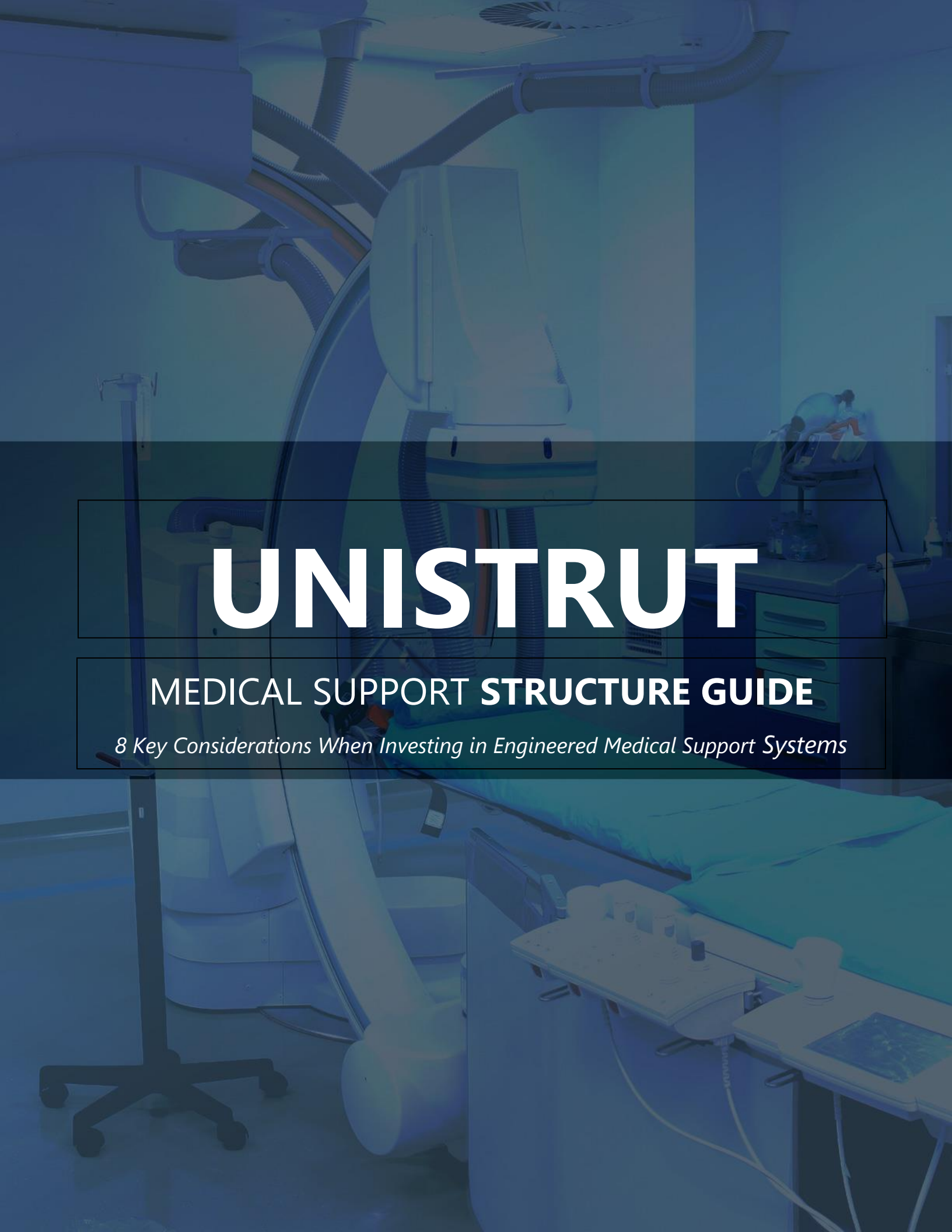

UNISTRUT

MEDICAL SUPPORT **STRUCTURE GUIDE**

8 Key Considerations When Investing in Engineered Medical Support Systems

8 KEY CONSIDERATIONS WHEN INVESTING IN ENGINEERED MEDICAL SUPPORT SYSTEMS

When it comes to construction, medical settings are in a constant state of flux: new equipment is installed to provide better patient care; space is reconfigured to maximize efficiencies and ROI; and new wings are added to accommodate more patients. Larger hospitals are often in a state of permanent construction.

While many people will see the important medical equipment suspended from the ceiling, few will ever notice the support systems that hold them in place above the ceiling tiles. Medical support structures are used to suspend equipment, including X-ray machines, motion-sensitive surgical equipment, and other critical medical devices. These machines don't come with a means of attachment from the manufacturer, so medical support systems are specially designed with channel and fittings to help anchor each machine to the ceiling for safe use.

