



**EXPANDING DESIGN OPPORTUNITIES AND  
FUNCTIONS WITH ADJUSTABLE  
CONCEALED HINGES**

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## Course Overview

Adjustable concealed hinges elevate modern and contemporary wall and door opening design, without sacrificing functionality. Determining the right type of hinge rests in the function of the door. Multiple factors of consideration vary from frequency of door use to composition, weight, height, and structure of the door. Additional consideration must be made for load capacity, and special applications such as fire doors, cladding, hidden frames, and power supplies.

Technological advances allow adjustable concealed door hinges to support weights exceeding 650 lbs. and can be used for fire doors up to 180 minutes, allowing more flexibility with sleek, flush designs in nearly all applications with functionality being the most important factor.

Adjustable concealed hinges support ideal design in luxury condos, apartments, hotels and prolifically designed residences. In order to maintain the functionality of a door opening, adjustability is an important factor.

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## Learning Objectives



Upon completion of this course the learner will be able to:

- Recognize the way new hinge technology allows for a broad range of options in concealed door hardware
  - Identify how proper hinge installation and adjustments can provide the best results
  - Understand how load capacity, height/width ratio, and weight factor into specifying the right hinge
  - Describe how concealed hinges can be utilized in a wide range of applications and improve the design
  - Discuss special applications for hinges, such as fire doors and power transfer to a door panel
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## Section 1 – Introduction to Adjustable Concealed Hinges

A concealed hinge in a hotel room, providing a sleek and modern design.  
*Photo courtesy of SIMONSWERK*

Adjustable concealed hinges create a perfect margin between the door and frame, while also providing a more modern and sophisticated appearance. In this section, we'll introduce adjustable concealed hinges and describe their features and benefits.

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## Movement



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Occupants are constantly moving through spaces, frequenting corridors, entering and exiting rooms to complete their daily tasks and routines.

While door hardware and hinges may seem to be a small part of building construction, the placement, layout, and the hardware bring movement to interiors, and the design of those doors can both inspire innovation and create atmosphere within a space.

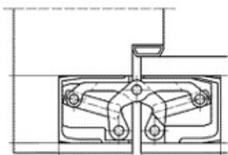
## Safety



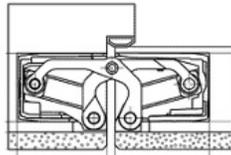
A 180-minute fire door opening prior to UL testing.  
*Photo courtesy of SIMONSWERK*

Doors can also provide safety as well as limit access to secured spaces while directing the flow of traffic for ingress and egress. Specially designed doors, such as fire doors provide two benefits. When closed they form a barrier and stop the spread of the fire. When opened, they provide a means of egress and escape. Hinges are tested as part of the door set.

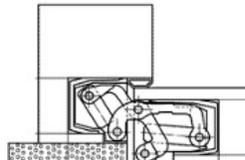
## Hinges



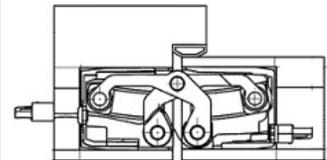
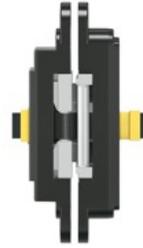
**Standard**



**With Cladding**



**Concealed Frame**



**Power Transfer**

A variety of concealed hinge options. | Photo courtesy of SIMONSWERK

While doors provide a physical barrier between spaces, movement is not possible without the use of hinges. While hinges have been made and used for centuries, technological advancements have not only improved functionality; advancements have also provided new possibilities for design and aesthetics.

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## What are Adjustable Concealed Hinges?



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## What are Adjustable Concealed Hinges?



The hidden hinge "disappears" into the wall when the door is closed.

