UNIVERSITY OF LOUISVILLE
J.B. SPEED SCHOOL OF ENGINEERING

CO-OP REPORT EVALUATION

NAME: Smith, Jane C. — *Last Name, First Name* Submittal Date: December 15, 2009

ACADEMIC DEPT. Mechanical Engineering Co-op Number: 1 **X** 2 __ 3 ____

EMPLOYER: XYZ, Inc. Co-op Semester: Fall 2009

CO-OP COORDINATOR

Accepted ___ Not Accepted ___ Co-op Coordinator ____________________ Date ____________

Remarks: ____

____

FACULTY EVALUATION

CO-OP REPORT:	Not Evident	Occasionally Evident	Evident	Clearly Evident
Clarity – *is information clear?*	1	2	3	4
Accuracy – *is the data accurate and precise?*	1	2	3	4
Information – *is it relevant and complete?*	1	2	3	4
Concise – *is it presented in appropriate depth?*	1	2	3	4

WRITING SKILLS: Excellent _____ Good _____ Satisfactory _____ Poor _____

LEARNING OUTCOMES: (check is present)

a) The student applied math/science/engineering knowledge. ❑
b) The student conducted experiments and analyzed data.. ❑
c) The student participated in designing a system, component, or process to meet desired needs within constraints. ❑
d) The student demonstrated the ability to work on TEAMS. ❑
e) The student had experience solving engineering problems. ❑
f) The student increased his/her understanding of professional and ethical responsibility as an engineer. ❑
g) The student demonstrated the ability to effectively COMMUNICATE! ❑
h) The student increased his/her understanding of the impact of engineering solutions on society. ❑
(E.G. Recognize the harmful consequences of engineering errors, and benefits of rapid economical solution to problems, in the business, the community and the environment.)
i) The student became aware of the need for lifelong learning in his/her/field. ❑
j) The student encountered contemporary issues in his/her field. ❑
k) The student experiences the use of techniques, skills, and modern engineering tools commonly used in engineering practice. ❑

This Report is **accepted** __________ This Report is **not accepted** ____________

Remarks: ____

____

Dept. Faculty: ______________________________ Date: ______________________________

I. EMPLOYER DESCRIPTION

XYZ, Inc. is a $2 Billion public company headquartered in Dover, Delaware. XYZ has manufacturing locations in five states, including Louisville, Kentucky. It also has operations in Europe. XYZ has a total of 4,000 employees. XYZ is a leading producer of high efficiency pumps and components used in the global chemical processing industry. The student was assigned to the Centrifugal Pump Division in Louisville, KY in the product development department. The division has 170 employees, 25 in the engineering department, and the remainder in manufacturing operations and administration. This division produces a line of pumps with approximately 150 different models and sells them to customers worldwide. The major customers are chemical plants and petroleum refinery plants around the world and include some of the largest chemical and petroleum companies, such as Dow Chemical, Dupont, and Marathon Petroleum.

II. MAJOR RESPONSIBILITIES AND DUTIES

During this report period, the student was assigned to a product development team that was charged to develop a new version of a 50 horsepower feed pump. The student worked directly with the design engineer and draftsman, as well as the test engineer and lab technicians.

(Purpose)Feed pumps of this size have been manufactured and sold by XYZ for over 20 years. The current model is called the Model 1000. The new pump, which is named the "Model 2000", added several new design concepts to increase the value of the pump to the customer. The primary objective of this project was to redesign the Model 1000 pump to increase sales and profits.

(Assumptions): The critical assumption of the team is that increased customer value will result in higher sales volume and a higher selling price compared with the old the Model 1000. In the Model 1000 design (and in the competitors' design), the pump vane and shaft seals are made of brass alloy. The new design proposed to use a new carbon filled polymer material for the seals which promised much lower friction and improved life in a corrosive chemical environment. ***(Clarity, significance, accuracy.)*** The result is a new "Model 2000" feed pump that will run longer between overhauls, generate less heat loss and use less electrical power than the old design at the same operating conditions. One key issue with the new design was that the new carbon seals are more expensive than the brass seals. The initial cost estimate by the team was $12.00 cost increase per pump. The project team decided to set a target to keep the cost of the "Model 2000" at the same level as the cost of the Model 1000. To lower the projected cost, the team decided to replace the copper winding in the motor stator with aluminum. Looking at projected commodity pricing, the switch to aluminum could save $15.00 per pump. If aluminum windings could be used in the new pump, the overall pump cost would be slightly lower than the Model 1000 and beat the project cost target.

