usage = (BHP * 0.746)/Motor Eff. * 8 * 365

$$\frac{(22\ BHP\ \times\ 0.746) \times\ 8\frac{hours}{day} \times 365\frac{days}{yr}}{0.91} = 52{,}663\frac{kW \cdot hr}{yr}$$

- Pumping Costs for Selected Pumps:

$$52{,}663\frac{kW \cdot hr}{yr} \times \$0.09/kW \cdot hr\ = \$4{,}740/yr$$

Cost of Selected Pump Station = $250,000

COMPARISON PUMPS

- The efficiency (wire-to-water) of the Comparison pumps and motors

$$Motor\ Effeciency\ \times Pump\ Efficiency = Wire\ to\ Water\ Efficiency$$

$$91\% \times 55\% = 50\%$$

- Energy Use for Comparison Pumps:

Power Usage = (BHP * 0.746)/Motor Eff. * 8 * 365

$$\frac{(38\ BHP\ \times\ 0.746) \times\ 8\frac{hours}{day} \times 365\frac{days}{yr}}{0.91} = 90{,}963\frac{kW \cdot hr}{yr}$$

- Pumping Costs for Comparison Pumps:

$$90{,}963\frac{kW \cdot hr}{yr} \times \$0.09/kW \cdot hr\ = \$8{,}187/yr$$

EFFICIENCY AND COST SAVINGS

- Increase in efficiency (wire-to-water) of the Comparison pumps and motors

$$\frac{73\%}{50\%} = 1.46$$

- Increase in efficiency

$$Percent\ Increase = \frac{90{,}963\ \frac{kW \cdot hr}{yr} - 52{,}663\ \frac{kW \cdot hr}{yr}}{90{,}963\ \frac{kW \cdot hr}{yr}} \times 100 = 42\%$$

- Cost Savings

$$Cost\ Savings = \$8187/yr - \$4{,}740/yr = \$3{,}447/yr$$

Cost of Comparison Pump Station = $250,000

PRESENT WORTH

$$Present\ Worth\ of\ Savings = A \times \frac{(1+i)^n - 1}{i \times (1+i)^n}$$

A = Annual Cost = $3,447
i = inflation = 3%
n = term = 10 years

$$Present\ Worth\ of\ Savings = \$3{,}447 \times \frac{(1+0.03)^{10} - 1}{0.03 \times (1+0.03)^{10}}$$

$$Present\ Worth\ of\ Savings\ From\ Decreased\ Energy\ Use = \$29{,}403$$

Conclusion

- By using the energy efficient high service pumps instead of a standard pump and motor, the efficiency is increased by 42% or 38,300 kW-hr per year.
- The increased wire-to-water efficiency is 46%. This level of efficiency is greater than the 20% recommended minimum for pumps and motors.
- At 9 cents per kW-hr, energy reductions from the more efficient pumps and motors will save up to $3,447 per year.
- Due to the energy Efficiency of the high efficient pumps cost approximately $3,447 less to operate than the existing pumps.
- The total present worth savings over 10 years is approximately $29,403.
- The cost for the energy efficient pump station and the comparison pump station are the same at $250,000.

SUPPORTING DOCUMENTS

CHANDLER HILAND PUMP STATION
400 GPM @ 200' TDH

Demonstrating Energy and Cost Savings for Pumps		
USAGE BASED ON 8 HRS/DAY, 365 DAYS/YR OPERATION		
Pump Parameter	New Pump (Proposed Pump, Spec)	New Pump (Proposed Pump, Spec)
Maufacturer	Grundfos CR90-2-1, 22 **BHP**	Peerless 4AE10, 38 BHP
Voltage/ Phase	460/3	460/3
	SELECTED PUMP	
Motor Efficiency, %	91	91
Pump Efficiency	80	55
Power usage, Kw-Hr/Yr	52,663	90963
Power Cost, $/Yr	0.09	0.09
Operational Cost, $/Yr	4740	8187
Savings, $/Yr	N/A	(3,447.00)
Base Standard Efficiency, %	0.73	0.500

