Optimal Management and Control of the System

AALSO Symposium 2007

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Optimal Performance at Minimum Cost

- Maximize system performance to provide best possible environment
- Employ operating strategies within quality constraints that minimize operating costs
- Utilize data processing and mining to verify system performance and operating strategies.

Optimizing Performance

- Sand Filtration
- Protein Skimmers
  - Flow control
  - Ozone application
- Ozonation
- Heating and Cooling

Sand Filtration

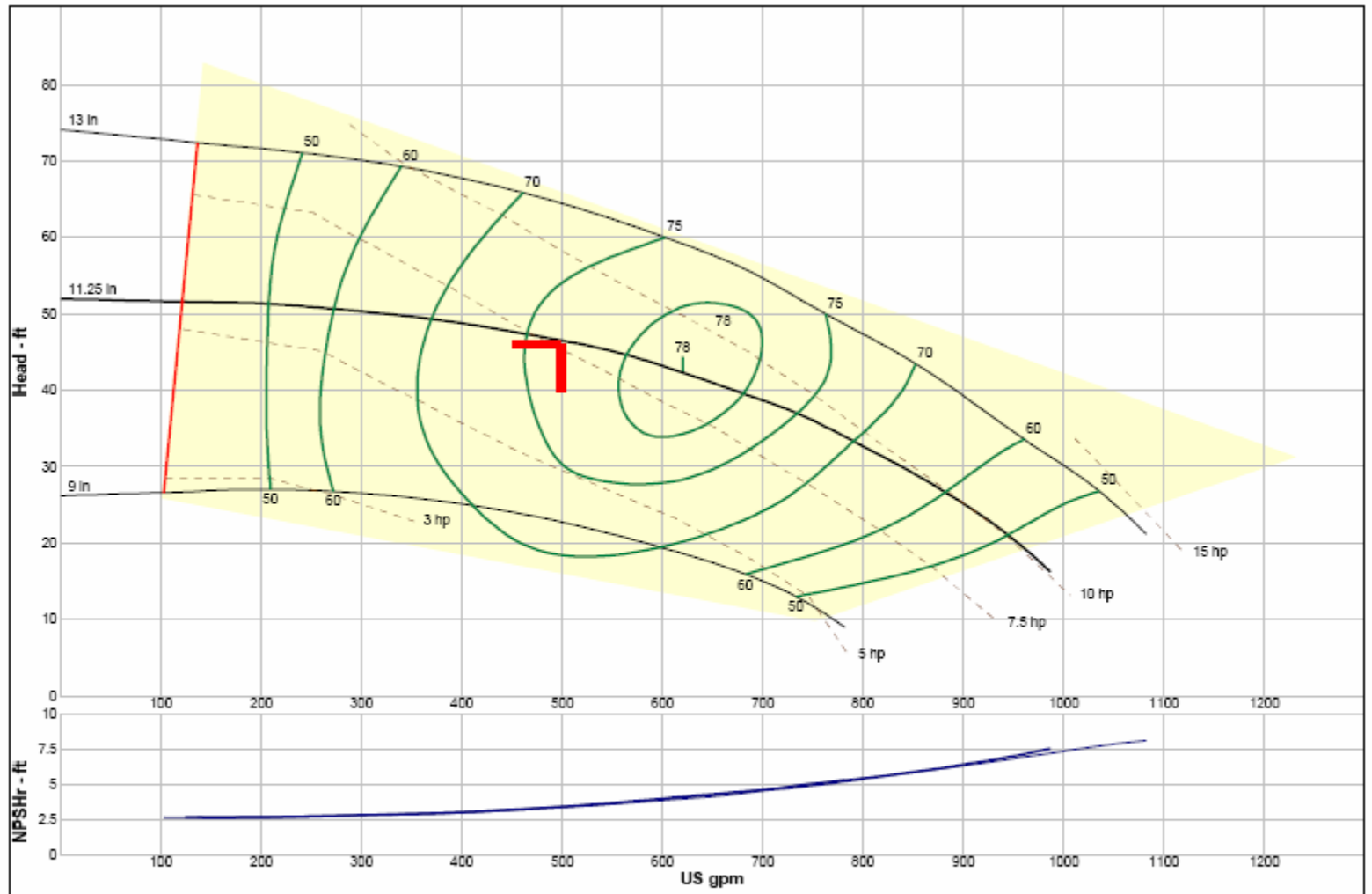
- Soft start and stop
- Flow control
- Filter Loading and performance
- Backwash control

Minimizing Cost

- Energy Economics
  - Pumping
    - Design Considerations
    - VFDs
  - Heating/Cooling and Thermal Storage
  - Utility Time of Use Rate Structures and process flow management
- Automatic Control Systems

Pumping – Design Considerations

- Pump Performance
  - Static Heads
  - Dynamic Heads (Friction Losses)
  - HP = Flow x TDH / (3960 x Efficiency)