The constant shifts in the medical field can make it difficult to determine how you should approach working with medical support structures. Unistrut Service Company has been providing medical support structure solutions for hospitals, clinics, and medical centers since we opened our doors in 1940. This experience has led us to create a comprehensive collection of articles about medical support best practices and other topics that can benefit you from beginning of a project to its completion.

If you'd like to learn more about the advantages of Unistrut ceiling structures for medical applications or want to request a quote, contact us online or give us a call at (877) 706-5926 to talk to one of our experts today.

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5 Mistakes to Avoid - Medical Equipment Support Structures

Visit any hospital, doctor's office, or outpatient clinic and you'll see all types of medical equipment suspended overhead. The systems in plain view do amazing things ranging from detecting the smallest anomaly on an X-ray to providing a surgeon the lighting needed to perform a delicate operation. What most of us never see are the support structures securing the equipment overhead.

We've designed support structures for medical equipment for many years. This experience means we have first-hand knowledge of how (and why) things go wrong. Here's some friendly advice on critical mistakes to avoid during the design and installation phases of medical supports.

1. **Inefficient Design Concepts**

One of the most common mistakes we see is an over-reliance on fabricated, red iron supports. We aren't saying red iron supports are always bad. In fact, we use them for projects with heavier load requirements. The key here is a design that pairs red iron with Unistrut channel and fittings.

The problem with designs based exclusively on fabricated structural steel is ease of modification. Medical equipment support structures frequently require adjustments during installation. Even small system tweaks to work around conduit, pipes, or HVAC duct work present in locations other than the areas called out in the original drawings–or minor variances in deck height–***may*** require welding and another union trade to get involved. In each of these cases, an inefficient design concept can increase–and potentially double–your labor costs.

Field welding in a medical setting doesn't just drive up labor costs. It also creates dust and releases potentially harmful gases into the air. Try telling the nurse manager you want to weld next to an active operating room—this never goes well.

2. **Improper Material Specification**

Having your system designed by Unistrut Service Company eliminates many of the potential problems mentioned above because we have a thorough understanding of medical applications. We also understand how to select the proper materials during system design. Here's our best advice on things to avoid when choosing materials:

- Specification of non-stock or more expensive Unistrut channel and fittings
- Use of materials that are too heavy for the application
- Materials that are too light for a heavy-duty application
- Selecting the wrong finish—because these are interior applications, Perma-Green or Electro Galvanized is the most efficient (and cost-effective) choice

3. Failure to Understand Deflection and Rotation Criteria

When folks don't understand OEM requirements for support structures, trouble isn't far behind. For example, some medical support structures can have moment loads over 12,000 ft. lbs. Remember, the equipment manufacturers have strict criteria for deflection and rotation. Although you'll see some variance between different manufacturers, typical industry standards include:

- Lights and booms – .2 degrees of plate rotation (under load)
- Radiology, Catheterization Equipment – 1/16" deflection

Excessive deflection ***will*** cause poor images. In extreme cases, you may be dealing with a finished room (paint, flooring, ceiling, etc.) and the equipment vendor may not be able to calibrate equipment. Failing to meet the manufacturer's specifications could end up forcing you to gut the ceiling and rework the structure.

Excessive plate rotation can cause "boom drift" where the equipment does not stay where the doctor or nurse has placed it. Boom drift can also cause internal clutches and brakes to fail—and when this happens, the manufacturer won't honor their warranty because the support structure is not to spec.

Protecting the equipment is an important design goal, but you also need to think about people. When staff and patients are positioned beneath systems that can easily weigh well more than 1,000 pounds (the new Flexmove system from Philips weighs 4,000 lbs.), you begin to understand why support structure design is so important. In each of the scenarios just described, the contractor can be held responsible for damages. The moral here is simple—make sure you understand the required deflection and rotation criteria.

4. Improper Anchoring

The best-designed strut support system is of no value when improperly anchored. Many booms require a "hybrid" adhesive system due to excessive dynamic loading. Because they are not intended for dynamic loading applications, mechanical anchors can "rock" in the drilled hole, causing movement. This motion doesn't just cause poor equipment performance—it can yield catastrophic results.

5. Missing the Big Picture

Our last discussion point involves vision—and thinking with an eye towards the future. The owner could change equipment manufacturers after the drawings are approved but before the installation starts. Or, the owner might decide to change manufacturers a few years down the road. It's important to think about ways to make the system design more "universal" to accommodate these types of changes. Planning ahead during the design phase could save your client thousands of dollars later.

Overhead medical support structures may look rather simple, but a lack of vision and planning can yield a system that does not meet your client's future needs. On the other hand, if you take the time to design a system that is easily modified downstream, your client will sing your praises when the time comes to make an equipment change.

