

Creative Design Highlights Vertical Conveyor at Cardinal Laminated Glass Plant



- F Series 4-Post Mechanical Lift
- Lifts Loads up to 3,500 lbs.
- 14' Vertical Rise
- 2 Levels of Vertical Rise
- 18 FPM Travel Speed

Cardinal Glass is a leading manufacturer of high performance glass for residential windows and doors with 37 manufacturing facilities across the United States. Many of the larger plants feature a PFlow Industries vertical reciprocating conveyor (VRC) to lift components to upper levels during the production process.

Several of these VRCs are unusually large and the PFlow F Series 4-post lift at the Ocala Plant being as big as any. But it is not just the sheer size of the lift that is unique. It is also the customization of major structural components, and the efforts to address certain design and installation challenges.

The Ocala VRC is installed directly in front of the production area where channels that seal the two glass panes are filled with moisture preventing desiccant. The channels come in hollow sticks that are over 23 feet long and then transported to the second floor for further production. Before the VRC, the channels were lifted by forklift to the second floor; a slow tedious process with little margin for error.

LARGE, SINGLE-PIECE LIFT CARRIAGE

The lift carriage required to safely transport the channels on carts is longer than most, with useable space dimensions of 5' W x 25' L x 7' H. Carriages of this size are typically two-pieces, bolted together onsite with interlocking sections, and then welded. Splitting a carriage into two pieces allows for easier transportation to the site and delivery into the building. But it does create more assembly work for the installation crew.

"We can build our lifts in the Milwaukee plant more efficiently than they can be built in the field, so we try to do as much of the fabrication work as possible before shipping," said Mark Rhyner, Retired PFlow Project Engineer. "Whenever possible a single-piece carriage is preferable. It allows us to have more control of its structural integrity, and avoids a costly and time-consuming step during installation."

Since the Ocala plant has a door large enough for the full carriage to enter the building, and PFlow routinely ships oversized loads around North America, PFlow decided to build one of the longest single-piece carriages to date. The total shipment with all components, including the four 23 sq. ft. steel guide columns, was 28,000 lbs.

The overall carriage surface dimensions are 6' 9" W x 29' 0" x 4' 0" L. Because of the unusual length, deflection becomes an issue. In order to maintain complete structural rigidity, the Ocala carriage is 14.25" thick, at least twice as thick as the norm. On the ground floor it settles in a pit with the top of the carriage flush to the floor.

The live load of the cart with the channels is 3,500 lbs.; not a heavy load for an F Series VRC. But the weight of the carriage is three-times that of the live load, making it a high capacity lift requiring additional structural bracing.

ADDITIONAL UNUSUALLY LARGE COMPONENTS

On the first floor where the channels are loaded on the carriage through the lengthwise (longer) dimension, there is a single-panel, fully automatic gate. This is one of the



largest engineered and fabricated gates of its kind by PFlow Industries. On the second level, the load exits the lift 90° through an opening with a steel roll-up door; the same narrow opening the forklift had previously used.

The lengthwise dimension on the second level, which is open to the ground floor below, is protected by a 27 sq. ft. wide back-stop panel attached to the upper portion of the two front guide columns. To provide the necessary strength and rigidity to secure the long open span, and still be manageable in the field, the back-stop panel required bolt-together assembly to be properly fitted and placed.

CUSTOM CHAIN TENSIONERS

The disproportionately long carriage caused some challenges in designing the VRC's lifting mechanisms.

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A standard four-post lift is a chain driven machine with a single-piece drive shaft that typically runs parallel to the longer dimension of the platform. The shaft drives a set of individual roller chains at each corner of the lift that raises and lowers the VRC in a precisely level manner.

Because single-piece shafts are only available up to 22 sq. ft., the Ocala shaft was designed to run along the shorter dimension. This was cause for concern as the long length of the drive chains would sag over time. In order to prevent this, PFlow designed custom chain tensioners to take up any slack and ensure complete stability of the platform.

BRACING CHALLENGES

The F Series VRC is commonly specified for heavy duty applications because its 6” wide flange guide columns provide support at all four-corners. An important aspect of the four-post structure is the secure anchoring of the guide columns to the ground floor, and diagonal bracing at the top or an intermediate level. While the Ocala VRC was easily anchored to the ground floor, the tight fit between the top of the columns and the ceiling, and the wide open space completely surrounding two sides of the VRC meant unique bracing challenges.

“With limited structural elements to attach the posts to, we had to be really creative in designing the bracing. We came up with a solution to weld in a tri-beam to the roof trusses and the top of the posts, both front and rear, but the ceiling overhead was so low that we had to fit it in within a couple of inches,” said Kevin Mannes of Florida Lifts. Florida Lifts, a PFlow dealer in Boynton Beach, worked PFlow on the front end of the VRC design. Once the design was complete, Florida Lifts managed the installation, assembled and delivered onsite.

“When dealing with big equipment it is important to get it right up front because it is really difficult to make modifications during installation. All major structural challenges need to be carefully addressed and specified during the conception of the lift, and built accordingly at the factory,” added Mannes.

QUICK INSTALLATION

With the VRC positioned in a primary production corridor it had to be installed as quickly as possible. The installation team worked 12 hour days and had the lift installed in just four days.

“It should have taken almost two weeks to install this lift, but we had four guys working twelve hour days, and got it done on the Friday of the week it arrived,” said Mannes. “This wouldn’t have been possible without the thorough design work up front.”

“The lift has worked well, we have no complaints,” said Ray Nalty, the Cardinal LG maintenance manager at the Ocala facility. “I only get called when there is a problem, which hasn’t happened so far.”