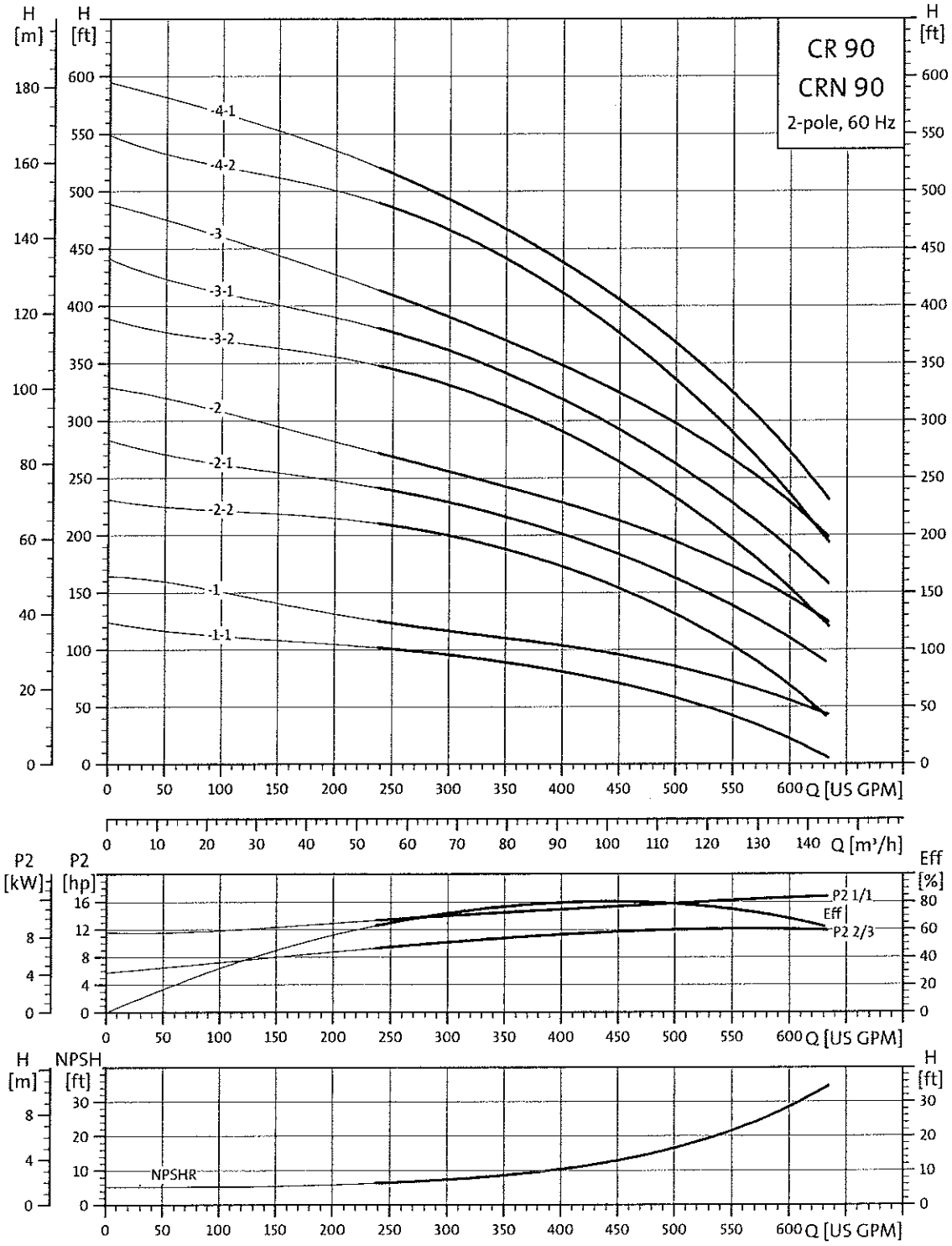
Power Usage = (BHP * 0.746)/Motor Eff. * 8 * 365

The purpose of this green case study is to find a pump that's 20% wire-to-water higher efficiency than other given pumps that can meet the application. The 55% pump is not categorized as high efficiency; the chosen pump is categorized as 'high efficiency' or the most efficient pump.