*Photo courtesy of SIMONSWERK*

Adjustable concealed hinges, also called invisible hinges or hidden hinges, allow a door to visually blend into a wall without obstruction. When installed properly, concealed door hinges are completely hidden, creating a visually stunning modern design in luxury apartments, hotels, kitchens, bathrooms, government buildings, lobbies in commercial buildings, and many other applications. Concealed hinges can provide superior customized solutions.

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## Benefits of a Concealed Hinge



There are many benefits to specifying and installing adjustable concealed hinges. In the next few slides, we'll discuss the versatility of adjustable concealed hinges as well as their superior functionality and how they can provide a holistic concept that incorporates balance and stability while enhancing interior and exterior designs.

## Aesthetics



Adjustable concealed hinges create a clean appearance that allows doors to be fully integrated within a wall without sacrificing function.

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## Finishes



A variety of concealed hinge finishes.  
*Photo courtesy of SIMONSWERK*

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A wide range of architectural finishes are now available on adjustable concealed hinges. Finish options vary by supplier, but could include the following finishes: satin chrome, satin nickel, stainless steel look, bronze metallic, matte black, polished brass, polished nickel, and bronze finish (in a range of colors). Some finishes are for more interior decorative applications while others can better withstand the elements in exterior applications, e.g. satin stainless steel.

# Versatility

Can be used with various door and frame materials

Wood Door / Wood Frame

Wood Door / Steel Frame

Steel Door / Steel Frame

Aluminum Door Systems

Frameless Glass Door / Aluminum or Wood Frame

Concealed hinges can be used with a variety of door and frame materials including wood, steel, aluminum, and glass.

## Versatility



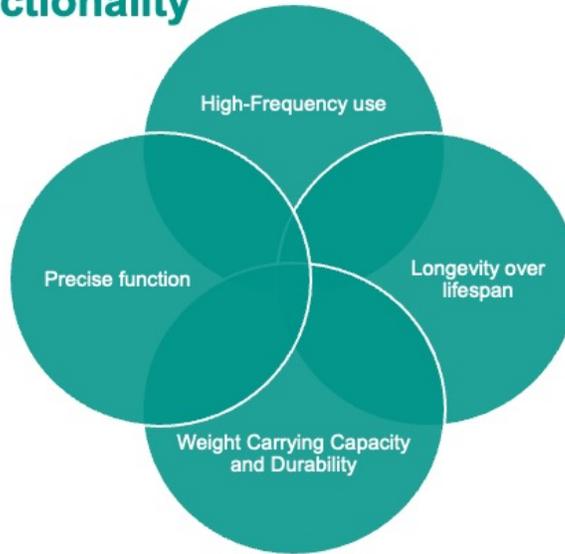
- Can be adjusted in three dimensions
  - Horizontal (X)
  - Vertical (Y)
  - In/out (Z)

Adjustable concealed hinges provide another element of versatility due to their adjustment features, which provide a simple way to create a perfect margin between the door and the frame. With the turn of an Allen wrench, most doors with concealed hinges can be adjusted in three dimensions: horizontal, vertical, and in/out.

Adjustable concealed hinges are distinguished by their flush margins and refined visual appearance.

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## Superior Functionality



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In addition to being versatile, adjustable concealed hinges provide superior functionality. In the past, concealed hinges could be used in very few applications, for example, closet doors that were lighter weight or on doors with limited use. With advancements in technology, adjustable concealed hinges can now be used in heavy doors (over 650 lbs.) that are frequently used, providing an effective way to create a perfect margin between the door and the frame. High quality adjustable concealed door hinges allow for high durability and longevity, even in high traffic areas. Some adjustable concealed hinges are maintenance-free and do not require lubrication.

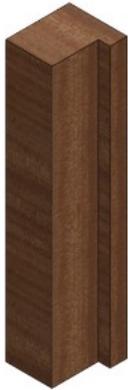


## Section 2 – Installation and Adjustability

Proper installation of adjustable concealed door hinges provide the best performance results, and a sleek, modern appearance. Therefore, as with all moving parts, improper installation can affect functionality and aesthetics, and can also lead to premature hardware failure. In this section, we'll discuss how minor adjustments can make a big difference during installation and extend the life of the hardware. Common door problems, e.g. door sagging, foundation wall settling and warping, require door assembly adjustments to maintain the functionality and meet life/safety requirements.

