UNISTRUT

MEDICAL SUPPORT INSTALLATION GUIDE

6 Important Considerations for Installing Overhead Medical Support Structures



6 IMPORTANT CONSIDERATIONS FOR INSTALLING OVERHEAD MEDICAL SUPPORT STRUCTURES

Overhead medical support structures are the hidden systems that keep hanging medical applications suspended. These structures are mounted above the ceiling tiles, keeping critical equipment like surgical lights, patient lifts, and scanning equipment in place while hidden away from view.

Although these systems play a crucial role for each piece of suspended equipment, the Original Equipment Manufacturers don't typically supply the means of attaching the equipment to the concrete deck or structural steel overhead. This is why contractors, engineers, and architects turn to us. The reason that the OEMs don't supply the support structure is pretty simple—they don't know what types of obstructions may be present in the room, the spans of the steel in the ceiling area, etc. For these reasons, each support structure is engineered—or application specific.

Unistrut Service Company has provided medical support structure solutions for demanding hospital, medical center, or out-patient clinic applications since 1940. Not only do we provide the <u>system</u> <u>specifications for Unistrut products</u>, which can be found in our PDF Library section of the Unistrut <u>website</u>, we've also documented some of what we've learned to help during the installation process.

Use this guide to learn about important considerations for installing <u>overhead medical support</u> <u>structures</u> and <u>contact Unistrut Service Company</u> for additional advice and information about our capabilities.





MEDICAL SUPPORT INSTALLATION GUIDE

Mounting Operating Room Lights with Structural Steel Support Structures	
Vs. Unistrut	F

The Importance of Using Genuine Unistrut Framing Channel for Medical	
Support Structures	7

Anchoring Medical Support Structures: Hollow Core Concrete Panels9

Support Patients Through Physical Therapy Swings with Unistrut 12

Working Around Obstructions for Patient Lift System Support Structures 14

Unistrut CPGE55 Cable Drape Rail for GE X-Ray Systems 17

Mounting Operating Room Lights with Structural Steel Support Structures Vs. Unistrut

When it comes to choosing between Unistrut and structural steel for overhead medical support structures, it can pay to use the former. Operating room (OR) installations are particularly well-suited for Unistrut because you can build support structures without welding. Welding creates explosion risks due to the presence of oxygen tanks and pulling burn permits is a no-no. This process also creates fumes and dust that contaminate sterile areas.

Medical installations also require the fabrication of overhead structures to support and precisely position equipment that can exert loads ranging from hundreds to thousands of pounds. For all these reasons, Unistrut is often the material of choice when fabricating overhead support structures for hospital applications. With this said, we routinely see inadequate support structures fabricated from structural steel that add cost and complexity to operating room remodeling projects. Our recent visit to a major hospital in the Columbus, Ohio area is case in point.

Assessing an Existing Medical Support Structure

A medical equipment manufacturer recently invited us to assess an OR support structure as part of a lighting update project. Hospital officials hoped to use the existing support structure, but the equipment reps were concerned about the support structure's suitability since the previous steel contractor failed to use any sort of bracing and the finished installation lacked engineering drawings. In cases like these, lighting manufacturers are concerned about two issues:

- Is the support structure strong enough to withstand the loads created by the equipment?
- Is the structure engineered properly to prevent boom drift, which can cause internal clutches to fail prematurely, creating major nuisances for surgical staff?

Complications with Assessing Structure Suitability

With this in mind, how does one assess a support structure's suitability? One course of action is to engage a structural engineer to analyze the existing structure, measure welds, determine steel sizes, and prepare a report on the findings. This process is very time-consuming and comes at great expense because you are paying for the engineer's time and you need to shut down the OR to perform the assessment. You also need to provide sufficient space (typically larger than the holes that were cut for the access panels) to allow a person to perform the appropriate measurements.



It gets even more complicated. In a best-case scenario, your structural engineer may verbally claim that the support structure seems adequate, but without the drawings, he or she won't put anything in writing. If your equipment fails, the manufacturer will claim that the support structure was to blame. In a worst-case scenario, your engineer is likely to find that the support structure needs modification to handle the loads. Since structural steel was used during initial fabrication, adding reinforcements means additional welding.

