SUPPLEMENTARY EXPERIENCE RECORD

(Refer to the instructions and example provided before completing this form. Only one copy of this form has been provided. Please make additional copies as required.)

APPLICANT'S FULL NAME: Blake Edward Boyd

DESCRIPTION OF ENGINEERING PERFORMED

ENGAGEMENT NO. 1 FROM: 9/2008 TO: 4/2009 (dates)

NAME OF EMPLOYER AND LOCATION: Top Secret

ENGINEERING SUPERVISOR'S NAME(S): Top Secret

After graduating from Texas Tech University, I was employed by Fire Protection in City, Texas in September 2008 to perform design analysis of fire sprinkler systems. My responsibilities included the analysis of construction documents to determine the proper type and layout of fire sprinkler system to be installed, as well as design analysis using engineering principles to determine adequate pump capacity, pipe sizing and equipment selection for each project. I regularly consulted with fire marshals to ensure compliance with local fire code as well as coordinating field activities such as site walkthroughs and water pressure testing. I acquired valuable experience in the engineering design process as well as the use of CAD software. My employment at FP also taught me about the construction process in general which proved to be of great value as I moved forward in my career.

In May of 2009 I was employed as a Project Leader for Engineering Firm Since then I have been providing engineering analysis on HVAC systems ranging in size from small office buildings to large laboratory systems. All projects to date have been located in cities and regions across Texas, including Dallas, Houston, Lubbock, Austin, Nacogdoches, Midland and the Rio Grande Valley.

For each project, I provide analysis of the mechanical design documents and develop plans for test and balance activities. I use an engineering approach to measure and determine the operating conditions of the mechanical equipment on each project and compare the operating conditions to the design intent. I troubleshoot and make necessary recommendations for any equipment that does not meet the design criteria, and I compile the field data into a test and balance report.

Office Building - City, Texas
Total Project Cost: $10,000,000
Project Dates: 9/2009 - 11/2009

My first project as a Project leader was a new corporate facility for Office Building in City, Texas. The new facility's mechanical systems consisted of 1 air handling unit serving 55 air terminal units with electric reheat. The hydronic system included a ground source heat pump with heat exchanger, chiller, cooling tower and 2 chilled water pumps.

(Continued on Page 2)

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APPLICANT'S FULL NAME: Blake Edward Boyd

DESCRIPTION OF ENGINEERING PERFORMED

ENGAGEMENT NO. 2 FROM: 5/2009 TO: 11/2012 (dates)

NAME OF EMPLOYER AND LOCATION: Top Secret

ENGINEERING SUPERVISOR'S NAME(S): Top Secret

(Office Building - Project Continuation from Page 1)

As a Project Leader, my responsibilities were to provide testing, balancing, and engineering analysis on the HVAC systems located on the above project. I also verified that the installed equipment was the same as the engineer approved submittal and prepared the test data sheets for use in the field. I produced a field book which contained the prepared test data sheets and was used throughout the duration of the project by the entire team assigned to the project.

I encountered an engineering problem during testing of the series and parallel fan powered boxes. During the testing of parallel fan powered boxes, I noticed that the fans did not turn off when commanded through the thermostat into a full cooling mode of operation. I reviewed the submittal documentation, which indicated that the fans associated with the parallel fan powered boxes should only energize during a heating mode of operation. After some diagnostic testing, in which I eliminated a number of possible causes of the problem, my attention turned to the control programming. I determined, through analysis of the control software, that the parallel fan powered boxes had been programmed as series fan powered boxes, therefore the fans would be continually energized during normal operation. I informed the controls contractor who corrected the deficiencies in the control programming. I subsequently rechecked the boxes and observed proper operation.

Projects similiar in scope:

School Facility (8/2009 - 9/2009)
Call Center (5/2010 - 7/2010)

University, Building - City, Texas
Total Project Cost: $22,000,000
Project Dates: 11/2009 - 4/2010

This building was designed to serve as a new engineering facility for Uni.. The mechanical systems consisted of 2 air handling units serving 115 air terminal units with heating hot water reheat.

