Engineering Note
for
E906 Detector Assembly

PROJECT: E906

TITLE: Station 1 Wire Chamber Repair

AUTHOR: Tom O'Connor – Argonne National Laboratory

DATE: June 3, 2013

REVIEWER(S): Kevin Bailey – Argonne National Laboratory

ABSTRACT: This document describes a procedure for rigging and rotating the Station 1 Wire Chamber when repairs are necessary.

DESIGN:

The wire chambers for Station 1 were originally built for E866. These chambers weigh approximately 100 pounds. In order to use them in E906 steel adapter plates are mounted to the two upper endplates of the wire chambers and aluminum extrusions are fastened to the adapter plates on one end. The other ends of the extrusions are attached to an aluminum I-beam (WF4 x 4.76) which is used to hang the detector in the E906 beamline. The complete assembly is shown in Figure 1.

In the event that these chambers require repair or maintenance they must be lifted out of the beamline and brought to a suitable workplace. Once removed from the experiment and laid horizontally the steel adapter plates must be removed from the endplate (along with the extrusions and I-beam) in order to provide access to the internal parts of the chamber. Once these plates are removed the screws must be re-attached so that the endplates are once again fastened to the u-channels in the detector with 6 screws. During these repair periods it is often necessary to use an overhead crane to flip the chamber over to gain access to the different wire planes. Removal of the steel adapter plates will expose a 3/8-16 tapped hole in each aluminum endplate, as shown in Figure 2. The endplates are made of Aluminum 6061 with a Yield Shear Strength of 20ksi (per Aluminum Design Manual, Part 1-A, 1994). In order to manipulate the chamber during repair, two swivel action hoist rings must be bolted to the endplates through these holes so that lifting straps can be slung through them to the crane. The hoist rings used for this purpose were purchased from McMaster-Carr (part number 29525T52) and are shown in Figure 3. These hoist rings are rated for 800 pounds and are specially designed for both side mounted and top mounted applications. The chamber, with side mounted hoist rings attached, is shown in Figure 4. Once these hoist rings are attached it is possible to use lifting straps and a crane to lift and manipulate the chamber in a safe and controlled manner. The shear force on each hoist ring is well within limits and in this configuration there is no danger of "tear-out" on the 3/8-16 tapped hole in the aluminum plate. The chamber, configured for top mounting, is shown in Figure 5. In this case the hoist ring is in tension and the load is still well within limits for the hoist ring. In this configuration there is also a shear stress on the internal threads of the aluminum endplate. The length of engagement of the 3/8-16 bolt on the hoist ring is 0.375 inches (this is the plate thickness). For internal 3/8-16 threads this length of engagement provides a thread shear area of $0.310 in^2$ and the resulting shear stress of the internal threads is 161 psi, which is acceptable for this alloy. When the repairs are complete then the straps and hoist rings can be removed, the steel adapter plate re-attached, and the chamber can be re-inserted into the beamline. When re-attaching the adapter plates it is necessary to use screws which are at least 1.25 inches long in order to ensure that they fully penetrate the aluminum endplate as well as the underlying aluminum U-channel frame on the detector.