## Frame Options

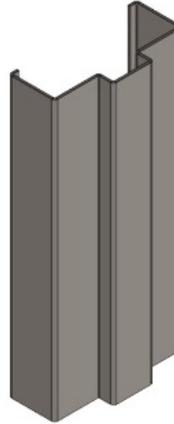
**Commercial frame**



**Casing frame**



**Steel frame**



**Aluminum frame**



Adjustable concealed hinges can be installed in a variety of combinations and in a variety of cases including commercial frames, casing frames, and steel frames.

These door hinges allow for three-dimensional adjustability, which will be discussed in more detail in the next few slides.

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## Challenges of Improper Installation



- Functionality can be compromised
- Compromised life safety and loss of use
- Damage
- Compromised aesthetics
- Premature hardware failure

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When door hinges are improperly installed, functionality can be compromised. When the door cannot be opened, important egress routes cannot be accessed. The fire door is to compartmentalize sections of the building. When the margin is too large around the door opening, fire and smoke can spread. In the same way, sound can travel through the opening.

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## Causes of Improper Installation



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There are many causes and reasons for improper installation. Door and frame prep is not always a perfect process and can adversely affect frame installation.

Over time, foundation walls may settle. In addition, doors may be abused, especially in high traffic areas. Abusive use can lead to deterioration from slamming, pulling on the lever, as well as pushing and pulling against a door closer or opener.

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## Causes of Improper Installation (continued)

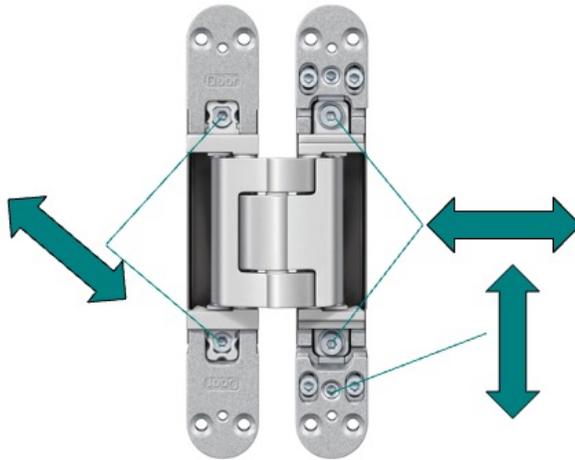


- Wide doors are even more affected
- Double doors are more difficult to align

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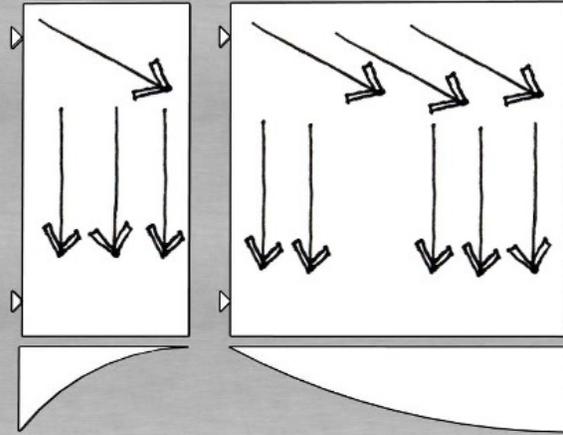
Wide doors are more affected than standard or smaller doors. Double doors can also be difficult to align. Proper preparation and alignment are crucial for a hassle-free operation.

## Adjustment options when installing concealed hinges



- Side adjustment (horizontal)
- Height adjustment (vertical)
- Depth adjustment (in/out)

Minor adjustments at the time of installation can make a huge difference both with regard to longevity and aesthetics. Once adjusted, the hinges are locked in place to prevent them from coming out of alignment.