(Continued on Page 3)

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APPLICANT'S FULL NAME: Blake Edward Boyd

DESCRIPTION OF ENGINEERING PERFORMED

ENGAGEMENT NO. 2 FROM: 5/2009 TO: 11/2012 (dates)

NAME OF EMPLOYER AND LOCATION: Top Secret

ENGINEERING SUPERVISOR'S NAME(S): Top Secret

(University, Building - Project Continuation from Page 2)

The hydronic system consisted of 2 chilled water booster pumps and 2 heating hot water booster pumps served by the campus central plant.

As Project Leader, I performed site walkthroughs early in the construction phase of the project to ensure that the mechanical systems were installed per the mechanical drawings and project specifications. I also observed the installation to ensure that it matched the engineer approved submittals.

An engineering issue I encountered on this project was when I began the building's chilled water balance. I measured the chilled water supply and return temperatures and pressures directly entering and leaving the coil of an air handling unit. I noticed that the chilled water supply temperature was higher than the chilled water return temperature. I also noticed that the chilled water return pressure was higher than the chilled water supply pressure. I performed the same measurements on the coil for the other air handling unit and obtained the same result.

After I analyzed the results of my measurements, I began to trace the chilled water piping back to its origin at the tap-off of the campus central plant main lines in the underground tunnel. I determined that the chilled water supply and chilled water return lines tapping off of the main central plant lines to the building were piped backward. I recommended to the mechanical contractor that the piping be corrected. After the issue had been reported to be corrected, I observed that the piping had been reversed in the tunnel. I verified the correct piping by remeasuring the chilled water supply and return temperatures and pressures. I determined that the corrections had been made and after completing testing of the building's remaining HVAC systems, I compiled a test and balance report that was approved by my supervising engineer.

Projects similar in scope:

Same University, Different Bldg. (8/2009 - 1/2010)
Different University, Administration Building (8/2011 - 12/2011)

(Continued on Page 4)

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APPLICANT'S FULL NAME: Blake Edward Boyd

DESCRIPTION OF ENGINEERING PERFORMED

ENGAGEMENT NO. 2 FROM: 5/2009 TO: 11/2012 (dates)

NAME OF EMPLOYER AND LOCATION: Top Secret

ENGINEERING SUPERVISOR'S NAME(S): Top Secret

Laboratory - City, Texas
Total Project Cost: $27,000,000
Project Dates: 7/2010 - 10/2010

Engineering Firm was retained to provide testing, adjusting and balancing services for the Laboratory. This was a new construction project consisting of 4 air handling units served by 1 outside air handling unit. Sixteen laboratory systems were served by 66 Phoenix supply, general exhaust, and laboratory hood exhaust air valves. The adjacent office space was served by 133 air terminal units with electric reheat. The exhaust airflow system was served by 2 roof mounted exhaust fans. The hydronic systems consisted of 2 chillers, 3 chilled water pumps, 1 boiler and 2 heating hot water pumps.

I provided engineering analysis of the mechanical design documents and developed a plan to test the systems. I prepared the mechanical drawings and field data sheets and created a field test book. I was responsible for organizing and leading a team to perform an engineering analysis of the operation of the mechanical systems on the project. As a project leader, I produced weekly progress reports and weekly deficiency lists which were submitted to my supervising engineer for review. While in the field, I was responsible for verifying the installed equipment versus the engineer approved submitted equipment. I also began representing my firm at project coordination meetings with subcontractors as well as with the owner, architect and engineer.

An engineering issue I encountered on this project was when I was testing the electric reheat on the building's fan powered air terminal units. I observed that the electrical reheat would not energize on select units. After performing diagnostic testing on a couple of units and analyzing the findings, I determined that a minimum air pressure safety switch existed for the heaters which prevented them from energizing without sufficient airflow in an effort to protect the heating elements from overheating and possibly catching fire. After consulting with the air terminal units' manufacturer's representative, I determined, through field testing of the units, the minimum pressure required to engage the switch.