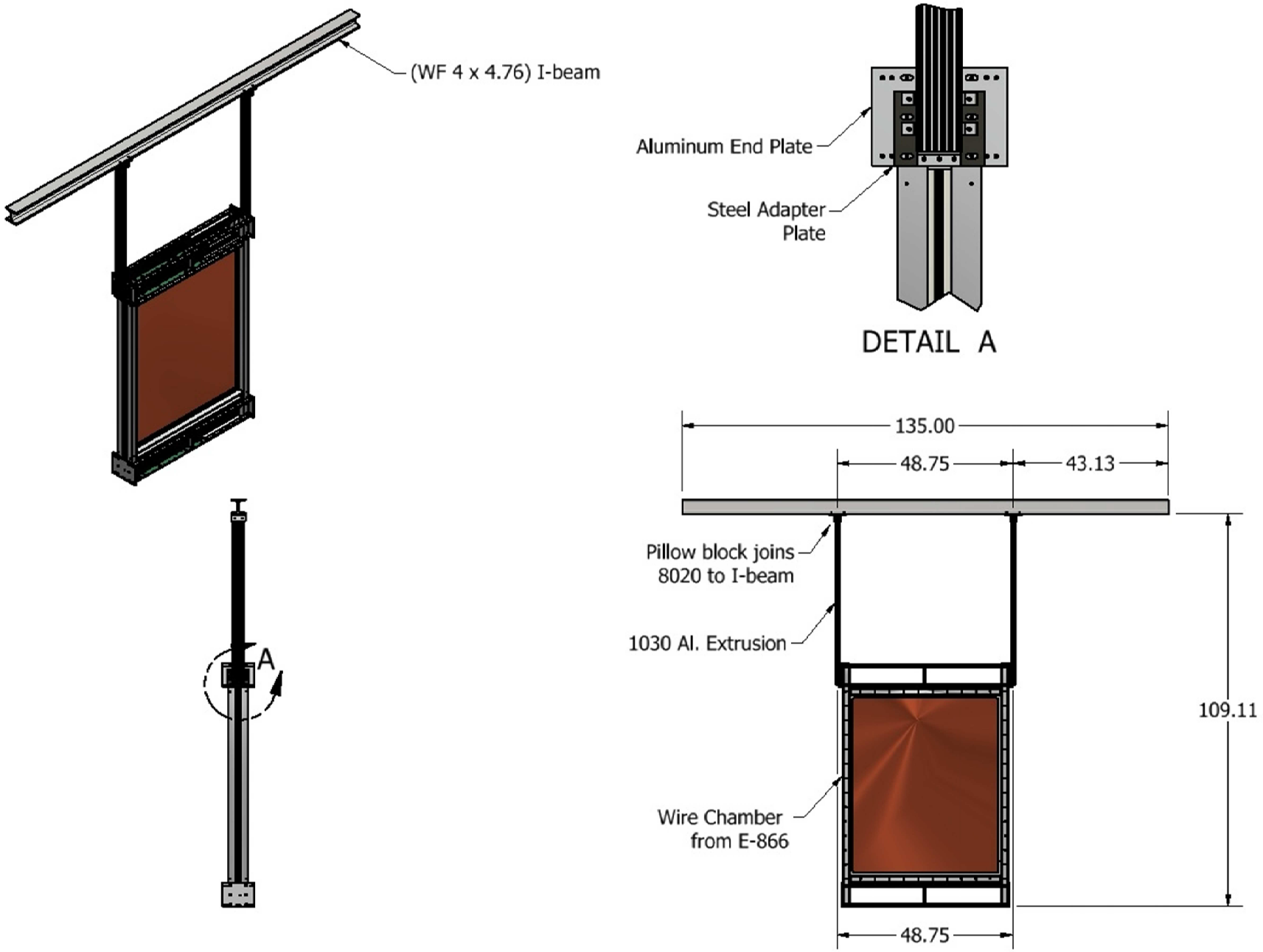

Figure 1 - Station 1 Wire Chamber for E906

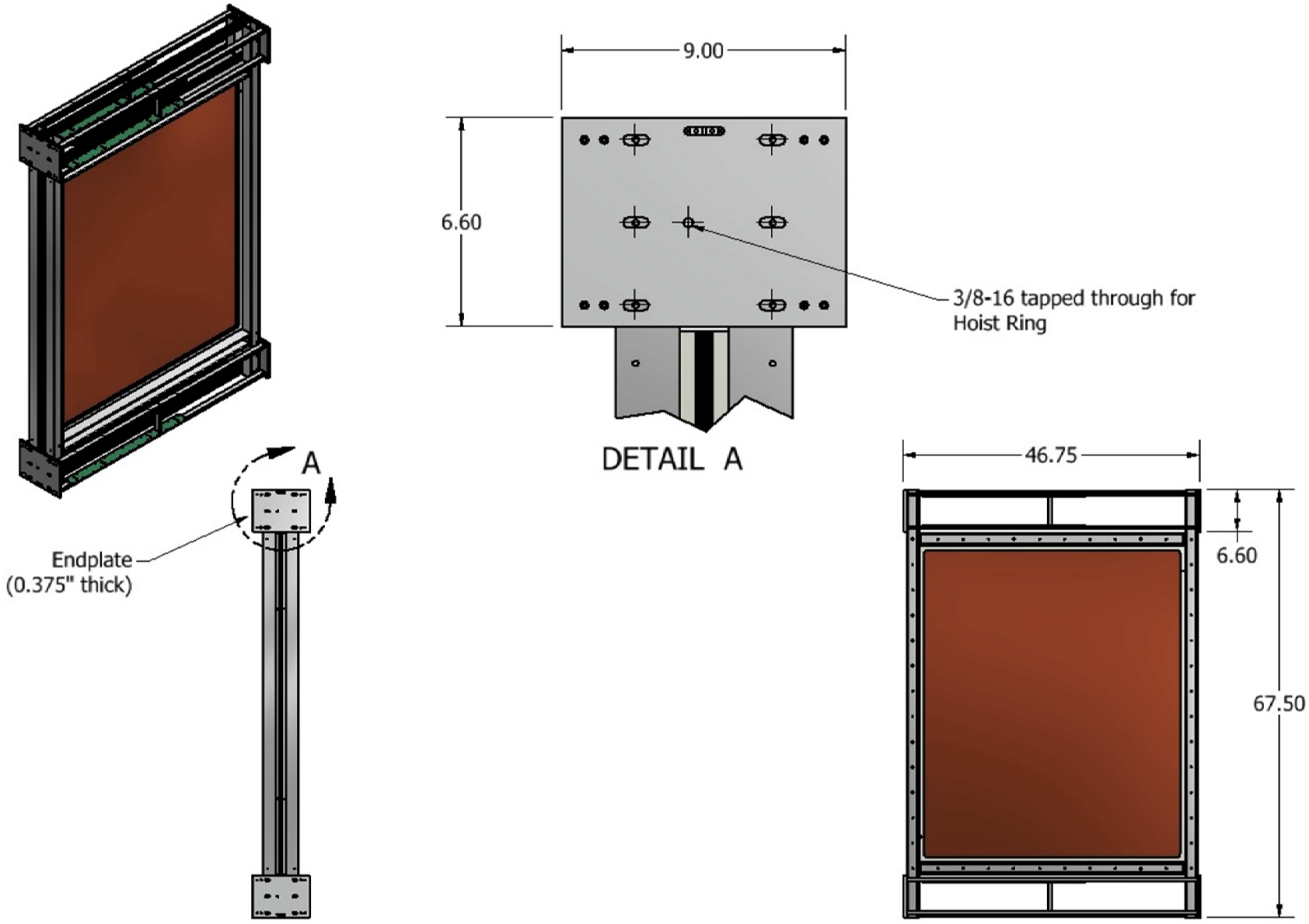

Figure 2 - Station 1 Wire Endplate View

