

Pump Practices & Life

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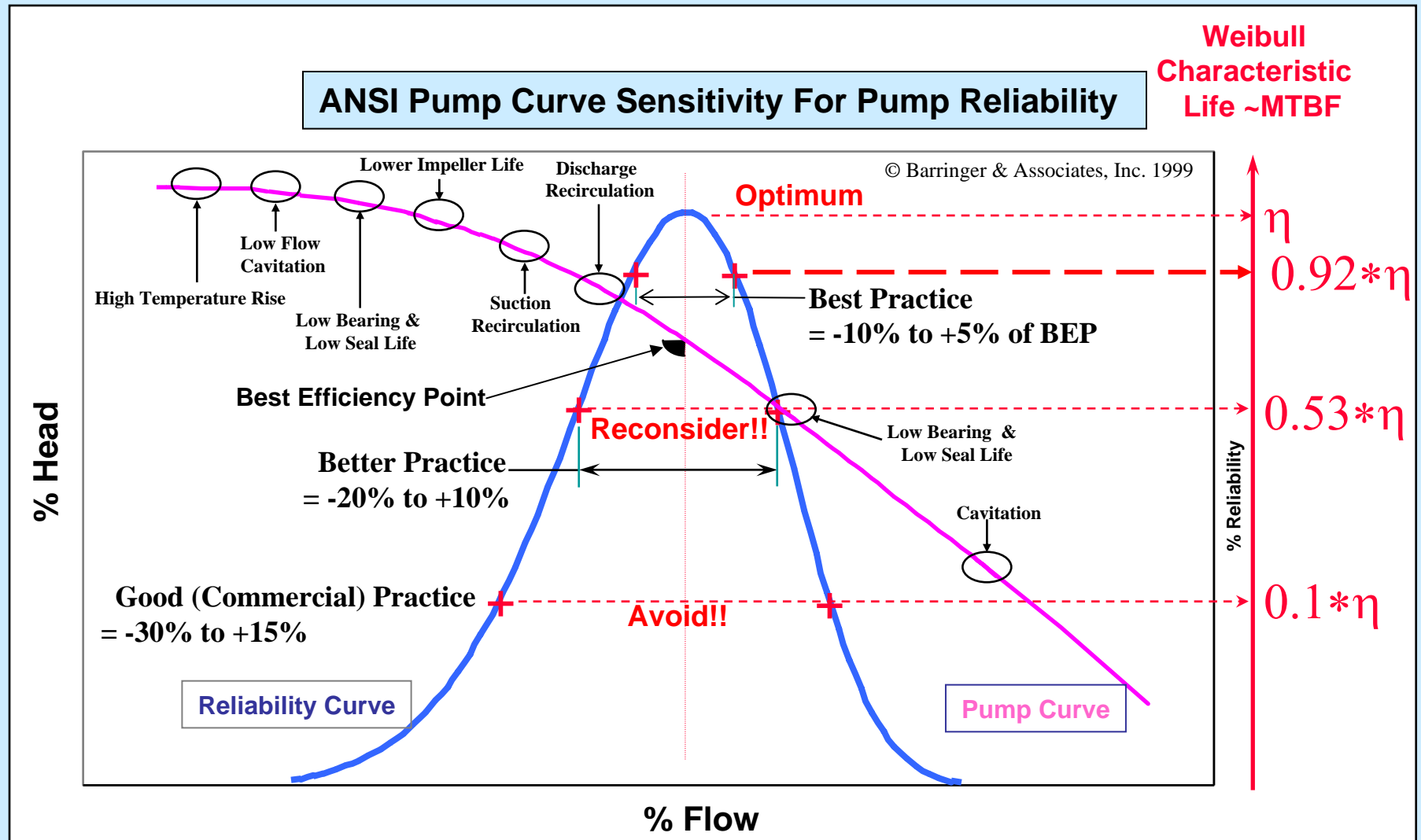
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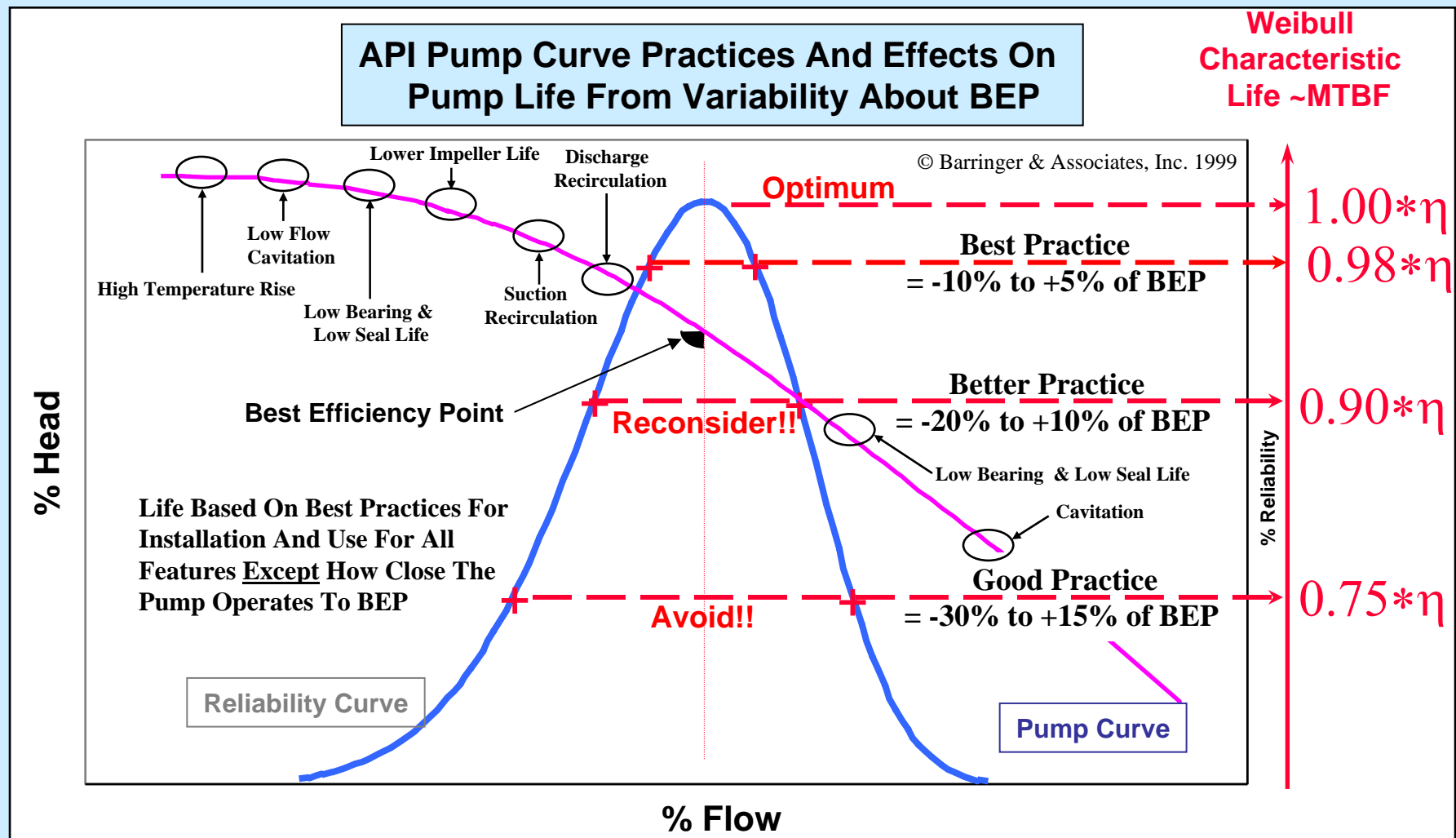
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Reliability measures the capacity of equipment or processes to operate without failure for a specified interval when put into service and used correctly.