Specifically the student had two primary roles on the Model 2000 pump project:

1. Characterize the new seals for the test pumps when they arrived from the German supplier, and

2. Generate a data base using MatLab to record data from the motors that were placed on test.

In the first task, when the seals were received, the student logged them in, selected samples from the lot, and then tested them several different ways to see if they met specification. Specific gravity was measured using an ASTM method; heat distortion temperature and melting point were determined using Thermal Analysis instruments. Samples were sectioned and measured for carbon fiber length using a metallurgical optical microscope. This data was entered in the project data base and lab note book. The student reported a summary of this data to the project team meeting at the weekly team meeting. A data summary was also provided to the design engineer. He used the data in the ongoing Finite Element Analysis program he maintained.

In the second task involved gathering data from the new design motors on test. The technicians built the test motors, and instrumented them with thermocouples to measure temperature at 15 different points in the motor and pump. They also installed special electrical connections to measure electrical power. The student was responsible for taking data on each motor every 100 hours of operation and entered the data in a MatLab database. A summary was provided to the team at the project team meeting.

(Points of view) The project team meeting was very important to the project and a learning experience for the student. The meeting and discussion was multi-functional; in addition to the engineering team, there were representative from marketing, finance and legal. Marketing was interested in performance, cost and when the product could be launched to the market. Finance tracked product cost and project costs. Legal was concerned about patent protection, and whether the claims to be made about the pump performance in the product ads were legal.

III. EMPLOYER BENEFITS

As discussed in Part II, the student was assigned to the project team to develop the new Model 2000 pump. The design has progressed through production release, and currently is going through pilot runs in manufacturing. If the development testing is successful, full customer launch is planned in late 2009. The Model 2000 is forecasted to result in significant financial benefits to XYZ, Inc. Since the Model 2000 is a superior product to the Model 1000 with higher customer value, the selling price will be increased from $2500 per unit (Model 1000) to $3000 per unit ("Model 2000"). Sales are predicted to increase from 1500 units per year worldwide to 2000 units. The resulting XYZ benefit is increased sales of $2.25 million/year, and increased profit approximately $450,000/year.

IV. STUDENT BENEFITS

A. I applied science and engineering knowledge during the materials characterization of the carbon test seal samples.

B. Participating with the technicians in evaluation testing the new motors allowed me to conduct experiments on the new design, gather data, and analyze and interpret results.

C. I was able to work along side the design engineer and view first hand the *design* of a new system (pump-motor) within a very narrow set of project constraints.

D. Attending the *weekly team meetings* gave me the opportunity to hear *other points of view* from experts outside engineering.

E. Regarding solving engineering problems, several of the pump seals on test failed soon after start-up. The project engineer convened a problem resolution team. I was a member. Several root causes were being investigated when the semester ended.

F. Regarding ethical responsibility, the new pump had to meet various industry standards: NEMA, UL, and AIChE. It was very important for the testing to be done in strict compliance with specified test procedures so that compliance could be certified.

G. An example of using communication tools, I made *verbal and written reports on the motor test program* in the weekly team meeting.

H. The Model 2000 project increased my understanding of the impact of engineering solutions on society. These pumps will be used in very hazardous conditions around the clock throughout the world. An unreliable or unsafe product could result in loss of life and enormous environmental damage.

I. This experience made me very aware of how rapidly technology changes, and the need for lifelong learning. The older, more experienced members of the department had a lot of knowledge about brass seals, but no experience or background in carbon filled polymer or how to evaluate it for pump seals. The team had to learn about new materials properties and evaluation techniques.

J. The engineering solutions the team provided in the Model 2000 feed pump *addressed contemporary issues* being faced today around the world – the need for a more efficient product that consumes less energy, has increased life and reliability and protects human life and the environment.

K. As part of the Model 2000 team, I used an array of *modern engineering techniques and tools*: MatLab, FEA software, and state-of-the-art lab test instruments.