## Section 3 – Load Capacity Ranges

This section will discuss various load capacity ranges and how height/width ratio and weight can factor into properly specifying a frame mounting reinforcement and hinge for the application.

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## Factors to Consider



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When determining the right hinge for the job, the main factors to consider are the height and width ratio of the door, frequency of use, and door weight. These factors will also help determine how many concealed adjustable hinges to specify, hinge location, and the type of hinges that are needed for a door assembly.

## Height/Width Door Ratios

Even if both the square footage and the weight of each door are equal, the height/width ratio must be considered.



Height and width door ratio refers to the height of the door from top to bottom as well as the width from left to right. These dimensions combined with weight, which we will discuss next, determine the correct concealed hinge to specify. If the door has compromised life safety requirements, it may be required to take a room/section out of service. This can be expensive.

## Determining Load Capacity

DOOR MATERIAL	1-3/8" DOOR THICKNESS	1-3/4" DOOR THICKNESS	2" DOOR THICKNESS
Hollow Metal	4	5	6.5
Hollow Core	2	2.5	-
Solid Core	3.5	4.5	5.25
Mineral Core	3.5	4	-
Pine (White)	3	3.5	4
Oak	5	7	8
Ash	4	5	6
Fir	3	3.5	4
Birch	4.25	5.5	6.25
Mahogany	3.5	4.5	5.25

\*weights in lbs per square foot



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## Weight



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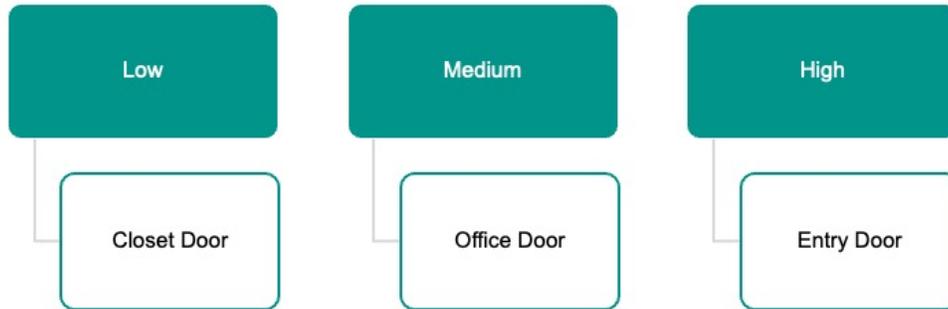
Door thickness, materials, and fire ratings all affect the weight.

Examples of applications that affect weight include:

1. A board foot of pine compared to a board foot of oak
2. Doors containing glass
3. Doors with cladding
4. Intumescent materials for fire rated doors
5. Steel gauge

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## Frequency of Use



These are examples of low, medium and high frequency of use.

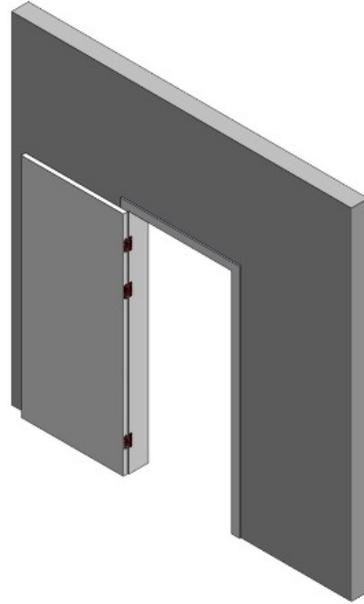
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When specifying a hinge, one must also consider the frequency of door use. There are three categories for frequency of use: low, medium, and high. Most manufactures conduct cycle testing to determine frequency of use. Durability should be a consideration when selecting an adjustable concealed hinge.