Support Structures for Medical Applications: Why Accurately Calculating Load, Deflection, and Rotation Matters

Thanks to its ease of installation and adjustability, Unistrut channel is often specified during the construction of overhead medical equipment support systems. The safe and effective use of catheterization c arms, radiology equipment, lights, and service booms suspended by Unistrut support structures requires proper calculations of load, deflection, and rotation to ensure both optimal equipment performance and the safety of your installation.

One common mistake is the misuse of the beam load tables found in the Unistrut General Engineering Catalog and on the Unistrut Service Company website. Please note that the standard "beam charts" shown on the next page provide the ***maximum allowable uniform load***. Most actual cases will require some type of "reduction factor" to properly determine the actual load capacity of the strut.

Beam Loading - P1000						
Span (in)	Max Allowable Uniform Load (lbs)	Defl at Uniform load (in)	Uniform Loading at Deflection			Lateral Bracing Reduction Factor
			Span /180 (lbs)	Span /240 (lbs)	Span /360 (lbs)	
24	1,690	0.06	1,690	1,690	1,690	1.00
36	1,130	0.13	1,130	1,130	900	0.94
48	850	0.22	850	760	500	0.88
60	680	0.35	650	480	320	0.82
72	560	0.50	450	340	220	0.78
84	480	0.68	330	250	160	0.75
96	420	0.89	250	190	130	0.71
108	380	1.14	200	150	100	0.69
120	340	1.40	160	120	80	0.66
144	280	2.00	110	80	60	0.61
168	240	2.72	80	60	40	0.55
192	210	3.55	60	50	-	0.51
216	190	4.58	50	40	-	47
240	170	5.62	40	-	-	0.44
See notes below for more information						

To help engineers and architects make accurate calculations, we also include notes and sample calculations as shown here:

1. Beam loads are given in total uniform load (W Lbs.) not uniform load (w lbs./ft or w lbs./in).

2. Beam loads are based on a simple span and assumed to be adequately laterally braced. Unbraced spans can reduce beam load carrying capacity.

3. For pierced channel, multiply beam loads by the following factor:

- "KO" Series 95%
- "T" Series 85%
- "HS" Series 90%
- "SL" Series 85%
- "H3" Series 90%
- "DS" Series 70%

4. Deduct channel weight from the beam loads.

5. For concentrated midspan point loads, multiply beam loads by 50% and the corresponding deflection by 80%.

6. All beam loads are for bending about Axis 1-1.

Sample Calculations to Demonstrate Beam Loading Charts and Load Reduction Factors

Sample No. 1: Say we have a 6' span of P1000sl and want to see what the load capacity is for a point load. Per the charts, P1000 is good for a maximum allowable uniform load (not load per foot) of 560 lbs. In referencing the notes below, we have the following load reductions:

- X .85 for the sl
- X .5 for a point load in the center
- X .78 load reduction per page 62 in the Unistrut General Engineering Catalog (Edition 17A)

Therefore 560 lbs. x .85 x .5 x .78 = 185 lbs.

Sample No. 2: Say we have a 5' span of P1001 and want to see the load capacity for a point load. Per the charts, p1001 is good for a maximum allowable uniform load (not load per foot) of 1,910 lbs. In referencing the notes below, we have the following load reductions:

- X .5 for a point load in the center
- X .97 load reduction

Therefore 1,910 lbs x .5 x. 97 = 926 lbs.

Note that these assume that the strut connection can handle the load. It is the responsibility of you and your engineer to review all calculations and connections, and to verify that all items are installed per Unistrut requirements. Unistrut Service Company takes no responsibility for the misuse of information provided. Local codes may dictate more stringent requirements. Catheterization and X-ray equipment are also highly sensitive to deflection and/or rotation.

The "typical" Catheterization or Radiology support requires <1/16" deflection, and the "typical" light or service boom requires < .2 degrees of rotation.

Designing supports for overhead medical equipment solely on material stress without considering deflection/rotation will compromise both the performance of your equipment and the safety of your personnel and patients. For example, an inadequate overhead support structure may cause excessive wear and eventual failure of service boom brakes and clutches.

With an inadequate support grid, heavy service booms may initially perform sufficiently, but with time, the interior boom components will begin to wear and continually fail. Eventually, the dynamic load may cause failure of the support, causing the equipment to come crashing down. Making accurate calculations of load, deflection, and rotation when designing your overhead ceiling support grid will ensure your medical equipment performs to manufacturer specifications while keeping lab technicians and patients safe.

Overhead Support Structure Mounting Options for Buildings with Inadequate Structural Members

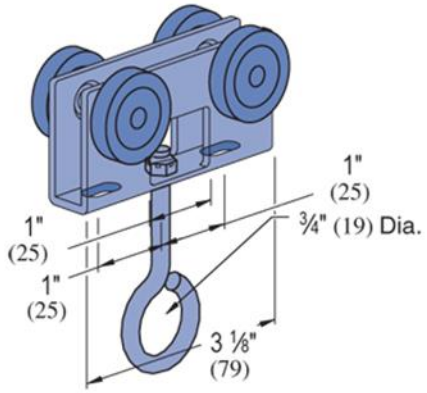
Many Unistrut applications require connections to steel columns, beams, or concrete, but what happens when these structural members aren't strong enough to handle the loads imposed by the system?

