

Category: 6 – Best Building Project – Subcontractor (\$6 – 10 Million)

Contractor: MTech Mechanical

Project Name: 1401 Lawrence

For over 5 years, from 2010 until 2015, there had not been a single building under construction that was over 325 feet tall. That was until The Beck Group began work on the 1401 Lawrence office building with MTech Mechanical as a key design-build team member. Today stands a 24-story, Class AA, LEED Gold office building, totaling 478,000 square feet with premium office and retail space at the gateway to downtown Denver.

The breakdown of the building includes 24 levels including retail, parking and exceptional office spaces. Level 1 includes the main lobby, approximately 10,000 sq. ft. of commercial/retail space, and the entrance/exit ramp to the parking garage. Levels 2 through 8 consist of open parking garage. Levels 9 through 24 (excluding level 13) are the commercial office floors in the building. A high-end fitness center of approximately 4,000 sq. ft. is included on Level 9 as a building amenity.

Saving Time and Money While Providing Value Engineering to the Owner's Benefit

Heating Hot Water Piping Loop

In the original narrative, a typical heating hot water piping system was described that would provide supply and return water for the VAV terminal units coming from one set of risers and piping in a loop formation. It was MTech's experience that having this piping installed with the risers out at the perimeter, in this case at four locations, provides a cost advantage to the project. MTech was able to redesign the system on each floor to a design that included (4) riser locations located in each quadrant of the building to eliminate the need for a piping loop. Not only did this save the owner money, but it made the design of the TI buildouts more flexible.

Because of this innovative thinking, \$340,000 was returned to the general construction portion of the project, by changing to the vertical riser approach. That is a significant amount of money on any project, but the net result gave the building more flexibility, and a ceiling plenum that had one less piping system in it.

Air Handling Unit Casing Construction

Each of the two air handling units for the building has a capacity of 150,000 cubic feet of air per minute (CFM). This size is well beyond the equipment sizing that is supported by typical catalogued equipment. One method of constructing the casings for large air handling units is to utilize a pre-fabricated, insulated panel system. While that is flexible and effective for custom construction such as this project, it also is expensive.

It is relatively common to utilize the general building elements to form part of the air handling unit casings for the construction of similarly-sized high-rise office buildings. MTech followed a similar approach for the 1401 project, where the concrete floor, roof, and curtain wall elements were used, along with super-sized gypsum-board partition construction to create the perimeter elements of the casings. MTech offered a budget reduction of slightly more than \$100,000 to change from using the insulated panels to using the building construction elements, and represented an excellent example of value engineering.

Utilization of BIM and Prefabrication to improve Costs, Scheduling and Coordination

With this project MTech began using the BIM process with Revit and AutoCAD immediately upon joining the team, in order to transfer information seamlessly to MTech's prefabrication shops. That is one of main advantages that MTech had over a traditional design-bid-build approach, where most times, the CAD files transmitted by the engineer are not well-coordinated with the model overall, and certainly not in a manner that they could be used for our in-house pre-fabrication processes.

MTech located approximately 200 of the plumbing system piping anchors in the concrete framing system, for piping on Levels 8 and 23, two of the most congested floors in the building. This aspect of the construction did not have an impact on life cycle costs, but it was fundamental to allowing MTech to complete a critical component of the installation, after the completion of the design process.

MTech also pre-fabricated all the sheet metal duct risers. The largest trunk duct size at that top of the risers had sheet metal dimensions of 12 ft. x 6 ft. Utilizing MTech's fabrication shop speeds up construction time, resulting in lower labor costs, and that piece of the work was not affected by weather delays.

Working with Other Trades to Overcome Obstacles in the Construction Process

Architectural - Air Handling Unit / System Layout.

A central station, variable air volume (VAV) HVAC system configuration was identified by the time that MTech was awarded the project. However, because of the small footprint of the individual floors (20,000 sq. ft.), and even smaller footprint for the mechanical penthouse, this prevented the construction of two HVAC shafts.

Instead, MTech implemented a single shaft, which housed two supply air riser ducts in the center of the building, and a second shaft, which served as the return air shaft on one end of the core. This arrangement created the need for a non-conventional “racetrack” arrangement for the air handling systems at the top of the building. All ductwork sections were custom-fitted, and no two-pieces were alike, due to having to fit within available space in the mechanical room on the roof.

Structural – Accommodating Changes at the Top of the Building, Late in the Project.

The roof over the mechanical level above the top-most tenant floor was designed and constructed of cast-in-place, post-tensioned concrete. Framed openings had been included in the design for the installation of the chillers. However, that had to be changed shortly after the HVAC design was completed, because the only practical location for the tower crane was where the chiller room was planned. Therefore the MTech engineering team had to lay out the chiller room again.

HVAC - FANWALL Technology

Coincident with the size of the air handling system identified above, the associated supply air fans had to have an extremely large capacity, with each of two groups of fans totaling 150,000 CFM. For this, MTech decided to use a FANWALL build-up fan arrangement. The average fan capacity typically is in the 30,000 CFM to 50,000 CFM range. The system at 1401 is easily three times that size and one of the largest that they ever have built.

The benefit to the project was that the large air handling capacity could be achieved in a relatively small footprint, without creating acoustical problems related to airborne sound, and through-floor vibration, while being well suited for installation in the site-erected casing approach for the building.

Schedule Delays and Subsequent Actions

The construction schedule was heavily impacted by concrete and weather delays by 153 days. These delays caused schedule compaction to our mechanical penthouse activities, as follows:

- The original schedule between penthouse rough-in and the dismantlement of the crane was reduced from four to two weeks.
- Every piece of mechanical equipment for the penthouse was hoisted in that duration.

Original rough-in schedule for the penthouse allowed for 55 days. The delays reduced the rough-in time to 38 days. MTech was able to meet this schedule by doing the following:

- The MTech CAD team's coordinated BIM model allowed for a clash free installation.
- Our field crews utilized a "hybrid" prefabricated piping system that included both mechanical coupling joints and weld joints to reduce the number of field welds to a minimum.
- The MTech pipe fitting shops prefabricated all heating hot water, chilled water, and condenser water piping systems and hanger assemblies.
- Ductwork was pre-assembled in multiple joints and then hoisted into place with the crane.

Exceeding Expectations and Enhancing the Downtown Denver Skyline

The project achieved LEED Gold in February 2017. Consequently, many of the "sustainable" items that are typically associated with a LEED Gold pursuit have been incorporated into the project. The most difficult points to achieve were for the HVAC systems, but with MTech's team utilizing FANWALL type supply fans as well as high-end water-saving plumbing fixtures, we were able to complete our section of the LEED scorecard with flying colors.

Safety on the project was a hot topic being in a highly exposed downtown site. MTech held specialty training in conjunction with Beck on tool tethering as well as pre-construction safety reviews prior to starting work. The MTech team had almost 50,000 man hours on-site with only one recordable accident in the last month of the project.

A few months after the project completion, MTech’s president received a letter from The Beck Group’s project superintendent and manager. In the letter they stated “MTech and its employees met these challenges head on at every point of engagement...It seemed there was no challenge too large to be managed or too small to be given proper deference.”

“Our goals for the project were to build a Class AA, LEED Gold office building. Both of these goals were successfully achieved with the assistance of MTech, and we appreciate their involvement in the construction of our facility,” Greg Jones, Director of Development, First Gulf.











