



VACUUM PLUMBING SYSTEMS

Case Study - Amazon Warehouse San Bernardino, CA

CONTRACTOR:

Source Refrigeration,
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EXECUTIVE SUMMARY

After Amazon opened its San Bernardino fulfillment center, they saw a need to include a grocery fulfillment department. Dry goods could be stored easily, but perishables, dairy and fresh produce required refrigeration.

Refrigeration units produce condensate that must be drained away and the location selected for these groceries didn't have drainage available, so it would need to be installed. Unfortunately, the slab in the facility was structural and thick because it had to support heavy traffic from equipment like fork lifts. Floor cutting for the drainage plumbing was anticipated and it looked to be a costly option.

Faced with the expensive challenge of trenching through a prohibitively thick slab with structural

steel throughout, the designers decided to utilize AcornVac's vacuum plumbing system, an overhead plumbing solution that avoided floor cutting altogether.

By using vacuum drainage, condensate waste can be lifted and drained through a piping network that resides in the ceiling space. This eliminates the need for cutting and running the drain lines through the floor, saving money and time as well as avoiding potential unforeseen challenges hidden under the floor.

Amazon uses personnel called "pickers" to pick product from shelves as it is ordered. In the grocery section, pickers enter large, walk-in coolers. It can be imagined as something akin to a supermarket inside the Amazon fulfillment center. Utilizing the AcornVac vacuum plumbing system as a solution was ideal, therefore, since the same system is utilized in thousands of supermarkets across North America.



The refrigerated Amazon Fresh section.

AcornVac was the chosen solution because the vacuum plumbing system:

- Reduces construction challenges and cost, accelerating the construction timeline. Remodels can advance without disruption caused by floor cutting.
- It is layout agnostic. No commitment to drain locations is necessary. Drainage piping meets the fixture from overhead, preventing gravity limitations from dictating the design of the project. Even last minute changes to fixture locations don't pose a challenge any longer.
- Using vacuum for the project gave freedom to change layout later.
- Vacuum drainage equipment also has the unique attribute of mobility: it can be taken with the owner if the facility location changes.

BACKGROUND

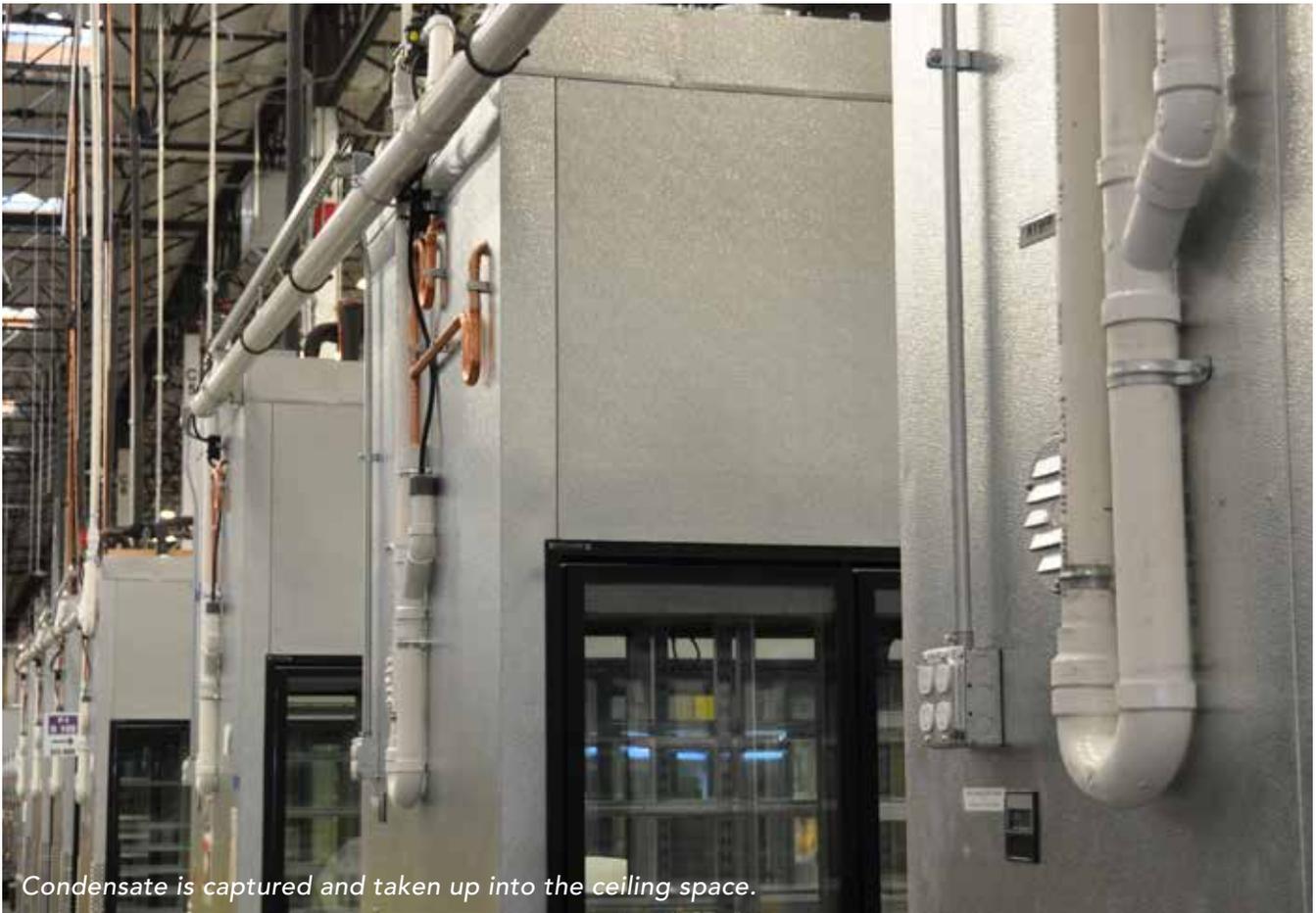
Amazon.com, Inc., often known simply as Amazon, was founded by Jeff Bezos in 1993. The company began as an online bookseller and has become the largest e-commerce retailer for products of all kinds. Though Amazon offers millions of books, movies, games and

music, it is other items—electronics, apparel, auto parts, home furnishings, health and beauty aids, toys and groceries—that contribute more than two-thirds of sales. If you can imagine it, Amazon probably sells it.