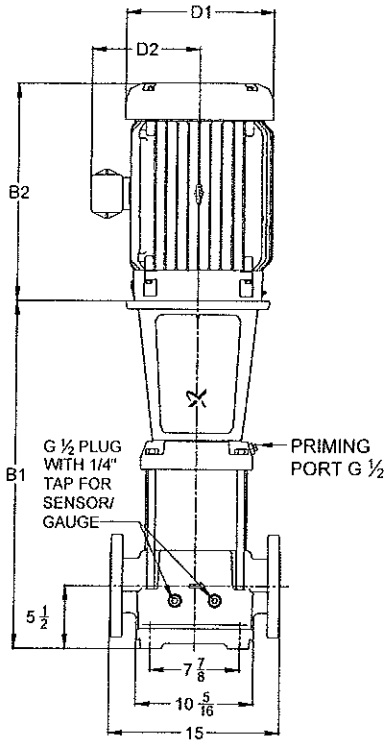
Performance curves

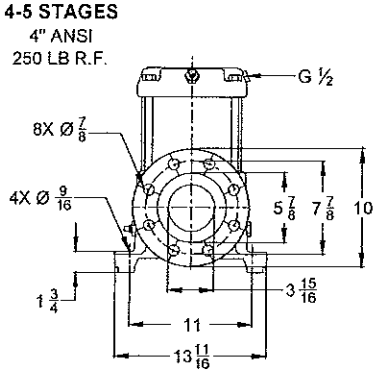
HILAND DAIRY PUMPS

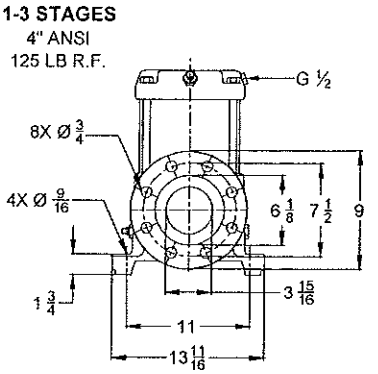
CR, CRN 90



Technical data







TM02 7702 3804

Pump type	P2 [hp]	Ph.	ANSI dimensions [inch]							Ship Wt. [lbs.]	ANSI dimensions [inch]			Ship Wt. [lbs.]
			B1	TEFC			ODP				MLE			
				D1	D2	B1+B2	D1	D2	B1+B2		D1	D2	B1+B2	
CR 90-1-1	15	3	26 7/8	10 1/4	8 3/4	43 1/2	10 5/8	7 3/8	45 7/8	350	-	-	-	-
CR 90-1	15	3	26 7/8	10 1/4	8 3/4	43 1/2	10 5/8	7 3/8	46 3/8	350	-	-	-	-
CR 90-2-2	25	3	30 1/2	13	11 1/2	46 7/8	11 1/2	9	50 3/4	455	-	-	-	-
CR 90-2-1	30	3	30 1/2	15 5/8	13 1/8	50 1/8	11 1/2	9	52	616	-	-	-	-
CR 90-2	40	3	30 1/2	15 5/8	13 1/8	53 1/2	13 1/4	12 1/4	53 1/2	631	-	-	-	-
CR 90-3-2	40	3	34 1/8	15 5/8	13 1/8	57 1/8	13 1/4	12 1/4	57 1/8	642	-	-	-	-
CR 90-3-1	50	3	34 1/8	17	14 1/8	61 5/8	13 1/4	12 1/4	56 5/8	672	-	-	-	-
CR 90-3	50	3	34 1/8	17	14 1/8	61 5/8	13 1/4	12 1/4	56 5/8	672	-	-	-	-
CR 90-4-2	60	3	37 3/4	19	15	68 1/4	15 1/4	13 1/4	63 5/8	876	-	-	-	-
CR 90-4-1	60	3	37 3/4	19	15	68 1/4	15 1/4	13 1/4	63 5/8	876	-	-	-	-

[1] Weights are based on pump with TEFC motor (see price list for individual weights)
All dimensions in inches unless otherwise noted.