For example, what happens when you want to suspend a 1,000-pound X-ray system overhead, but the building can't handle the load and meet the stringent deflection requirements of all major equipment manufacturers? Our support structure for a GE X-ray system illustrates how our design experience created a solution to overcome a building's structural limitations.

Most of the X-ray system support structures we design are for hospitals or buildings that can handle significant loads. In this case, we were dealing with a building originally designed for retail use. The architect charged with converting the space to medical use worried about the strength of the building's structural members and an engineer commissioned to analyze the situation confirmed these concerns. Further complicating matters, this was a rush job—which is often the case with medical projects—and the architect wanted uninterrupted sight lines for the new space.

Before hanging any strut, we needed to start with a structural steel superstructure consisting of four 3x3 square tube columns nestled within the wall cavities and six overhead beams approximately two feet above the ceiling. Strategically placing the upright columns in this manner and connecting them to the overhead beams created an out-of-sight superstructure from which to hang the channel without cluttering up the radiology room's floor plan. The superstructure was also designed so it can be utilized during future room renovations.

With the suitable structural steel in place, we added a support system made from Unistrut P1000 and P1001 back-to-back channel, P2786 beam clamps, P2751 trolleys, and P2484 and P1359 angular fittings. For readers new to the Unistrut System, the images below illustrate some of the fittings and hardware used to complete this project:

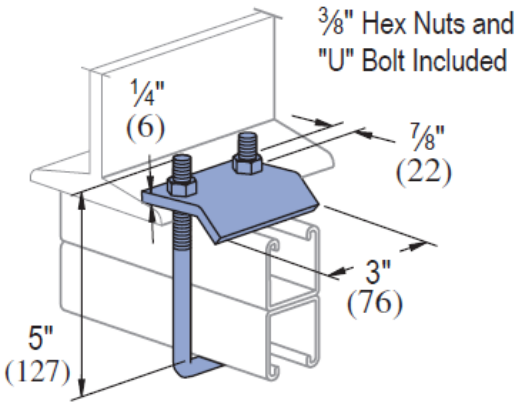


Standard Dimensions:

- Hole Diameter: 9/16" (14mm)
- Hole Spacing (From End): 13/16" (21mm)
- Hole Spacing (On Center): 1-7/8" (48mm)
- Width: 1-5/8" (41mm)
- Thickness: 1/4" (6.4mm) with steel meeting or exceeding
  ASTM A1011 SS GR 33, or

  0.220" (5.6mm) with steel meeting or exceeding ASTM A1011 HSLAS GR 45

Unistrut P2751 Four Wheel Loop Trolley Unistrut P2751 4 Wheel Loop Trolley

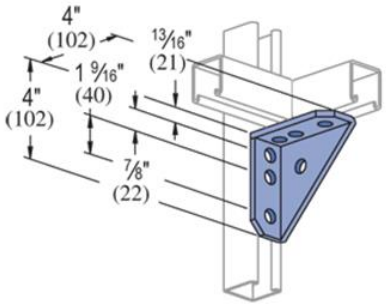


Wt/100 pcs: 92 Lbs (41.7 kg)

- For use with Beams up to ¾" (19) Flanges and with Channels P1001, P1101, P2001, P3001, P5000, and P5500.

Design Load Each
1000 Lbs (4.45 kN)
Use in Pairs Only

Unistrut P2786 Beam Clamp Unistrut P2786 Beam Clamp



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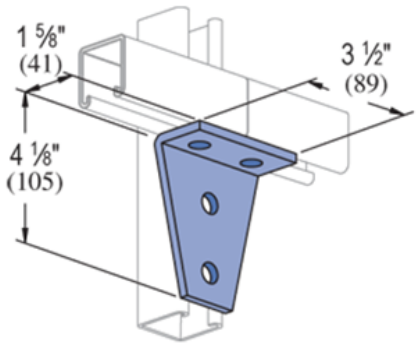
Unistrut P2484 - 7 Hole 90 Degree Gusseted Fitting Unistrut P2484 - 7 Hole 90 Degree Gusseted Fitting



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- Hole Spacing (From End): 13/16" (21mm)
- Hole Spacing (On Center): 1-7/8" (48mm)
- Width: 1-5/8" (41mm)
- Thickness: 1/4" (6.4mm) with steel meeting or exceeding
  ASTM A1011 SS GR 33, or

  0.220" (5.6mm) with steel meeting or exceeding ASTM A1011 HSLAS GR 45

Unistrut P1359 4-Hole 90 Degree Fitting Unistrut P1359 4-Hole 90 Degree Fitting

Below are some photos of the X-ray support structure:

In most cases, we find ways to attach to existing structural members, but this is not always a viable option. By leveraging years of design experience, we completed this project on time and on budget—despite the limitations of the building.