(Continued on Page 5)

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DESCRIPTION OF ENGINEERING PERFORMED

ENGAGEMENT NO. 2 FROM: 5/2009 TO: 11/2012 (dates)

NAME OF EMPLOYER AND LOCATION: Top Secret

ENGINEERING SUPERVISOR'S NAME(S): Top Secret

(Laboratory - Project Continuation from Page 4)

Through further engineering analysis and calculation, I determined and compiled the new minimum airflows required to ensure that the safety switches would remain engaged. I recommended the changes to the engineer of record which were accepted. After completing the remaining testing of the building's HVAC systems, I submitted a test and balance report which was accepted by my supervising engineer.

Other projects similar in scope:

Similar Laboratory (10/2010 - 1/2011)
Another Similar Laboratory (5/2011 - 9/2011)

University Project - City, Texas
Total Project Cost: $3,800,000
Project Dates: 1/2011 - 3/2011

Engineering Firm was hired to perform testing, adjusting and balancing services for the third phase of the University Project at University. The building consisted of many diverse HVAC systems that provided me invaluable engineering experience.

The building consisted of 3 air handling units serving 34 zones with heating hot water reheat, 2 outside air handling units, 3 direct expansion air handling units, 15 roof mounted exhaust fans, 2 chilled water and 2 heating hot water booster pumps served by the campus central plant. The building was divided into sections that were determined by the type of equipment being used by the students in the space. There were multiple snorkel exhaust and dust collecting systems serving a woodworking area, welding area and sandblasting area.

As the project leader, I provided engineering analysis of the mechanical design documents and performed testing, balancing, and engineering services on the mechanical equipment.

(Continued on Page 6)

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DESCRIPTION OF ENGINEERING PERFORMED

ENGAGEMENT NO. 2 FROM: 5/2009 TO: 11/2012 (dates)

NAME OF EMPLOYER AND LOCATION: Top Secret

ENGINEERING SUPERVISOR'S NAME(S): Top Secret

(University Project - Project Continuation from Page 5)

I encountered an engineering problem upon my testing of a large snorkel system serving the welding area. The system consisted of 14 snorkel exhaust inlets served by a roof mounted exhaust fan. The snorkel system configuration prevented accurate airflow measurement at the inlets. I analyzed the exhaust system configuration and determined that the total airflow could be measured on the discharge side of the fan. After measuring and adjusting the fan to achieve its total design airflow, I then turned my attention to balancing the individual snorkel exhaust inlets. I determined that since the snorkel inlets were of similar size, I could proportionally balance them via air velocity measurements obtained with an airfoil. I performed the measurements and adjusted the system to obtain proportional velocity measurements at each inlet. Subsequent smoke testing with the design engineer confirmed that the system was properly balanced.

An additional engineering challenge was encountered during testing of one of the roof mounted exhaust fans. I performed initial airflow measurements at the exhaust inlets served by the fan. I determined that the airflow total was significantly lower than designed. I then verified the maximum speed of the fan and adjusted the fan sheave to obtain the maximum possible airflow. I observed that the airflow remained low as well as the fan amperage was measured to be operating at its maximum nameplate value.

Based on the results of my fan test, I suspected that there was an airflow blockage in the system. I then analyzed the mechanical drawings as well as the field installed ductwork to determine where I might find a blockage in the system. I began at the exhaust inlets and methodically worked up the system until I reached the roof curb. I unscrewed the fan from the roof curb to find that the gravity damper mounted in the curb was partially shut due to its obstruction by electrical conduit that prevented it from moving freely. I informed the mechanical and electrical contractors of the deficiency and after it was resolved, measured and set the fan to achieve its design airflow.