PEERLESS PUMP®

Customer :

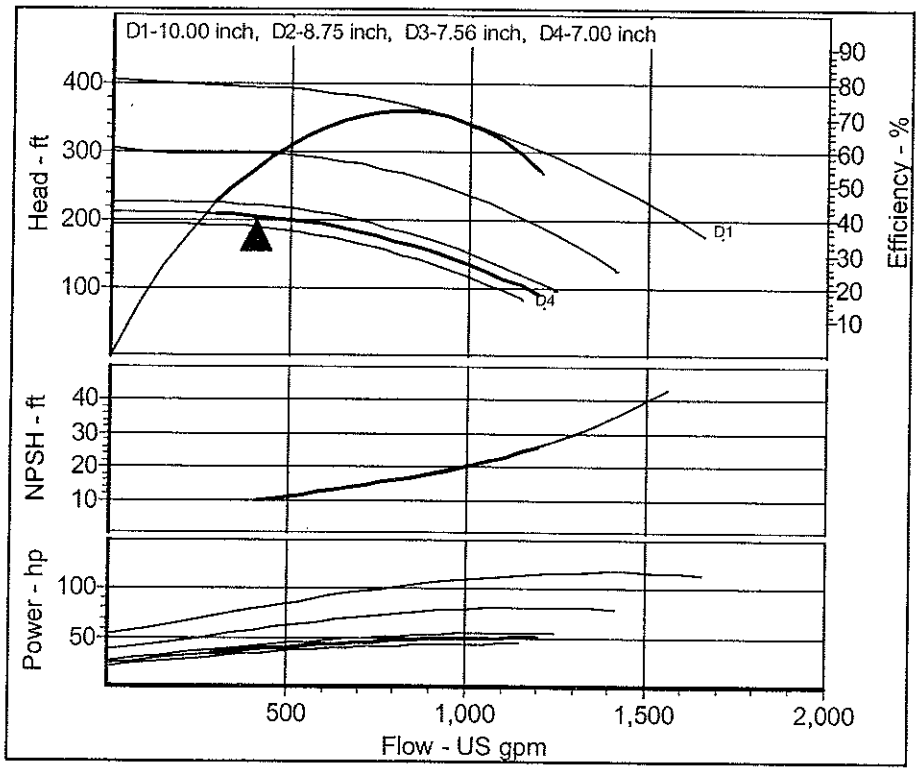
Contact :

Project :

Phone : Fax :

Quote No. : US-3690-124 Page No : 1 Date : Monday, March 26, 2012

Type:	AE Horiz Mtg - Horizontal Split Case Single Stage	Item :	1
Pump Model:	Peerless - 4AE10	Impeller No.:	2693319
Nom. Speed:	3550 RPM, 60 Hz Electric	Fluid:	Water
Impeller Dia.:	7.29 inch	Temperature:	68 °F
Curve No.:	3132010	Viscosity:	1.007 cSt
Market :	Water	Sp. Gravity:	1.000
		Your Ref. :	



Duty Flow	400	US gpm
Duty Head	200	ft
Imp. Dia.	7.29	inch
Power Required	37.7	hp
NPSH Required	9.7	ft
Efficiency	55.2	%
Peak Power	50.7	hp
Closed Valve Head	210.5	ft
Tolerance	Hyd Inst-Peerless Std	

Comments

Perf. curve represents typical perf, vel. head is incld. Perf. curves tests are performed in accordance with H.I.Stds.

Flow (US gpm)	Head (ft)	Efficiency (%)	Power Required (hp)	NPSH Required (ft)
289.2	209.5	45.0	34.0	
402.1	205.9	55.4	37.8	
514.9	199.3	63.2	41.0	11.5
627.8	189.5	68.6	43.8	13.2
740.6	176.4	71.6	46.1	15.0
853.5	160.1	72.0	47.9	17.1
966.3	140.8	69.7	49.3	19.5
1079.1	118.2	64.2	50.2	22.4
1192.0	92.4	54.9	50.7	25.9

PEERLESS PUMP®