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## Additional Factors to Consider

- Door closers
- Powered door openers



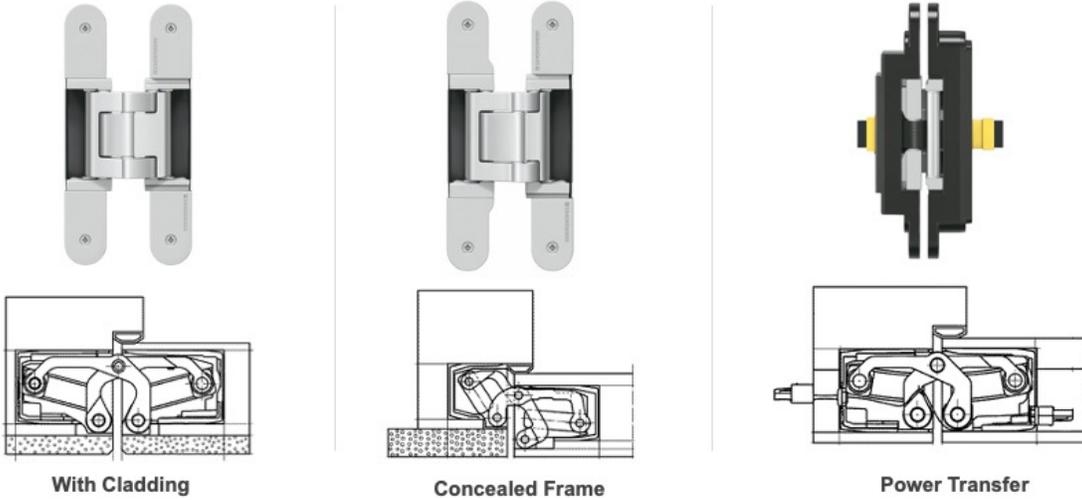
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Due to additional applied force, door closers or powered door openers may be subject to different load value considerations and hinge placement. To withstand the additional load from a door closer, an additional hinge may need to be placed in the upper third of the door below the upper hinge. In addition, for a powered door opener, another hinge may be required in the lower third of the door above the bottom hinge.



**Section 4 – Special Applications for Concealed Hinges**

## Special Applications for Concealed Hinges



A variety of concealed hinge options. | Photo courtesy of SIMONSWERK

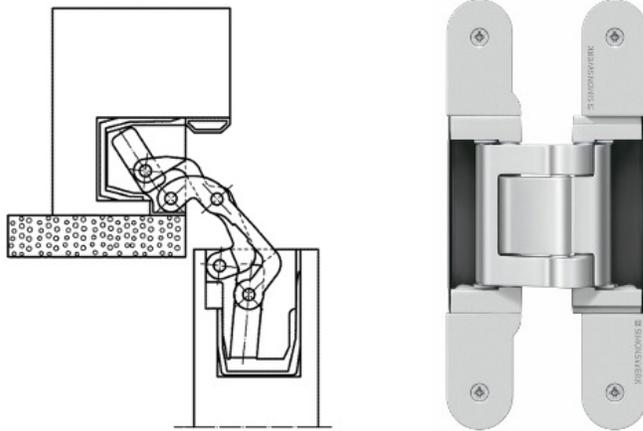
While doors provide a physical barrier between spaces, movement is not possible without the use of hinges. While hinges have been made and used for centuries, technological advancements have not only improved functionality; advancements have also provided new possibilities for design and aesthetics.

## Hidden Frames



Hidden frames allow for doors to be flush with the walls. This modern, sophisticated application is not only prevalent in high profile places like the Oval Office and Buckingham Palace. It's also available for use in contemporary residential applications and office spaces.