Corporate HQ - City, Texas
Total Project Cost: $135,000,000
Project Dates: 3/2011 - 8/2011

(Continued on Page 7)

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APPLICANT'S FULL NAME: Blake Edward Boyd

DESCRIPTION OF ENGINEERING PERFORMED

ENGAGEMENT NO. 2 FROM: 5/2009 TO: 11/2012 (dates)

NAME OF EMPLOYER AND LOCATION: Top Secret

ENGINEERING SUPERVISOR'S NAME(S): Top Secret

(Corporate HQ - Project Continuation from Page 6)

Corporate HQ was a 6 level, 750,000 square foot national corporate training facility designed to further the professional development of Corp. employees. The building's mechanical systems consisted of 33 air handling units serving 170 air terminal units with heating hot water reheat, 740 fan coil units and 47 exhaust fans. The central plant hydronic system consisted of 3 chillers, 2 cooling towers, 11 chilled and condenser water pumps, 2 boilers and 4 heating hot water pumps.

This project was one of the largest in my division's history and provided me with invaluable experience in project leadership, project management and technical engineering experience. As Project Leader, I was tasked with reviewing the submittal documentation and project specifications to ensure that the installed equipment correctly met the design intent. I was also responsible for leading a two man team in the field as well as daily communication of deficiencies and potentially problematic issues to the rest of the project team. I increasingly took on responsibility in representing my firm at subcontractor's and owner's construction progress meetings, as well as during meetings scheduled with other subcontractors to troubleshoot and resolve building mechanical issues.

I encountered an engineering issue on this project during the course of testing an air handling unit system serving offices located on the West end of the building. While testing the fan powered boxes associated with the AHU, I observed that the boxes were consistently unable to achieve their design airflow or maintain space temperature. I performed diagnostic testing and measurements on the boxes in an attempt to identify the cause of the airflow deficiency. After analyzing the data I obtained, I determined that the units' VAV controls were operating properly. I then turned my attention to the air handling unit. After performing preliminary performance measurements on the unit, I used an engineering approach to analyze the data and determined that the unit was experiencing lower than design supply airflow. My measurements indicated a higher than expected fan discharge static pressure. I then performed a static pressure profile analysis by systematically measuring static pressure in the supply airflow ductwork. After analyzing the data, I determined that there was a significant pressure drop across the sound attenuator installed immediately leaving the air handling unit.

(Continued on Page 8)

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DESCRIPTION OF ENGINEERING PERFORMED

ENGAGEMENT NO. 2 FROM: 5/2009 TO: 11/2012 (dates)

NAME OF EMPLOYER AND LOCATION: Top Secret

ENGINEERING SUPERVISOR'S NAME(S): Top Secret

(Corporate HQ - Project Continuation from Page 7)

I consulted with the design engineer to determine if the sound attenuator could be removed by providing pressure and airflow measurements along with operating performance analysis. After the design engineer recommended that the sound attenuator be removed, I repeated my testing of the unit and performed another duct static pressure profile of the system. I determined that the unit was able to achieve its design airflow without the sound attenuator. I discussed my findings with the project team and it was decided to permanently remove the sound attenuator from the system. I finalized my testing by setting the system to operate as designed.

Other projects similar in scope:

Another Corporate High-Rise (4/2010 - 5/2010)
Data Center (7/2012 - 8/2012)

University, Residence Hall - City, Texas
Total Project Cost: $47,000,000
Project Dates: 5/2012 - 8/2012

University commissioned the construction of the new Residence Hall Residence Hall to help meet the demand of its growing student population. The project consisted of a 5 level Residence Hall and a 2 level Dining Facility joined by a connecting lobby. The buildings' mechanical systems consisted of 11 rooftop air handling units, 231 fan coil units with outside air provided by dedicated outside air handling units, 40 exhaust fans, 2 air cooled chillers, 2 chilled water pumps, 2 heating hot water pumps as well as a steam to water heat exchanger that was served by the campus's central plant.

As Project Manager, I was responsible for maintaining all aspects of the project. These responsibilities included meeting the project deadline by planning the field activities of a two man field crew, maintaining the project budget, attending construction progress meetings and maintaining a positive

(Continued on Page 9)

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ENGAGEMENT NO. 2 FROM: 5/2009 TO: 11/2012 (dates)

NAME OF EMPLOYER AND LOCATION: Top Secret

ENGINEERING SUPERVISOR'S NAME(S): Top Secret

(University Residence Hall - Project Continuation from Page 8)

relationship with the client through honest, timely communication. I was also responsible for report preparation and quality control.