How Unistrut Simplified the Assessment

By using a PRO 3600 digital protractor, we were able to measure the actual plate/structure rotation under actual load in four rooms without enlarging the existing access panels: OR 1, OR 3, OR 8 and OR 2. The structures in OR 1 and OR 2 appeared similar in construction, as did OR 3 and OR 8. Both "types" were welded structures, and are not a modular structure that allows modification without welding. To perform each test, we placed both existing light heads at one end, and rotated smoothly 180 degrees, while measuring the rotation with the digital protractor.



Most medical equipment manufacturers, including Steris, Stryker, Skytron, and Berchtold to name a few, allow for a maximum of .2 degrees rotation under load, but upon careful inspection, the values exceeded recommended tolerances. Actual rotation per our testing is shown below. Please note that we are giving two readings per room, one "North South" and one "East West."

- OR 1: .4 degrees and .28 degrees
- OR 3: .68 degrees and .24 degrees
- OR 8: .47 degrees and .07 degrees
- OR 2: .46 degrees and .73 degrees



As you can see from the measurements above, only one of the eight runs fell within the recommended tolerances. Based on our findings, hospital administrators had a difficult decision to make: modify the existing support structure, which will require additional welding, or start from scratch with a modular structure made from Unistrut channel.

Issues with Low Bid Structural Steel

Unfortunately, we see situations like this on a frequent basis. In many instances, low bid structural steel fabrications, some less than 5 years old, need to be scrapped because the support structure will void the manufacturer's warranty on the OR lights. To make matters worse, if the existing structural steel support system does meet with the manufacturer's specs, any reconfiguration of the operating rooms that requires moving lighting requires additional welding and fabrication in a hospital environment.

Put another way, the original cost of the support structure, combined with an engineering assessment and subsequent demolition of the old installation, far exceeds the price tag associated with building with Unistrut from the start of the initial project.

What to Consider for Overhead Support Jobs

Before you begin your next project, remember to ask yourself a couple of key questions:

- What critical tolerances must be held?
- Will failure to meet these specifications have any adverse effect on equipment?
- What construction methods are appropriate given the installation environment?
- Is welding safe? Is it practical?
- What is the expected service life of the installation?
- Would remodeling of the room require modifications to the support structure?
- Will your contractor supply finished engineering drawings?

Reviewing this list of questions prior to beginning work on your overhead support structure will help you steer clear of additional costs and headaches down the road. To learn more about overhead support structure for medical applications, our company capabilities, or to request a quote for Unistrut solutions, <u>contact Unistrut Service Company for more information</u>.



The Importance of Using Genuine Unistrut Framing Channel for Medical Support Structures

Unistrut Framing Channel is specified and used for a wide range of medical and hospital applications, including overhead X-ray machine supports for radiology rooms, supports for operating room lights, monitors, service booms and medical gas columns, and CRT monitor supports. The bolt-together design of Unistrut medical support systems allows for installations to be completed with standard hand tools, thereby eliminating the need for special jobsite welding accommodations or the cutting of structural steel. With this said, it is important to specify and utilize genuine Unistrut framing channel instead of inexpensive knockoff materials of an unknown origin which can fail when subjected to significant load pressures.

Effects of Using Knockoff Materials in Place of Unistrut

The picture shown below illustrates what can happen when contractors do not install Unistrut framing channel specified in project prints. The support structure in this radiology room was built using "non Unistrut" materials. If you look closely, the channel crushed under load.



Unistrut Service Company actually bid on this project, but the job was awarded to another contractor. Our engineers were asked to troubleshoot the structure when the client noticed movement with the equipment. We removed the defective generic channel, designed a proper system using Unistrut P1001 and P3301, and fixed the customer's problem.



We were also able to properly level the system and remove the shims that were installed by the other contractor when attempting to install the support structure.

Our customer learned that even though low-cost, knockoff strut may "look" like our products, it will not perform like genuine Unistrut framing channel. It may be tempting to award contracts strictly on the basis of cost, but if a bid comes in at an extremely low price point, there may be trouble ahead. This why you need Unistrut at the **beginning** of your project instead of discovering the damage at a later date.



Anchoring Medical Support Structures: Hollow Core Concrete Panels

Channel size and style, fittings, elevations, spacings, and overall dimensions are important aspects of a Unistrut support structure design, but of equal or greater importance is how the system attaches to the concrete ceiling. Our recent work with a general contractor troubled by the presence of hollow core concrete panels is a case in point.