4 Options to Consider Before Reusing an Overhead Medical Support Structure

The inevitable equipment upgrades and remodeling projects common to hospital settings often prompt questions regarding the merits of repurposing an existing overhead support system versus a new installation.

Strong and stable systems ensure proper functioning of equipment and protect manufacturer's warranties of highly sophisticated lighting and imaging systems weighing hundreds or thousands of pounds. Patient liability and employee safety are also a concern. Before any decision is made regarding the use of an existing overhead support structure, it's important to consider all available options to make an informed decision.

Option No. 1: Reusing the Existing Structure

On the surface, the least expensive option is to assume that since the existing structure held the old equipment, it's suitable for reuse. Although this *may* be true, there are no guarantees that the existing support structure is suitable for the new equipment. If problems arise, the equipment manufacturer will claim that the general contractor has final responsibility for the strength and stability of the mounting structure.

Re-purposing is your least expensive option, but this approach also has the most potential downside because nobody has assessed the structure's suitability for the new application. Your project may also experience delays if the contractor discovers problems mid-project. Worse yet, the new equipment may malfunction or even fall during use. With these outcomes in mind, the reuse of an existing support structure has potential hidden costs that may far exceed anticipated savings.

Option No. 2: Review the Existing Structure

The second option is to hire an engineer to review the existing structure and compare the support system to standard design practices. This additional step often unveils missing bracing, loose hardware, and improper design concepts that can save substantial time downstream. The last thing an architect, general contractor, or construction manager wants to tell the project manager is that their project is facing delays because the existing support structure is insufficient to handle the new equipment loads.

Although a site visit is not fail-safe, a simple engineering judgment goes a long way toward spotting potential problems. In some cases, repairs and modifications to the existing structure *may* improve system performance and safety. If you do elect to reuse the existing support structure, we recommend having a competent carpenter perform a "nut and bolt" check to ensure that the structure's hardware remains properly torqued.

Option No. 3: Conduct a Formal Assessment of the Existing Structure

A third option is to hire an engineering firm like Unistrut Service Company to conduct a formal assessment of the existing structure. Unlike a simple site visit, this option includes a complete engineering review, including load calculations.

In a best possible case scenario, the engineering study may find that existing structure is suitable for re-use and the general contractors can move forward installing the new equipment. If the study discovers design flaws or structural issues, the complexity and feasibility of repairs and modifications depends on the original fabrication method. Older support structures fabricated using Unistrut or a similar style of channel lend themselves to field modification, but most of the structural steel and red iron supports we see in the field require welding. The byproducts of welding (fumes, dust, and potential explosions from sparks near oxygen) are problematic in hospital settings.

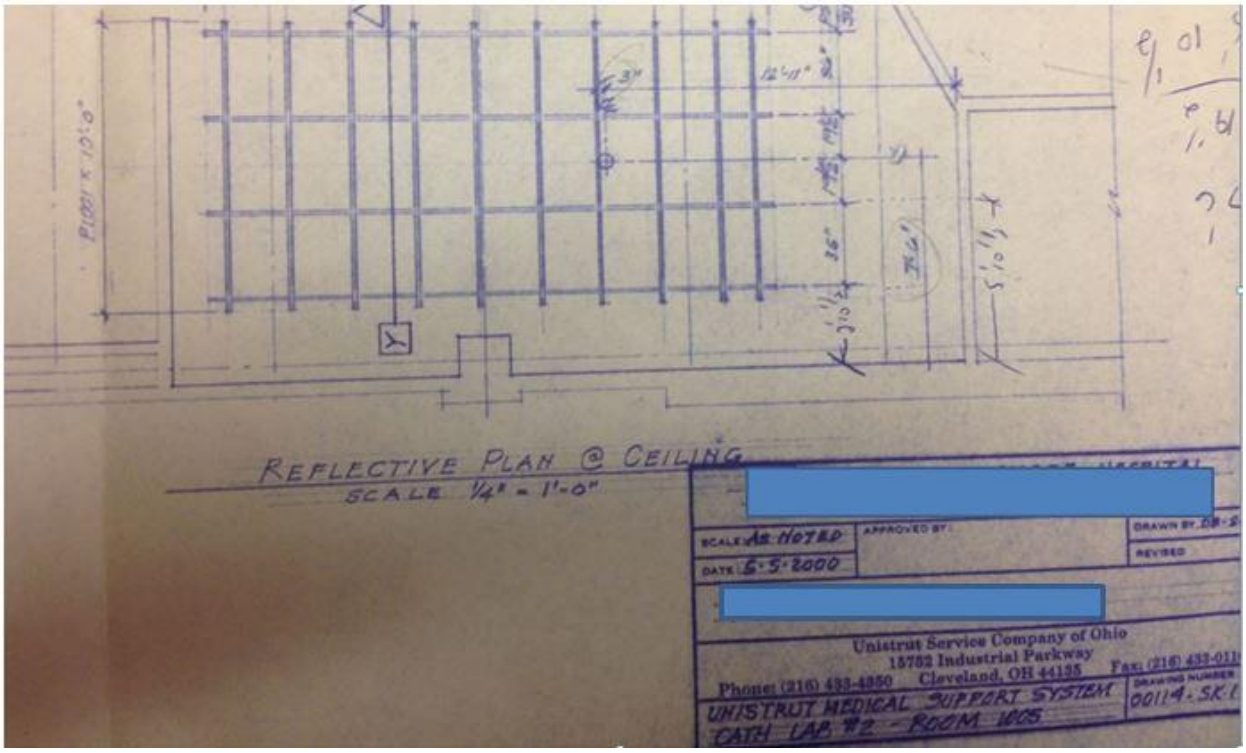
While you may be tempted to explore this option, remember that the combined costs of the engineering assessment and potential repairs may significantly exceed the investment required to replace the entire system from scratch. It's also important to note this step is solely a design analysis; there is likely *no* warranty on the lighting, cath lab, X-ray, patient lift, or boom system if a weld should fail or break.