The new, state-of-the-art Amazon warehouse is the company's seventh in the state of California, and third Amazon-related operation in San Bernardino, where the company launched its first California fulfillment center in 2012. Amazon's fulfillment centers may be one of history's greatest logistical and operational triumphs.

AcornVac's skilled personnel, professional design, and high quality technical solutions helped solve their difficult wastewater engineering problems.

The Amazon fulfillment center is where all the planning, picking, packing, shipping and receiving occurs. It's a mammoth operation that requires advanced logistics and operational support. Amazon fulfillment centers are a critical element in Amazon's strategy to manage its inventory efficiently and accommodate millions of online shoppers.



Condensate is captured and taken up into the ceiling space.

CHALLENGES

Challenge #1: The building was originally designed without a grocery section. When it became necessary to add in both dry goods and large walk-in refrigerators for perishables, it also became apparent that costly floor cutting and time consuming trenching for gravity drainage would be necessary.

Challenge #2: A thick structural slab was required to support heavy equipment in the structure. This meant that the challenges with floor cutting and trenching were even more significant.

Challenge #3: The design choice they had to make needed to minimize impact to operations and space.

Source Refrigeration, the group responsible for bringing vacuum plumbing as a solution to Amazon, knew about AcornVac because of previous experience installing the product. Source Refrigeration recognized the mechanical design challenges and saw that vacuum plumbing could both solve the issues and reduce costs.

AcornVac's skilled personnel, professional design and high quality manufactured equipment provided the solution. AcornVac vacuum plumbing systems

typically route piping overhead, eliminating the need for cutting and trenching. The approach would also be affordable and have the least impact on operations and space requirements.

ALTERNATIVE SOLUTIONS

The typical and obvious solution for drainage is to go gravity. With a structural slab, however, costs go up considerably. Typically, with a structural slab, x-rays are required to identify where the structural steel is located. Then, core drilling through the slab must occur at each point where drainage is required. Often, drainage runs must be located below-slab, reducing the amount of vertical space available for the required slope, sometimes necessitating pumps to boost waste to the sanitary sewer connection. All this consumes time, comes with risks and costs money.

Many engineers continue to use traditional gravity systems and cite that their preference is due to the higher cost of vacuum plumbing. However, it is time for renewed consideration from the industry because vacuum plumbing systems often cost less.

ACORNVAC – THE IDEAL SOLUTION

Amazon initially was unfamiliar with vacuum plumbing and its benefits. Source Refrigeration explained to AcornVac that, although Amazon was enthusiastic to pursue AcornVac's vacuum plumbing technology, they had reservations about the costs. Amazon was also concerned about maintenance expenses after installation.

Source Refrigeration took the time to explain the benefits that come with vacuum plumbing. The costs would be much lower than with gravity. The maintenance would be minimal and fixing issues would be more straightforward. Their doubts addressed, Amazon chose to move forward with the AcornVac vacuum plumbing system.

“The AcornVac vacuum plumbing system helped [Amazon] achieve their mission because it’s a non-invasive product. You can install it in any location [and] you don’t have to rip up floors, so [Amazon] is able to move merchandise through many other areas without extensive plumbing.”

*- Ray Kelly, Manager,
Source Refrigeration*

RESULTS

Amazon, like all AcornVac's customers, received professional inspections and support services during installation and commissioning of the system. They also received customized training on their vacuum system so they'd be familiar with the tools available to them to effectively maintain it.

AcornVac provides all its customers continued access to training for new personnel and maintains support staff to ensure that the systems it provides uphold the reputation it has gained. Amazon was no exception to that level of care.

The Amazon Warehouse in San Bernardino has proven to be an important part of Amazon's growth in California, and they are proud to continue creating jobs and helping to support the economy. The well-designed AcornVac vacuum system has met the challenge and provides reliability in their busy day-to-day operations.



AcornVac vacuum plumbing throws off the shackles on design brought on by the rigid limitations of gravity drainage. In renovation, vacuum plumbing can overcome the infrastructure challenges that exist in situations like Amazon's, giving opportunity in a space where it otherwise would never have existed.

In new construction projects, making the decision to use vacuum plumbing is a design choice that will allow simple modification, layout changes and non-committed fixture locations in the future when the need inevitably arises.

Furthermore, as a plumbing system ages, leaks inevitably occur, but leaks on vacuum plumbing systems draw air in and don't leak waste out. Whereas in gravity plumbing systems, leaks leave the pipe and can jeopardize employee safety and destroy inventory or infrastructure leading to significant costs. AcornVac vacuum plumbing systems are equipped with visual alerts for maintenance personnel to identify any leaks that may develop over time in the vacuum piping network, making troubleshooting and long-term maintenance much easier.

The AcornVac vacuum plumbing system:

- Eliminates the need to cut into the floor
- Provides future layout and design freedom
- Reduces project timelines
- Doesn't require continuous slope
- Can be routed around obstacles in overhead spaces
- Has no mainline clogs
- Yields long-term maintenance benefits
- Saves money



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