An engineering issue I encountered on this project was when I began testing of the dorm room fan coil units. I performed initial measurements, analyzed the data and determined that the system was producing excessively high supply airflow. I set the unit to achieve the lowest possible airflow allowed by the fan coil unit's configuration, and determined that the supply airflow remained excessively high. I then reviewed the submittal documentation and found that the design total static pressure for the fan was significantly higher than the pressures I measured at the supply fan. I used an engineering approach in my analysis of the problem and determined that due to the relatively small size of the rooms that the ductwork did not provide as much resistance to flow as the designer intended. After consulting with the design engineer and the project team, based on the analysis of my test measurements, I concluded that we could achieve design airflow by adding pressure to the duct system. The team had reported experience in using perforated metal plates and we concluded that this was worth a try. I recommended the mechanical contractors make the changes to a select number of trial units on the first floor. Shortly thereafter, I tested the units again and determined that the airflow had been reduced to a level that was acceptable to the engineer and project team. I provided the final data for review by the project engineer and it was approved. I then directed the mechanical contractors to make the changes to the remainder of the fan coil units on the project. After completing testing of the buildings' systems, I compiled separate reports for the Residence Hall and the Dining Facility that were accepted by my supervising engineer.

I experienced another engineering issue on the project after field testing had been completed. I received a report by the owner's project manager that the interior lobby doors were remaining open due to excessive negative pressurization in the building. Upon arrival to the lobby, I confirmed the project manager's observations and began the process of solving the problem. By working systematically through the outside air handling unit and exhaust fan systems, and by using an engineering approach, I determined that the outside air dampers serving 3 of the 5 rooftop units in the Dining Hall were shut.

(Continued on Page 10)

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DESCRIPTION OF ENGINEERING PERFORMED

ENGAGEMENT NO. 2 FROM: 5/2009 TO: 11/2012 (dates)

NAME OF EMPLOYER AND LOCATION: Top Secret

ENGINEERING SUPERVISOR'S NAME(S): Top Secret

(University Residence Hall - Project Continuation from Page 9)

I had previously set them 95-100% open during the course of testing the units to achieve design outside airflow and building pressure. After commanding the dampers open through the control programming, I observed the excessive negative pressurization issue in the lobby had subsided. I performed static pressure measurements across the doors in the lobby and determined that the issue had been corrected.

New Hospital - City, Texas
Total Project Cost: $170,000,000
Project Dates: 10/2012 - 11/2012

On this project, I was tasked with assisting another team in meeting the construction completion deadline. I tested several air handling unit systems with both supply and return fans, ducted outside air and relief air, variable volume air terminal units and ducted return airflow systems. I also completed testing on the building's stairwell pressurization system consisting of 3 roof mounted stairwell pressurization fans serving the 9 story stairwells and equipped with a stairwell pressurization sensor to maintain proper pressurization during a fire alarm.

An engineering issue I encountered on this project was during the testing of one of the ducted return airflow systems associated with an air handling unit system that served the hospital's main lobby. After completing a series of preliminary return inlet airflow readings, I measured the total system return airflow and determined that the system was deficient in total return airflow. By using an engineering approach to the problem, I determined that the best course of action was to inspect the length of the system to identify if any branch dampers in the system may be closed. I also performed preliminary air handling unit testing to obtain a baseline operating condition to aid in solving the deficient airflow problem. I determined from my analysis of the data that the return fan was operating at full speed with much higher than anticipated total static pressure based on an analysis of the fan's performance curve. My attention then turned to the inlet totals to identify any areas of the duct system that may be experiencing lower airflow relative to the rest of the system which would indicate a blockage in that

(Continued on Page 11)

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APPLICANT'S FULL NAME: Blake Edward Boyd

DESCRIPTION OF ENGINEERING PERFORMED

ENGAGEMENT NO. 2 FROM: 5/2009 TO: 11/2012 (dates)