Option No. 4: Modification or Installation of a New Support Structure

The only ways that ensure the equipment manufacturer will honor a warranty include removal and installation of a new support structure backed by engineering drawings and PE seals, or making modifications (again, backed by engineering drawings with PE stamps when necessary). These options may seem unnecessary, but when you factor in the costs associated with voided equipment warranties and potential patient liability, new or thoroughly-reviewed support structures are the most cost-effective solutions over time.

As an example, we were once hired to assess the suitability of a Cath Lab support structure we designed over 17 years ago. In this case, the new equipment's support structure requirements were remarkably similar to the old equipment. The owner hired us to confirm the original calculations, perform a nut and bolt inspection (re-torqueing), and add any additional changes. In this case, no additional changes were necessary.

Here is one of the original drawings, which features our old address and phone number:



If you are wondering what to do with an existing overhead support structure, remember to explore your options with an engineering company that understands the complexities of hospital and medical applications. A suitable overhead support structure will help ensure proper and accurate operation of your equipment while keeping patients and staff out of harm's way.

Retrofitting Radiology Room Support Structures

Clients often ask us about reusing existing radiology room support structures when swapping out older machines for newer equipment. When the size and weight of the systems are similar, clients assume we can retrofit their existing support structure. Sometimes we can recycle an existing support structure with some minor tweaks, but in other cases, we can't.

Issues with Reusing Support Structure

For the sake of argument, let's assume the owner is swapping a GE system for a Philips or vice versa. Both systems are similarly sized, weighing about 1,000 pounds each. With this information in mind, you might think that reusing the support structure is a slam dunk, but we can't begin to make this call before removing the ceiling tiles and inspecting the existing system.

If we are dealing with fabricated red iron supports, it may be difficult to mount the new equipment without making significant modifications, including welding. Welding is always problematic in a hospital setting due to fumes, dust, and the risk an open flame poses around bottled gases. On the other hand, if the support structure is modular, strut-based system, the odds of repurposing go up, but there is a catch.

Conducting an Engineering Review

The general contractor has final responsibility for the strength and stability of the mounting structure—not the X-ray equipment manufacturer. If the equipment fails, the manufacturer may point to an inadequate support structure and void the warranty. How do we determine if the existing structure is adequate? We start by referencing the existing system's engineering calculations and drawings to assess the structure strength. If we did the original work, this information is archived in our system.