## Hidden Frames



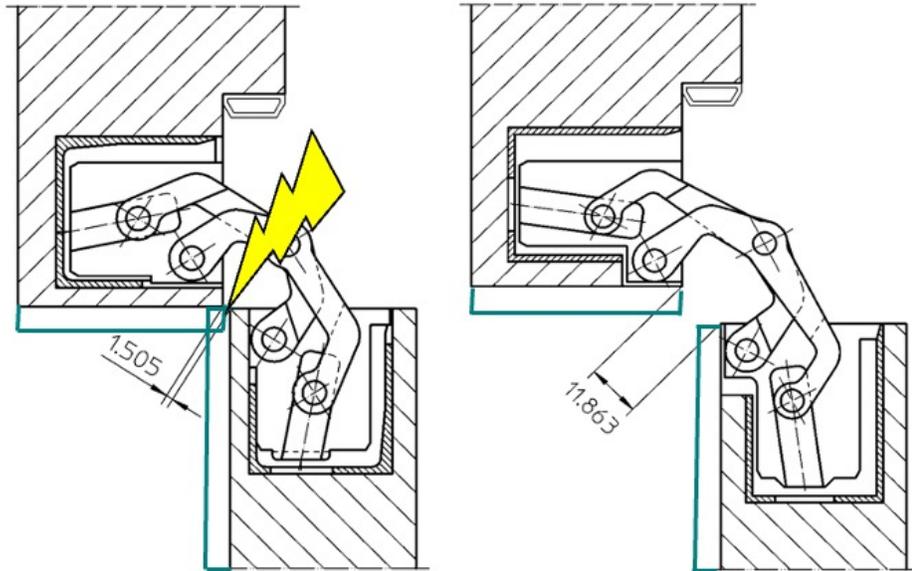
In this example, the recessed frame allows for cladding or drywall to be flush with the door.

## Doors with Cladding



Functionality of the hinge must be maintained when introducing higher-level design concepts like texture, pattern and/or cladding. Here's an example of a door and a wall with the same cladding using concealed adjustable hinges.

## Doors with Cladding



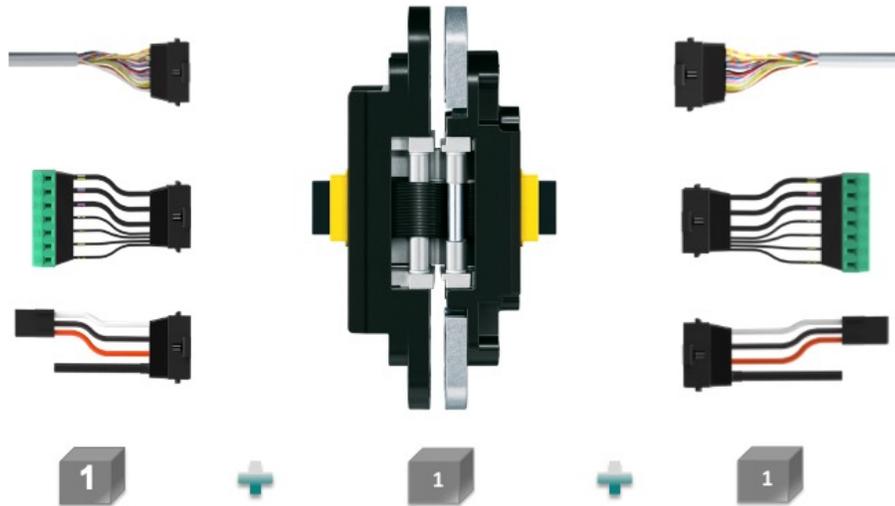
Specifying the correct hinge to allow for door swing is important for proper operation of the opening, e.g. wide throw hinges or installation brackets.