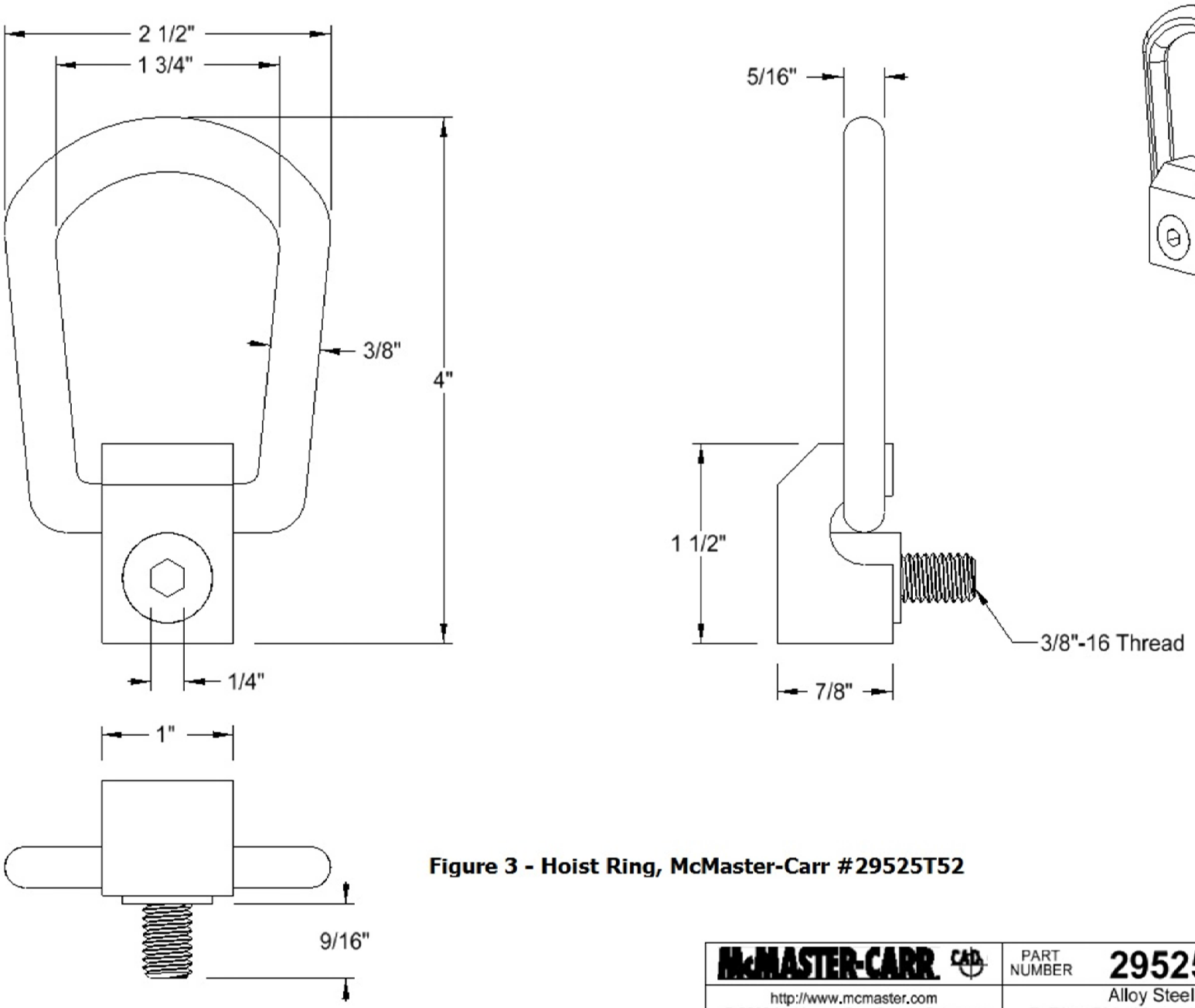

Figure 3 - Hoist Ring, McMaster-Carr #29525T52

McMASTER-CARR CAD	PART NUMBER **29525T52**
http://www.mcmaster.com © 2008 McMaster-Carr Supply Company	Alloy Steel D-Ring Side-Mount Hoist Ring
Unless otherwise specified, dimensions are in inches. Information in this drawing is provided for reference only.	

