

NORTHWEST ENGINEERING
College Avenue
Pullman, WA 99164-2920

TO:
FROM: Dr. Jacob Leachman
DATE: January 8th, 2018
SUBJECT: Axial Fan Testing

We need performance plots of our two-stage axial flow fan for use in a building HVAC control system. The damping on the fan system will change; therefore, the performance plots should predict the fan operation under variable back pressure.

We predictive equations to correlate flow, power requirements, and efficiency of our two-stage fan. We need the plots to cover the full rotational speed range of the fan. Your results should include performance curves in non-dimensional form that can be compared to competing fans. You will also need to demonstrate the ability to predict fan performance at non-measured conditions, quantify the confidence in your predictions, and establish limits for your predictive equations.

Please prepare a written test proposal to be submitted on January 22nd at the end of lab time. The final presentation and report must be submitted on February 7th at the start of lab time. If you have any questions, please contact me.

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MEMORANDUM

TO:
FROM: Dr. Jacob Leachman
DATE: January 8th, 2018
SUBJECT: Centrifugal Fan Testing

The centrifugal fan system in our laboratory has been configured in accordance with the applicable test codes and equipped with a digital data acquisition system. We need to develop performance curves and data for this system that may be used to size fans for HVAC applications around the WSU campus.

I want you to develop the equations to correlate flow, power requirements, and efficiency of our fan. We need the plots to cover the full rotational speed range of the fan. Your results should include performance curves in non-dimensional form that can be compared to competing fans. You will also need to demonstrate the ability to predict fan performance at non-measured conditions, quantify the confidence in your predictions, and establish limits for your predictive equations.

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MEMORANDUM

TO:
FROM: Dr. Jacob Leachman
DATE: January 8th, 2018
SUBJECT: Air Compressor Performance Testing

A local company is considering utilizing our compressor to supply pressurized air to their building. We need to characterize the performance of the compressor in terms of volumetric efficiency and mechanical efficiency over the accessible range of the test setup.

Your results should include performance curves that can be compared to competing compressors. You will also need to demonstrate the ability to predict performance at non-measured conditions, quantify the confidence in your predictions, and establish limits for your predictive equations.

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MEMORANDUM

TO:
FROM: Dr. Jacob Leachman
DATE: January 8th, 2018
SUBJECT: Concentric Pipe Heat Exchanger Testing

A local company is considering the possibility of reclaiming heat from a commercial laundry operation. We need to develop a predictive model for the performance of the concentric tube heat exchanger in the laboratory.

Your results should include performance curves in epsilon-NTU form that can be compared to competing heat exchangers. You will also need to demonstrate the ability to predict performance at non-measured conditions, quantify the confidence in your predictions, and establish limits for your predictive equations.

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MEMORANDUM

TO:
FROM: Dr. Jacob Leachman
DATE: January 8th, 2018
SUBJECT: Jet Pump Testing

A local company is considering the use of an air jet pump to both clean and paint surfaces. It is desirable to use a flexible hose to direct the flow from the jet pump, however, we do not know how this will affect the jet pump performance. We need you to determine how this modification affects the jet pump performance.

Your results should include performance curves in non-dimensional form that can be compared to competing pump systems. You will also need to demonstrate the ability to predict performance at non-measured conditions, quantify the confidence in your predictions, and establish limits for your predictive equations.

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MEMORANDUM

TO:

FROM: Dr. Jacob Leachman

DATE: January 8th, 2018

SUBJECT: Roots Blower Testing

A brewery is considering use of our Roots Blower for aeration during brewing. We need to develop a predictive model for the performance of the roots blower in the laboratory.

Your results should include performance curves of volumetric and mechanical efficiency in terms of pressure rise and rotational speed that can be compared to competing systems. You will also need to demonstrate the ability to predict performance at non-measured conditions, quantify the confidence in your predictions, and establish limits for your predictive equations.

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MEMORANDUM

TO:
FROM: Dr. Jacob Leachman
DATE: January 8th, 2018
SUBJECT: Cross Flow Heat Exchanger Testing

A company is considering using an air/water coupled-heat pump in a HVAC application. We first need to characterize the performance of the cross-flow heat exchangers that will transfer heat between the water and air streams. We need to develop a predictive model for the performance of the heat exchanger in the laboratory.