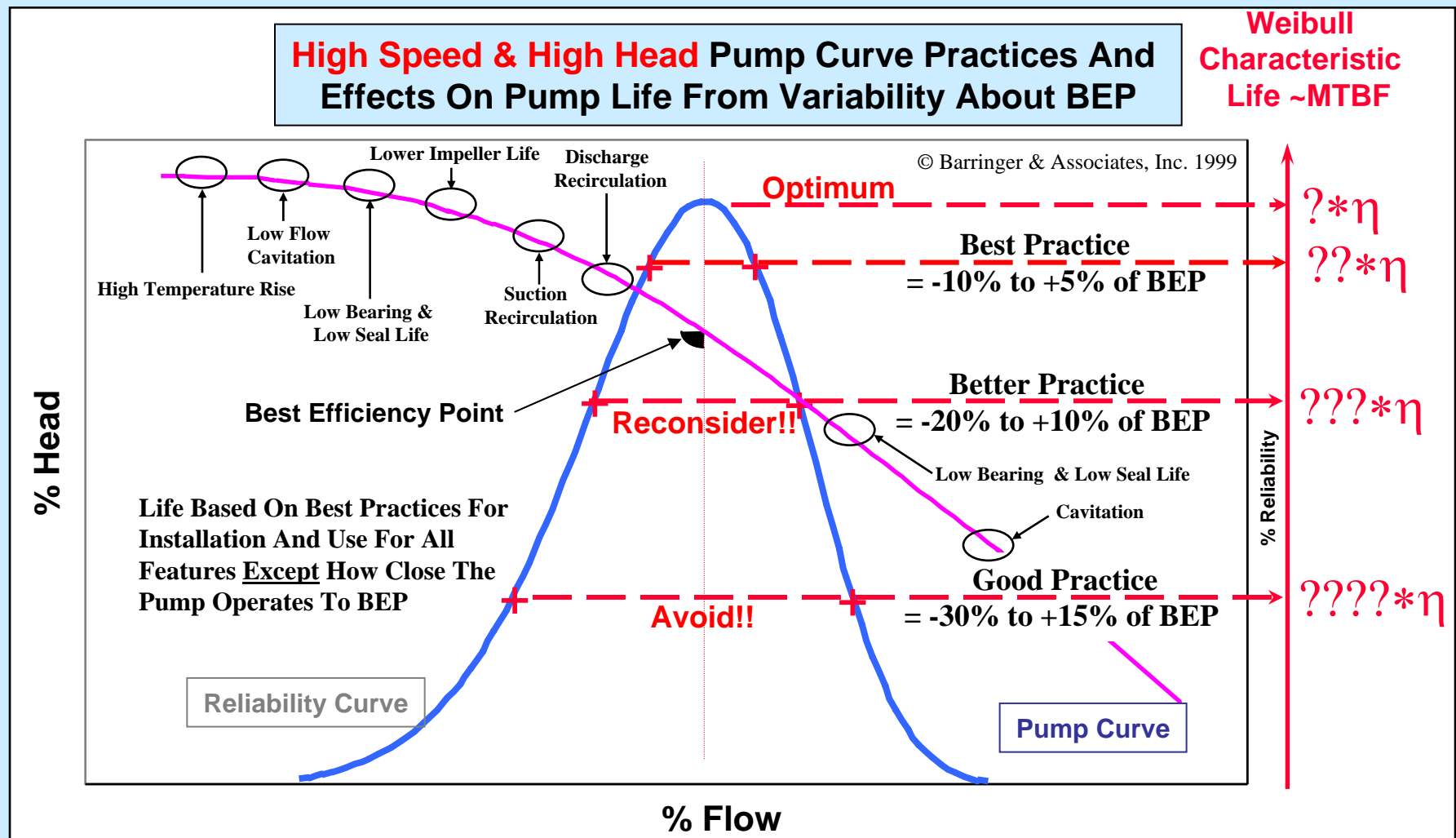
Pump Curve Practices & Life-ANSI



Pump Curve Practices & Life-API



Pump Curve Practices & Life?