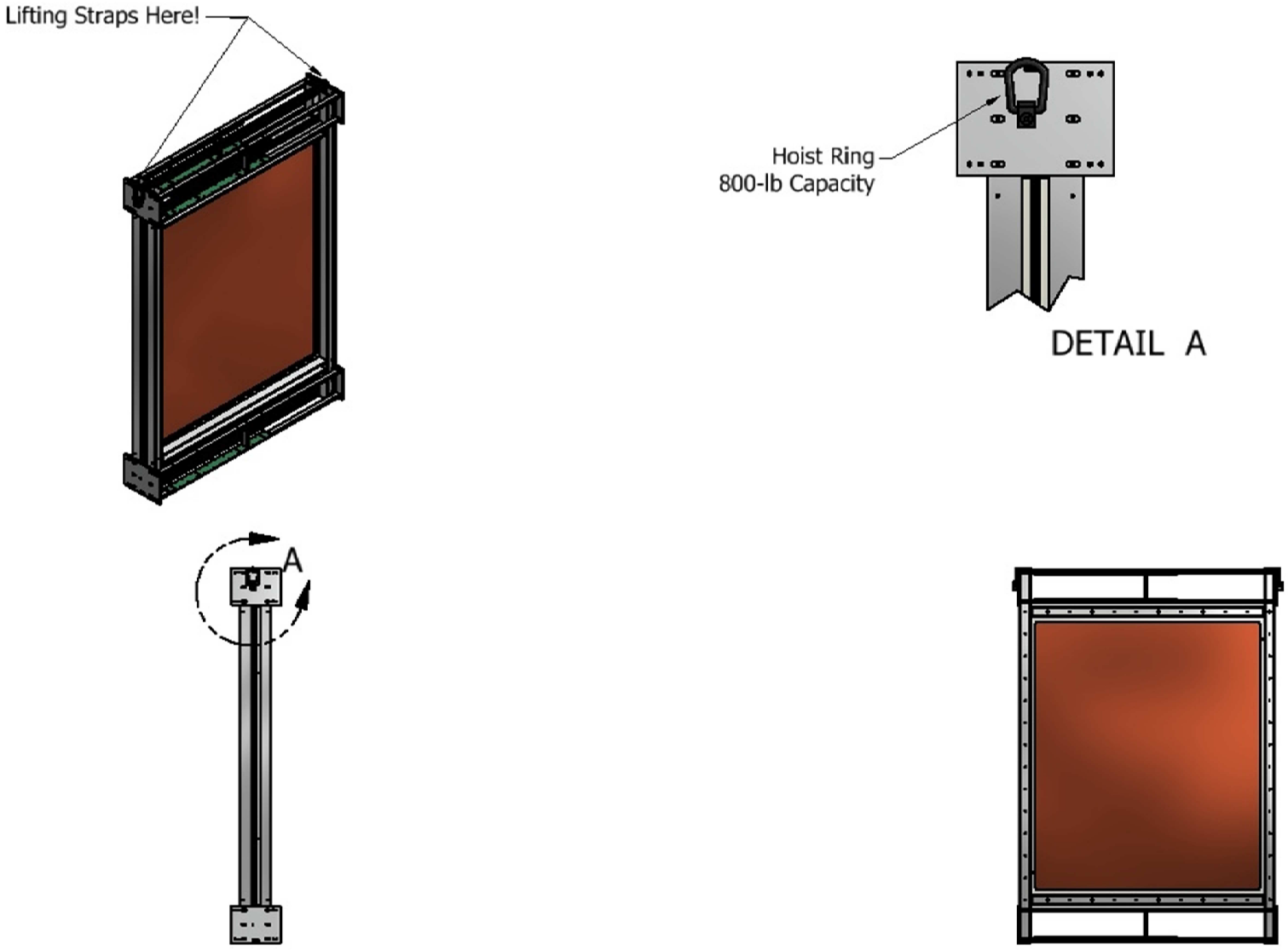

Figure 4 - Station 1 Wire Chamber with Side Mounted Hoist Rings