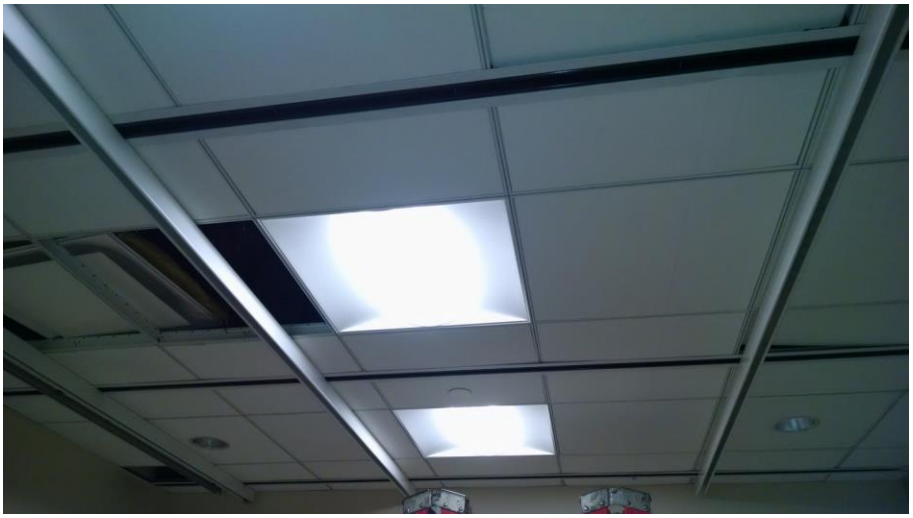
In cases where another vendor completed the work, we need to secure the original drawings and calculations or re-engineer the system. The engineering review may determine the support structure is compatible as is, or that it requires minor modifications. The key is having the engineering data in hand to protect your warranty and the patients and personnel near suspended equipment that can weigh more than 1,000 pounds. An engineering review may seem like an unnecessary step to some, but it is vital to ensure safe operation of the new system.

To address the original question—yes, there are specific instances where we *do* repurpose existing systems. For example, we recently fielded an inquiry regarding reusing a 10-year-old GE 3 rail system.

After years of reliable service, a decision was made to remodel and outfit a radiology room with equipment from another manufacturer. The owner wanted a slightly lower ceiling, and they were keen on keeping project costs to a minimum.

The original drawings and calculations verified the feasibility of mounting the Unistrut support structure beneath an existing GE 3 rail system on spacing as mandated by Philips. The finished project shown below illustrates what we can do with the proper support documentation in hand:

The next picture is from the same hospital. When this radiology room was remodeled, we again consulted our original drawings and calculations before mounting P5500T rails below the existing grid to support new GE equipment.



Overhead medical equipment support structures are not unlike the foundation of a house. We build on an existing foundation, but only when the structure is sound. The analogy used here is a bit simplistic, but now you should have a better understanding of the information required to make an informed decision.

Designing Unistrut Support Systems for Radiology and Medical Applications: Common Problems

We often receive calls from contractors, architects, and engineers wanting to play an active role in the design of a Unistrut Medical Equipment Support System. Since one of the most common applications is a Radiology (X-Ray) grid, let's discuss some design issues associated with these types of installations.

One design that we frequently see is adding structural steel beams (I Beams, or Wideflange Beams) perpendicular to the Unistrut, but just 3-1/4" above the ceiling (equal to the height of the P1001 ceiling channel). There are a few problems in doing this. We will address a few of them below.

Design Load

Most Radiology rooms are designed for a 1,000 lb. load anywhere on the system. There are some that are higher and some lower, but this load gives a basic idea for this discussion. The ideal beam clamp to attach P1001 Unistrut to the beam is a P2786, which is rated for 2,000 lbs./pair. Unfortunately, these are wrap-around style beam clamps, and would extend below the ceiling, something that is typically not acceptable. There are alternative clamps, but they do not have the same load rating.

Deflection

Industry standards require system deflection to be below 1/16". Spanning structural steel across a room, most likely around 15' or so, will exceed the deflection requirements of the system.

Steel Tolerances

Most radiology systems have certain requirements for plumb and level. Because most structural steel is not fabricated to the tolerances that the equipment drawings require, chances are good that you are dealing with steel that is at least 1/4" or 1/2" off over that span. Simply bolting P1001 below this does not fix the problem.

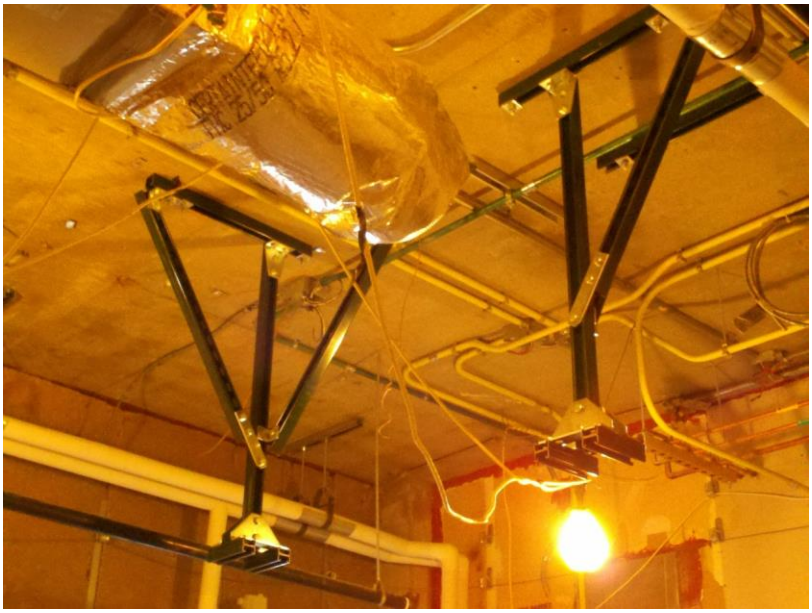
Solving Support Issues

Now you may ask, "What do I do for our Unistrut system?" We recommend having the structural steel several inches above the ceiling. Having the steel above the ceiling will allow the installation of additional Unistrut members, allowing infinite adjustment within the vertical members to get the system plumb and level.