Hilti HDI-P Concrete Anchor

The low-cost, hollow core concrete ceiling sections commonly used in office building construction can create significant design challenges in hospital settings. In this case, our GC had concerns over securing 1,000 pounds of X-ray equipment to a hollow core panel style ceiling with traditional concrete anchors, per his supplied drawings.

One suggested option—reinforcing each hollow section panel with liquid grout—wasn't feasible because the process would have taken 2-3 weeks and put the GC behind schedule and over budget. We don't come across hollow core concrete panels in hospital settings often, but when we do, we recommend Hilti HDI-P drop-in anchors. The Hilti-HDI-P is an internally-threaded, flush-mounted expansion anchor designed for solid and core panels, precast plank, and post tensioned slabs. Each anchor features a lip to ensure flush installation, consistent anchor depth, and easy rod alignment.

	Length in. (mm)		Nom.	Ultimate loads, lb (kN)								Allowable loads, lb (kN) ³							
Nominal			bit dia.	f' _c = 4,000 psi concrete				Hollow core ^{1,2}				f' _c = 4,000 psi concrete				Hollow core ^{1,2}			
diameter			in.	Tension		Shear		Tension		Shear		Tension		Shear		Tension		Shear	
1/4	5/8	(15.9)	3/8	1,430	(6.4)	1,870	(8.3)	1,550	(6.9)	2,275	(10.1)	285	(1.3)	375	(1.7)	310	(1.4)	455	(2.0)
3/8	3/4	(19.1)	1/2	1,900	(8.5)	3,000	(13.3)	2,100	(9.3)	4,000	(17.8)	380	(1.7)	600	(2.7)	420	(1.9)	800	(3.6)
1/2	1	(25.4)	5/8	3,000	(13.3)	6,075	(27.0)	3,110	(13.8)	5,495	(24.5)	600	(2.7)	1215	(5.4)	620	(2.8)	1,100	(4.9)

HDI-P Loads–Normal-Weight Concrete and Hollow Core Concrete Panels

1 The Admissible Anchor Location must be established to prevent damage to the prestressed cable during the drilling process. Verify the location and height of the cable with the hollow core plank supplier to confirm Admissible Anchor Location.

2 Minimum compressive strength of hollow core panels is 7,000 psi at the time of installation. The minimum thickness "t" is 1-3/8 inches.

3 Allowable loads calculated with a 5:1 factor-of-safety.

HDI-P Load Chart

To eliminate any potential concerns over safety, each of the 12 anchors connecting the support structure to the concrete ceiling was pull-tested at 500 lbs.:



Anchor Pull Testing



Pull Testing Hilti Anchors



The test results confirmed a secure connection at each anchor point, ensuring the safety of the X-ray equipment, as well as the lab technicians and patients. Our knowledge of concrete, medical support systems, and available anchoring products saved the general contractor boatloads of money—and time.

Identifying Concrete Anchor Issues

We don't typically dedicate an entire post to a discussion of concrete anchors, but this installation offers some key takeaways that may serve you well in the future. For starters, this install ended well, but critical decisions made early in the design process could have led to a very different outcome. The GC (a repeat customer) brought us in early and understood that the review process on a complex job takes time and coordination. In this case, the least visible portion of the support structure—the concrete anchors—had great potential to derail a time sensitive project.

Each <u>overhead support structure</u>—and each room—presents a unique combination of obstacles standing in the way of a successful installation, but the right technical expertise, materials, and installers can help ensure that the job gets done on time and on budget.



Support Patients Through Physical Therapy Swings with Unistrut



When most folks think about Unistrut framing channel, their minds go straight to commercial and industrial applications. What you might not know is that the same features that make Unistrut ideal for commercial and industrial installations translate to medical applications, too.

Many <u>medical installations</u> are support structures for radiology rooms, catheterization labs, and operating rooms. Although many medical equipment support structures precisely position heavy medical equipment overhead, Unistrut channel also supports patients.

Physical therapists routinely use patient swings to help their patients recover from nagging injuries or after surgery. The physical therapy swing installation pictured above consists of <u>Unistrut P1001</u>, <u>P1000</u>, and <u>P3301</u> strut attached to structural beams concealed by ceiling tiles. The installation is rated at over 500 pounds and required no welding or drilling.