Your results should include performance curves in epsilon-NTU format that can be compared to competing systems. You will also need to demonstrate the ability to predict performance at non-measured conditions, quantify the confidence in your predictions, and establish limits for your predictive equations.

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MEMORANDUM

TO:
FROM: Dr. Jacob Leachman
DATE: January 8th, 2018
SUBJECT: Water Pump Testing

My lab is considering utilizing the water pump to circulate chilled water between equipment. I need to know the flow rate through the pump at variable levels of flow restriction.

Your results should include performance curves that can be compared to competing systems. You will also need to demonstrate the ability to predict performance at non-measured conditions, quantify the confidence in your predictions, and establish limits for your predictive equations.

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MEMORANDUM

TO:
FROM: Dr. Jacob Leachman
DATE: January 8th, 2018
SUBJECT: Acoustics Testing

We need to evaluate the calibrate the suitability of our anechoic chamber to conduct acoustics testing in accord with relevant standards.

You need to evaluate baseline acoustic signatures for the anechoic chamber when no other equipment is running. Compare this acoustic signature to when other experiments are running in the room. Finally, compare this result to the relevant baselines to determine over what ranges our anechoic chamber is suitable for testing.

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MEMORANDUM

TO:
FROM: Dr. Jacob Leachman
DATE: January 8th, 2018
SUBJECT: Rotary Vane Vacuum Pump

Our vacuum pump is under consideration for use as a backing pump for a turbo-vacuum pumping system. Physical constraints do not allow for the backing pump to be located near the turbo-vacuum pumping system. We need to know how much restriction can be placed between the backing pump and turbo-pump before a significant loss in turbo-pump performance occurs.

Your results should include performance curves in terms of pressure and conductance losses through various tubing lengths, and restrictions. You will also need to demonstrate the ability to predict performance at non-measured conditions, quantify the confidence in your predictions, and establish limits for your predictive equations.

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MEMORANDUM

TO:
FROM: Dr. Jacob Leachman
DATE: January 8th, 2018
SUBJECT: Compact CPU heat exchanger

We are designing an integrated micro-electronics package for use in a custom PC-like controller box. We need you to characterize the performance of several finned heat exchangers to evaluate whether active cooling is required

Your results should include performance curves in terms of heat load, power required, and effectiveness/NTU. You will also need to demonstrate the ability to predict performance at non-measured conditions, quantify the confidence in your predictions, and establish limits for your predictive equations.

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MEMORANDUM

TO:
FROM: Dr. Jacob Leachman
DATE: January 8th, 2018
SUBJECT: Vortex Tube Performance

We are constructing a test facility to characterize a novel vortex tube modification for a gas liquefaction concept. We need you to establish baseline operating performance for the vortex tube system in the ME 406 lab.

Your results should include performance curves in terms of input pressure, temperature, flow rate, and cold flow fraction. You will also need to demonstrate the ability to predict performance at non-measured conditions, quantify the confidence in your predictions, and establish limits for your predictive equations.

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MEMORANDUM

TO:
FROM: Dr. Jacob Leachman
DATE: January 8th, 2018
SUBJECT: Small Engine Performance

We are considering whether the performance of our small engine dynamometer is performing up to standard specs for the engine. We need you to fully characterize the engine performance at the rated specification.

Your results should include brake specific fuel consumption, indicated power output, and brake losses. You should compare these values to the engine specification and estimate the theoretical values for the engine based on a cold-air standard analysis.

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MEMORANDUM

TO:
FROM: Dr. Jacob Leachman
DATE: January 8th, 2018
SUBJECT: AC Unit Performance

WSU CAHNRS is attempting to retrofit an old greenhouse to control the climate for investigating growth of a new barley variety. They need to know if the Air-Conditioner system they have specified is adequate.

We need you to conduct an analysis of the AC unit performance relative to various greenhouse internal temperatures. Your analysis should measure the Coefficient of Performance for the AC unit and compare to relevant SEER standard values. Present predictive performance curves for the AC unit performance so that CAHNRS can estimate costs for operation at various temperatures.

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