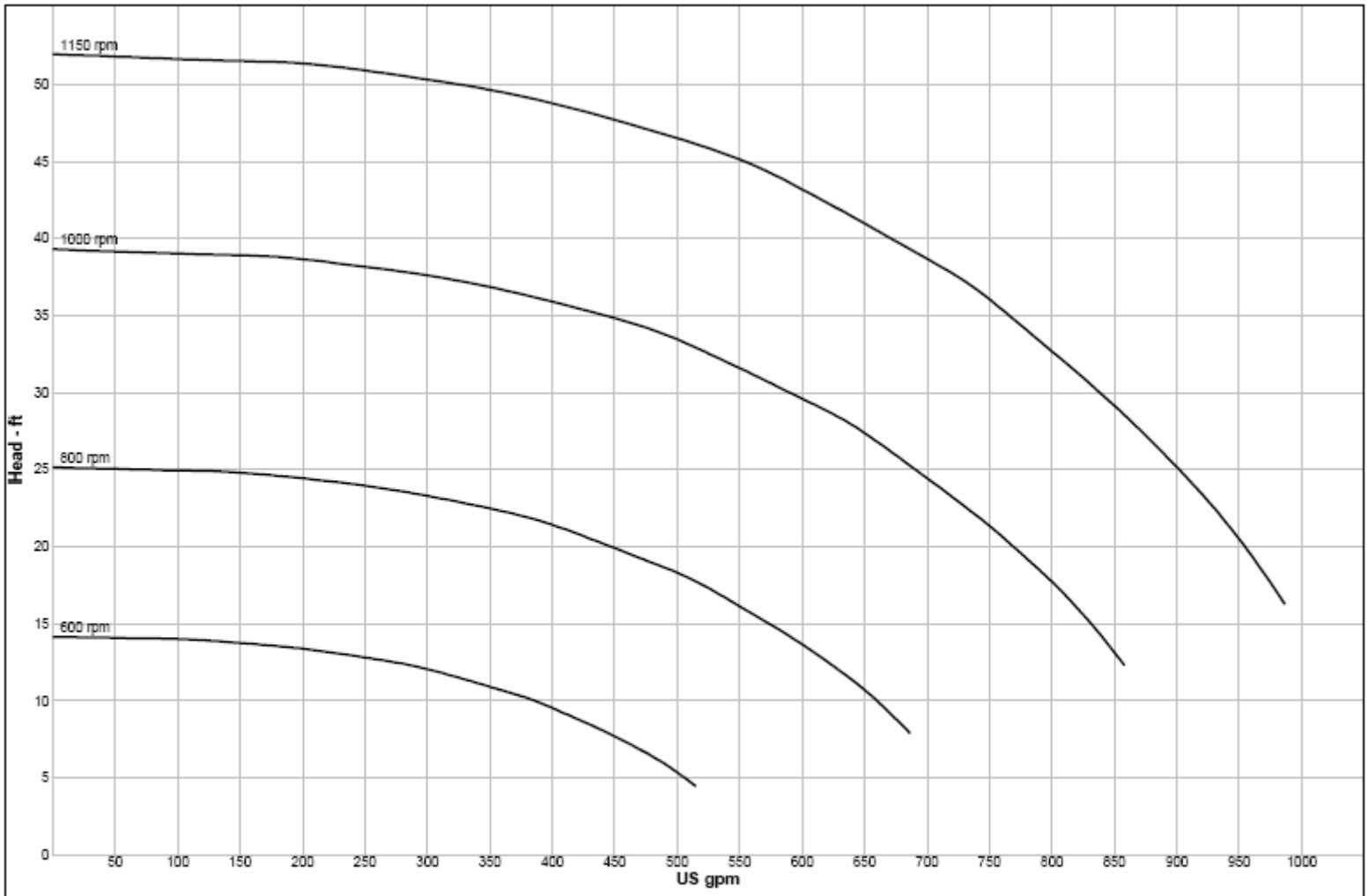


Company:
Name:
5/4/2007

METPRO-FYBROC DIVISION
Catalog: Fybroc Horizontal Ansi Process Pumps.60, Vers 1.0
1500 End-Suction - 1200
Design Point: 499 US gpm, 46 ft

Size: 4x6x13
Speed: 1150 rpm
Dia: 11.25 in
Curve: A60147

MET PRO CORPORATION
Fybroc



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MET PRO CORPORATION
Fybroc

VFDs – Variable Frequency Drives

- Reduced Energy Costs
- Operating Flexibility
- Quieter Operation
- Less wear on mechanical components

Physical Laws

- Flow is directly proportional to speed
- Head is proportional to speed squared
- Power is proportional to speed cubed

Speed, Flow and Power Relationships

% Speed	% Flow	% BHP
100	100	100
90	90	73
80	80	51
70	70	34
60	60	22
50	50	13
40	40	6

Operating Results

VFD Filter		FCV Filter	
Initial HP	6.3	Initial HP	20.8
Initial kW	4.7	Initial kW	15.5
Final HP	20.8	Final HP	20.8
Final kW	15.5	Final kW	15.5
Total kWh/day	151.2	Total kWh/day	372
Annual Savings	$6,044	($0.075/kwh)	

Utility Rate Structures

- TOU – Time of Use Rates
- Consumption Charges
  - Based on total consumption within specific time periods
- Demand Charges
  - Based on Maximum Demand during specific time periods

Heating and Cooling

- Avoiding peak demand charges
- Using off peak rate periods
- Thermal Storage Strategies
  - One Degree (F) in 1 Million Gallons
    - Approx 680 Tons (12,000 Btus)
    - Approx 82 Therms (100,000 Btus)
  - Operate only in off peak periods

Process TOU Management

Reduction in flow/large decrease in power

- Example
  - Reducing flow 10% results in a 33% power reduction
  - 10,000 Gpm to 8000 Gpm at 50 TDH
  - Reduces demand from 135 Kw to 69 Kw
  - Demand charge of $15.00/kw = $990/month

Automatic Control System

- Process Control Elements
  - Flows
  - Temperatures
  - Levels
- Operational Event Logs
- Data maintained on both Process and Operational Logs

Data Processing

- Verification of optimal operating strategies
- Detection of process anomalies
- Quantification of operating economics