## Continuous Power Transfer



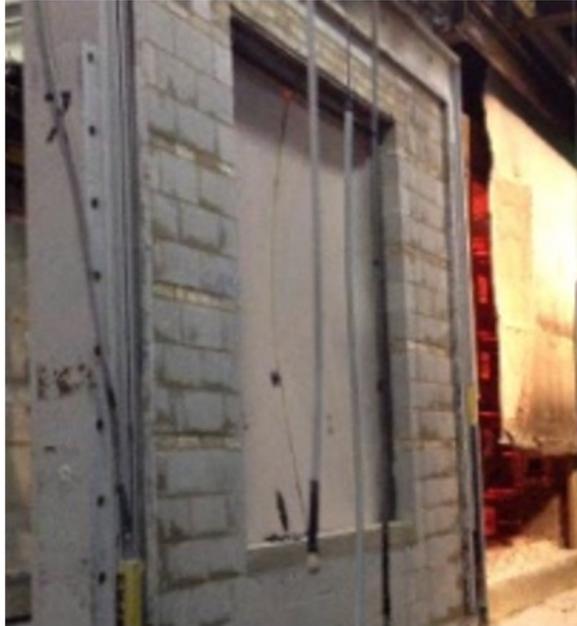
In today's modern world, efficient buildings often require the ability to control and operate doors remotely. This requires the transfer of electrical power and information from door frames to door panels. Adjustable concealed hinges and power transfer set-ups provide a sophisticated way for occupants to use card readers, access and door control systems, electrified locks, monitoring systems, and multimedia components.

## Power Transfer



This view shows how cables can be connected through a concealed hinge assembly.

## Fire Doors



Fire testing is of the utmost importance for manufacturers to meet NFPA standards. This is a picture of a door installed prior to fire testing.

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## UL Listing



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When specifying fire doors and hinges for the door assembly, look for hardware that meets requirements for UL Listing. For over 100 years, UL Standards have evolved to provide guidelines for fire protection and fire safety in buildings. Hardware meeting the standard will have the UL certification on its packaging. Fire doors and hardware that have been UL tested for fire protection typically list the number of minutes at which they can withstand the heat. UL listed hinges may not be combined with every UL listed door – it may require an engineering sign-off.

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## Case Study – 15 Hudson Yards, New York City

- 88 floors
- 917 foot tall tower
- Mixed-use building—commercial, residential, retail



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Let's look at a large scale project that has many different kinds of openings. At **15 Hudson Yards** in New York, multiple design teams were involved with this 88 floor, 917 foot tall tower with 1000s of openings.

Form following function is a principal in architecture and industrial design that shows how the shape of an object or building is related to its function or purpose. As we have seen an increase in minimalism in the last 20+ years relating to architecture and design, naturally, we are drawn to remove visual encumbrances. Concealed hinges achieve this by mortising the hinge into the door leaf and the frame.

All door openings are a sum of their components. There is the door to separate the room on either side of the opening, the hinges to swing the door, a lock/latch to keep the door closed, levers/spindles/turn-pieces to operate these mechanisms, closers to pull the door closed, and frames to seat the door in the opening. In commercial applications, these openings must meet a fire code to address life safety issues with regards to egress, smoke containment, and fire suppression.

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## Case Study – 15 Hudson Yards, New York City



### The Challenge

- Multiple door types, functions and varying life safety requirements created dozens of hardware sets
- Doors must meet code **AND** meet the design team's intent

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In an 88 floor mixed-use building in NYC with a world class design team there is a lot of opportunity to bring minimalism into the appearance of the door to enhance the building and its interior design aesthetic.

Not all doors have the same life safety requirements and certainly there will be design differences across the different spaces. A door is not just a door. There are exponential design ideas and potential solutions that must be reviewed to ensure that on installation everything comes together and works properly. This becomes a challenge for the specification team to ensure that the doors meet code in addition to the design team's intent.