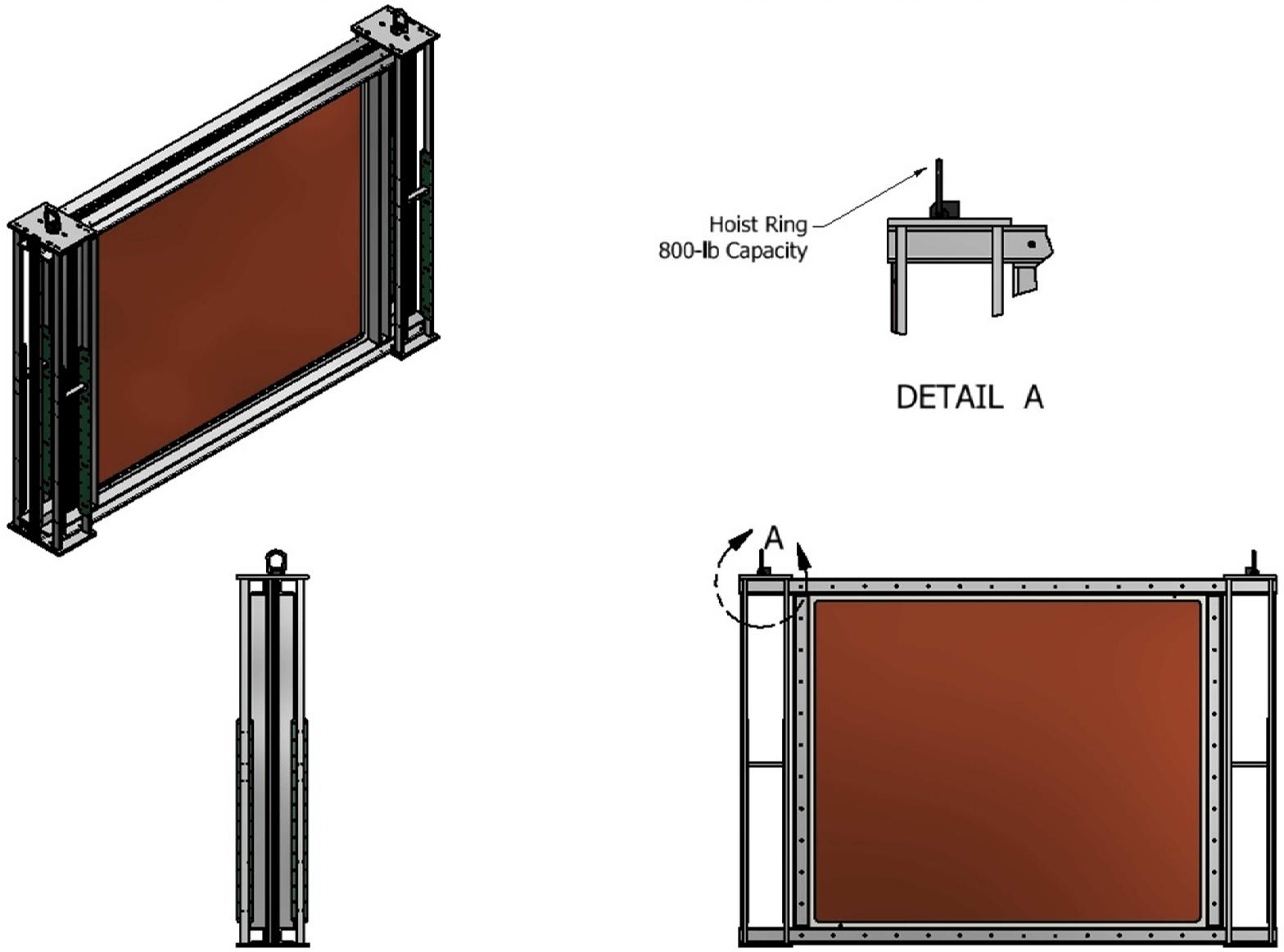

Figure 5 - Station 1 Wire Chamber with Top Mounted Hoist Rings