Medical Support Structures: Exam Lights Versus Surgical Lights

Now and then, we receive contractor inquiries about pricing for overhead lighting support systems. In many instances, the contractor is working from drawings supplied by an architect and they are looking for pricing information on design and installation services. We are always eager to help, but when a drawing has generic references to "surgery/exam" light details, we need additional clarification before moving forward. Here's why.

Most exam lights are relatively small and lightweight. Unistrut supports used to suspend exam lights usually consist of a single vertical member with two braces as shown in the photographs below:



Surgical lighting systems are much larger (most are in the 24" diameter range), and of course, much heavier. Unistrut support structures surgical lights typically consist of four vertical members and up to eight braces as shown in the photo below:

What may seem like a minor detail is rather significant because an exam light requires a different support structure than a surgical light. Now that you understand the difference, let's talk about a few scenarios where a lack of drawing clarity can cause some problems.

Exam Lights vs. Surgical Lights Issues

This first potential problem is confusion during the quotation process. It's possible to end up comparing a quote for an exam light support system with a quote to build a surgical light support structure. The surgical light support system will come in much higher and the owner won't be able to make an apples-to-apples comparison. It's also worth noting that a much sturdier surgical light support system is overkill for an exam lighting application.

To be a good steward of the owner's resources, you'll want a support structure that fits the application. Ultimately, we'll need to know the manufacturer of the lighting system (e.g., Steris, Stryker, etc.) because there are slight nuances to each brand that must be accounted for during design. When requesting a quote for a Unistrut support structure, it's always important to supply accurate and detailed information. Sometimes this may seem like an unnecessary extra step, but doing so will ensure that your support structure is appropriate for your application. You may even save some money as well.

How and Why You Should Compare Quotes

Have you ever been puzzled by contractor bids with significant price discrepancies? Sometimes a low bid means your contractor is cutting corners to hit a price point or business is slow. A higher bid may signal a contractor that is buried in jobs or testing the waters to see how his pricing compares with the competition. In other cases, a higher bid may mean better design, workmanship, and materials.

It's always important to make apples-to-apples comparisons and to fight the temptation to dismiss quotes exclusively based on price. If your request for a bid returns two quotes that differ only on price and the materials and workmanship from both firms is similar, entertain the low bid. On the other hand, if there are significant differences in the quotes, you need to better understand what you are being asked to buy. Ask yourself some simple questions:

- What are the pros and cons of each contractor's materials choices?
- How do the design concepts differ? Does one design lend itself to a more efficient installation?
- How long will the installation be in service?
- Is the ability to modify the installation mid-project or down-stream important?
- Is support for field issues important?

We recently received a call from The Cleveland Clinic to revisit a project our team quoted more than 10 years ago. We were not the "low bidder" and the contract for a ceiling-mounted support structure for operating room (OR) lights was awarded to another contractor. This year's renovation of the OR includes plans to change out the lights in the same location.

During selective demolition, one of the welds broke. According to an outside structural engineer, poor design and installation methods, which included a hodge-podge of welded, fabricated steel, and channel of unknown origin, caused the system to fail and future remodeling incorporating this structure would have posed significant challenges.

The picture below is from a different contractor's installation, but it illustrates the same basic points. The channel in the picture looks like modular strut, but it is not genuine Unistrut material. Close examination also reveals mismatched channel in different profile configurations (and fittings) from multiple manufacturers.

Unfortunately, the low bidder used fittings and channel from multiple sources for this installation, so it was not possible to reuse the existing structure. The Unistrut Service Company team remedied this situation by designing a proper solution to allow for a quick installation and modularity.

For the Cleveland Clinic job, making repairs to the existing structure would have required tenting and welding in an active operatory. This was a bad idea, as the estimated costs of the repairs would nearly exceed starting over from scratch.

Both the decision to accept the lowest bid and a failure to appreciate the significant differences between the two approaches to the support structure design came back to haunt our client. With this information in hand, our client opted for a new medical equipment support structure designed and installed by Unistrut Service Company, not only so that it may potentially be reworked in the future, but because it's a wise decision to utilize a company that specializes in this type of work.