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## Case Study – 15 Hudson Yards, New York City

- **Eric Weinstein, AHC/CDC, CDT**, of Architectural Openings, Inc. was the specification writer for many parts of 15 Hudson Yards. He points out:
    - "The architect or designer collaborates with me about a door detail and I have to figure out how to make it work. This collaboration sometimes comes with special requirements. For example, special designed cladding, often with patterns, are detailed to be applied to the face of the door. This affects the weight of the door and potentially could interfere with how it swings. I use the commercial grade high quality adjustable concealed hinge because it allows for increased weight; allows for the swing of the door to prevent door and frame contact; and it allows for field adjustability to get a perfect 1/8" gap. This is a benefit to the installer who works in field conditions that may not always be perfect."
    - "Adjustable concealed hinges have a wide variety of sizes for all types of applications. Their hinges are appropriate for interior doors, commercial interior doors, fire doors and very heavy doors. I have to decide what the correct application will be."
    - "They are commercial grade adjustable concealed hinges and are a proven hinge on many prestigious projects worldwide."
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## Case Study – 15 Hudson Yards, New York City

Eric Weinstein went on to say “**conditions are not always perfect**”.

Using an adjustable, concealed hinge is an advantage to the installer and the labor cost is greatly reduced by the ability to get the door square with simple adjustments, making adjustments easy and cost effective. But why?

Concealed hinges provided a proactive solution for on-site conditions

- This type of hinge can be considered a value-add to a project e.g. reduced labor on installation.
- Dynamic on-site conditions are met with the ability to set the door in place using an adjustment in the hinge rather than shimming the door.
- Future cost savings for the facilities department e.g. a simple adjustment to get the door back into alignment can be done by on-site staff rather than calling in a door specialist.

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Eric Weinstein went on to say “conditions are not always perfect”.

Using an adjustable, concealed hinge is an advantage to the installer and the labor cost is greatly reduced by the ability to get the door square with simple adjustments, making adjustments easy and cost effective.

But why?

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## Case Study – 15 Hudson Yards Conclusion

Why adjustable concealed hinges are an advantage to the design team

- Aesthetically pleasing while providing exceptional functionality
- Cohesive family of products to specify
- The architect had specific design ideas which were achieved by utilizing the commercial grade high quality adjustable concealed hinges

Why adjustable concealed hinges are an advantage to the installer

- Reduced labor costs
- Ease of future adjustments – simple and friendly to the facilities management budget

In this project, to date, there are no known post-installation issues that required outside consultation or labor

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In the long term, the price of the project is the sum of components and labor. Using an adjustable, concealed hinge is an advantage to the installer. The labor cost is greatly reduced by the ability to get the door square with simple adjustments. Further, it makes adjustment at a later date easy and cost effective. This is a benefit to the facilities management budget.

Within this project the design team had specific ideas of what the finished project should look like. Their objective for aesthetic and functionality that was set by the design team was achieved by utilizing the TECTUS family of hinges.

In this project, to date, there are no known post-installation issues that required outside consultation or labor.

## Known factors in construction for *future* consideration

The building settles slightly over time. This can cause the door and frame to become out of tolerance.

Floors are not perfectly flat to begin with causing one side of the frame to be slightly higher than the other side.

High-use environments where the frame or door may become out of alignment due to collision(s), impact(s), or other factor(s).

For a door to operate effectively, many things must happen. Primarily, the door must be perfectly square with the frame. Construction standards state there must be a 1/8" gap between the door and the frame.

As we practice architecture, when design finally meets a construction site

Sometimes things go awry and there are many potential reasons why:

- 1.) The building settles and the door and frame are out of tolerance not allowing the mechanism to positively latch.
- 2.) The floor was not perfectly flat to begin with causing one side of the frame to be slightly higher than the other side.
- 3.) High-use environments where the frame or door may become out of whack due to collision or impacts.
- 4.) Any number of other factors can also contribute.

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## **Presentation Conclusion**

Adjustable concealed door hinges allow for functionality within a wide range of contemporary and modern door designs. Proper specification is crucial to achieve design intent and function.

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## Thank You

This concludes the continuing education unit **Expanding Design Opportunities and Functions with Adjustable Concealed Hinges**.



Please take the quiz to receive your credits.

**Thank you for your interest in adjustable concealed hinges.**

For more information on SIMONSWERK adjustable concealed hinges, visit <https://www.simonswerk.us>

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