Benefits of Unistrut for Physical Therapy Swings

One of the main differences between Unistrut designs and those of some other companies is a greaseable swivel feature. Some installers use common eyebolts that are inappropriate for this type of load, and we were recently contacted to rebuild a swing that experienced an eyebolt failure. When you consider the potential liability associated with this type of failure, it pays to work with a company that has a proven track record designing therapy swings. Below are some pictures of a recent patient therapy swing installation:



The picture above does a good job illustrating how the Unistrut is secured to structural beams and most of the support structure is concealed by ceiling tiles.



The medically-related applications for Unistrut are virtually endless. Whether need to support medical equipment or patients, Unistrut can help you design medical support solutions for your projects.

Working Around Obstructions for Patient Lift System Support Structures

When it comes to medical applications, contractors feel extra pressure to complete overhead support systems with lightning fast speed while delivering finished installations that meet demanding specifications. Revenue losses from idle space can range from tens of thousands of dollars for an intensive care unit to more than \$1 million per day for an operating room. Then there are the hidden costs associated with poor designs that range from voided OEM warranties to increased patient liability. For all these reasons, leading medical centers nationwide turn to Unistrut Service Company for help with their designs, such as patient lift systems for nationally-known hospital networks.

On a repetitive basis, doctors, imaging technicians, and physical therapists lift and reposition patients that are heavier than ever. These repetitive motions increase the worker's risk for musculoskeletal disorders and jeopardize patient safety. Hospitals and clinics combat these risks with mechanical patient lifts.

Supporting Patients with Unistrut

There are several outstanding mechanical patient lifts on the market, but all these systems have one common denominator: an overhead support structure. Regardless of the manufacturer, you'll need a support structure that is strong enough to ensure safe operation while blending seamlessly with existing MEP above the ceiling. The picture below illustrates the complex nature of ceiling areas found in healthcare settings.





Designing and installing ceiling support structures for unfinished space often yields the widest range of lift placement options. That said, "clean" installations may still contend with plumbing, electrical conduit, and HVAC ducts that interfere with the supports. For fully functional rooms, it can take the expertise of practiced engineers and installers to yield work-around strategies for unmoveable obstructions.

One of the advantages of designing the patient lift support structure with Unistrut is our ability to work around obstructions without compromising system strength. What's more, the modular nature of the Unistrut framing system takes the worry and stress out of adapting to unanticipated obstructions discovered during installation. The pictures below show an installation for the Cleveland Clinic.







Installing patient lifts is an important first step toward safeguarding worker and patient safety. That said, one of the most important components of the system is the part we seldom see—the overhead support structure. If you have questions about patient lifts or overhead support structures for medical applications, <u>contact a medical support expert like Unistrut Service Company</u> to put our years of experience to work for your project.



Unistrut CPGE55 Cable Drape Rail for GE X-Ray Systems



Periodically, contractors and installers of GE medical equipment see drawing references to a cable drape rail designated as part number CPGE55. This part is designed to hold X-ray system and cath-lab cables off the ground while the tube crane slides across the rails. When CPGE55 comes up in conversation, we are typically hearing from a frustrated contractor who cannot locate this cryptic and elusive part number in the Unistrut catalog. If this scenario sounds familiar, you are not alone—it frequently happens. In this case, the part number is correct, but you will not find it in the Unistrut Catalog. The good news is that even though you will not find CPGE55 in our catalog, you have come to the right place.



What is CPGE55 Cable Drape Rail?

CPGE₅₅ comes as a complete kit from Unistrut Service Company. The kit consists of 20 feet of trolley rail, five trollies, end stops, and attachment hardware. Though this is our most common configuration, we can cut to any length and increase or decrease the trolley count as needed. Typically, painting is done in the field to prevent damage in transit. CPGE₅₅ Cable Drape Rail installs with simple hand tools and ¹/₂" bolts. The Unistrut Channel Socket is an ideal tool for this type of installation.

Here are additional resources that may help with the installation of overhead medical equipment:

- <u>CPGE55 Installation Drawing Example</u>
- Unistrut Applications Showcase Brochure



Whether you are searching for a CPGE55 Cable Drape Rail or assistance with an overhead support system for an engineered medical application, it can help to have assistance from practiced experts. Unistrut Service Company Engineers have years of experience designing and installing overhead support systems for X-ray machines, LED monitors, service columns, microscopes, surgical lighting, gas columns, and so much more. Put our shared knowledge base to work for you and <u>contact Unistrut</u> <u>Service Company today for further assistance</u>.