NAME OF EMPLOYER AND LOCATION: Top Secret

ENGINEERING SUPERVISOR'S NAME(S): Top Secret

(New Hospital - Project Continuation from Page 10)

portion of the ductwork possibly causing the higher than anticipated system pressure. By analyzing the return airflow inlet totals, I pinpointed a branch of the ductwork that was excessively low on airflow and concluded that the remaining branches of the system, while still unbalanced, were within 10% of their design inlet totals. I determined that there was most likely a blockage in that branch of the ductwork. After further duct pressure analysis, I highlighted a section of the duct and directed the mechanical contractor to investigate the section for blockage. The next day, the mechanical contractor informed me that there was indeed a closed branch damper found in the system that was not indicated on the mechanical drawings. After the branch damper was opened, I again measured the return air inlets on the system as well as performed air handling unit return fan testing and determined that the fan was able to achieve design return airflow with a much lower total static pressure. I set the air handling unit system to operate at design and submitted test data sheets that were accepted by my supervising engineer.

New Forensics Laboratory - City, Texas
Total Project Cost: $7,000,000
Project Dates: 9/2012 - 10/2012

The New Forensics Laboratory project was a new laboratory addition to Owner's existing facility. The project consisted of 1 rooftop air handling unit serving 7 air terminal units and 12 laboratory supply air terminal units, 2 constant volume laboratory exhaust fans with a bypass damper serving 11 laboratory exhaust air terminal units, 3 general exhaust fans and 2 fan coil units.

As Project Manager, I continued to increase my responsibility and decision-making regarding both the engineering aspects of the project as well client management.

I encountered an engineering issue during the laboratory exhaust system testing. The laboratory exhaust air terminal units were venturi type and required a minimum differential pressure to be

(Continued on Page 12)

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APPLICANT'S FULL NAME: Blake Edward Boyd

DESCRIPTION OF ENGINEERING PERFORMED

ENGAGEMENT NO. 2 FROM: 5/2009 TO: 11/2012 (dates)

NAME OF EMPLOYER AND LOCATION: Top Secret

ENGINEERING SUPERVISOR'S NAME(S): Top Secret

(New Forensics Laboratory - Project Continuation from Page 11)

maintained to ensure proper operation of the valve and to maintain airflow at the unit. To properly set the bypass damper at the exhaust fans, I determined which exhaust valve was furthest from the fans and experienced the least amount of pressure, therefore creating a "worst case scenario". I monitored the differential pressure at the valve while modulating the bypass damper in an attempt to achieve the minimum required pressure. After performing testing on the system, I determined that two fans were required to operate with the bypass valve modulated 70% closed to achieve the minimum pressure at the valve. I knew from my review of the submittal documentation and laboratory exhaust system sequence of operation that only one fan was intended to operate at a time with the other fan providing redundancy. I systematically worked through each aspect of the system that I determined could have an effect on the valve's differential pressure. I began by performing a static pressure profile of the ductwork. I analyzed the data I obtained and concluded that there was no significant pressure loss in the system that would indicate an opening in the ductwork or excessive leakage.

I soon realized that the issue most likely resided with the valve itself. I proceeded to inspect the unit to determine if it was properly configured. Relying on my previous experience with laboratory valves, I determined that the valve was installed and configured properly. My attention then turned to the condition of the valve's control air hosing which connected the valve to the rest of the system. It appeared to be in good condition so I connected my air multimeter to the hosing to determine if there was a blockage. Based on my measurements, I determined that there was a blockage. I disconnected the hoses from the unit, blew through them to dislodge any debris, and reconnected. I observed insulation material discharge from one of the hoses during this process. I then remeasured the differential pressure across the valve and observed that the pressure was well above the minimum needed to maintain proper operation. After completing testing, I determined that only one fan was needed to achieve design airflow for the laboratory exhaust system.

Other projects similar in scope:

Hospital Renovation (11/2010 - 2/2011)
Hospital Diagnostic Testing 1/2009 - 12/2009)
Medical Center Renovation (6/2010 - 7/2010)

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Applicant's Signature **Date**