Reliability Practices On Weibull Life, η

| | | Pump Curve % Off BEP | L/D Suction Straight Runs | Rotational Shaft Alignment | Piping Alignment | Rotational Balance | Foundation Design | Grouting | | | | | | |
|-------------------------|---------------------------------|----------------------|---------------------------|----------------------------|-----------------------------|----------------------------------|---|-------------------------------|---------------------------|--------------------------|-----------------|--|--|--|
| Best Practices | Resulting eta Multiplier | + 5% to -10% of BEP | L/D = 10 to 12 | ±0.001 inches/inch error | ±0.003 inch error | Smooth at 0.0198 ips | 5 Times Equipment Mass | Monolithic And Adhesive Epoxy | | | | | | |
| Impeller | 0.9726 | 98% | 100% | 100% | 100% | 100% | 100% | 100% | | | | | | |
| Housing | 0.8547 | 86% | 100% | 100% | 100% | 100% | 100% | 100% | | | | | | |
| Pump Bearings | 0.8719 | 98% | 100% | 100% | 100% | 99% | 100% | 100% | | | | | | |
| Mech. Seal | 0.9533 | 98% | 99% | 100% | 100% | 100% | 100% | 100% | | | | | | |
| Bearing Seal | 0.8719 | 98% | | | | | | | | | | | | |
| Shaft | 0.9801 | 98% | | | | | | | | | | | | |
| Coupling | 1.0000 | 99% | | | | | | | | | | | | |
| Motor Bearings | 1.0000 | 100% | | | | | | | | | | | | |
| Replacement Mtr. | 1.0000 | 99% | | | | | | | | | | | | |
| Motor Starter | 1.0000 | 100% | | | | | | | | | | | | |
| | | | | | Pump Curve % Off BEP | L/D Suction Straight Runs | Rotational Shaft Alignment | Piping Alignment | Rotational Balance | Foundation Design | Grouting | | | |
| Better Practices | Resulting eta Multiplier | + 10% to -20% of BEP | L/D = 6 to 8 | ±0.003 inches/inch error | ±0.010 inch error | Good at 0.0448 ips | 3.5 Times Equipment Mass | Slightly Pourous But Adhesive | | | | | | |
| Impeller | 0.6583 | 88% | 95% | 95% | 94% | 95% | 95% | 98% | | | | | | |
| Housing | 0.5163 | 73% | 95% | 95% | 92% | 95% | 95% | 95% | | | | | | |
| Pump Bearings | 0.3950 | 79% | 90% | 88% | 88% | 90% | 90% | 90% | | | | | | |
| Mech. Seal | 0.4314 | 88% | | | | | | | | | | | | |
| Bearing Seal | 0.3950 | 88% | | | | | | | | | | | | |
| Shaft | 0.5705 | 79% | | | | | | | | | | | | |
| Coupling | 0.6036 | 92% | | | | | | | | | | | | |
| Motor Bearings | 0.9776 | 94% | | | | | | | | | | | | |
| Replacement Mtr. | 0.6036 | 100% | | | | | | | | | | | | |
| Motor Starter | 1.0000 | 100% | | | | | | | | | | | | |
| | | | | | | Avoid | | | | | | | | |
| | | | | | | | | | | | | | | |
| Good Practices | Resulting eta Multiplier | +15% to -30% of BEP | L/D = 1 to 3 | ±0.009 inches/inch error | ±0.125 inches error | Rough at 0.248 ips | 0.5 Times Equipment Mass or Stilt-Mounted | Cementitious & Low Adhesion | | | | | | |
| Impeller | 0.1949 | 68% | 75% | 90% | 69% | 81% | 88% | 88% | | | | | | |
| Housing | 0.1438 | 70% | 80% | 83% | 64% | 79% | 78% | 80% | | | | | | |
| Pump Bearings | 0.0151 | 65% | 60% | 58% | 40% | 61% | 50% | 55% | | | | | | |
| Mech. Seal | 0.0095 | 65% | 60% | 58% | 40% | 61% | 50% | 55% | | | | | | |
| Bearing Seal | 0.0151 | 51% | 60% | 40% | 40% | 64% | 55% | 55% | | | | | | |
| Shaft | 0.1149 | 65% | 60% | 58% | 40% | 61% | 50% | 55% | | | | | | |
| Coupling | 0.0737 | 76% | 80% | 65% | 71% | 78% | 70% | 75% | | | | | | |
| Motor Bearings | 0.8625 | 78% | 80% | 55% | 80% | 75% | 60% | 60% | | | | | | |
| Replacement Mtr. | 0.0737 | 100% | 100% | 100% | 100% | 100% | 100% | 100% | | | | | | |
| Motor Starter | 1.0000 | 100% | 100% | 100% | 100% | 100% | 100% | 100% | | | | | | |

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Reliability practices must be connected with costs to find the **lowest long term cost of ownership** calculated by **net present value**.

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Summary

- Important impacts on life involve:
 - Equipment grade
 - Installation grade
 - Operation grade
 - Maintenance grade
- No free lunches—someone pays for everything
- Think about the life cycle cost of your actions—engineer the results

Remember effects of abuses are cumulative! You may try to hide your atrocities but the equipment accumulates the history and someone pays in the end