JONATHAN®
Engineered Solutions

SLIDE TECHNICAL MANUAL

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I. Background: We are Excellence in Motion

Jonathan Engineered Solutions (JES) specializes in access and linear movement solutions.

This guide is a small fraction of engineering capability at JES. Should you have any questions or customization needs, please feel free to contact the technical staff at JES.

JES products provide a linear motion solution to allow movements to packages, drawers, chassis, unit, bin, box, panel, platform, module, enclosure, container, tray, mechanical assembly and sub-assembly, and other customer based designs.

Products include:

- Slides in various lengths and travels and materials
- Brackets to mount slides to various stationary structures
- Components to meet applications requirements
- Accessories to aid in installation or improve performance
- Cable Management to provide linear motion to bundling of wiring or cables
- Door Stops to keep panels open while extending slides
- Align-A-Load Pins for shock and vibration control
- Complete tray assemblies

Slide Terminology: JES Slides are often called: Slide Rails, Chassis Slides, Chassis Rails, Rack Mounted Rails, Drawer Slides, Suspensions, Guides, Glides, Tracks, Sliders to name a few.

JES slides are constructed from the following materials

- Aluminum
- Carbon Steel
- Stainless Steel
- Exotic Alloys
- Contact JES for materials other than above

JES slide movements are available in various forms

- Ball Bearings
- Ball Bearing Rollers
- Rollers, Non Ball Bearing
- Friction
- Applied Coated Friction Reduced Materials
- Ball Bearing & Roller Bearing

JES uses the following corrosion protection materials

- Anodize (Hard, Clear, Colored)
- Post Plating
- Zinc, Zinc Yellow, Zinc Black
- Black Oxide
- Pre-Plating
- Electro-galvanized
- Painting
- Powder coated
- Passivation
- E-coating

Slides and most JES products can be customized to meet customer applications and requirements.
Contact JES for details.

MATERIALS AND FINISHES

Aluminum Products*

Material

Channels:	7075-T6 aluminum
	6061-T6 aluminum (includes Dyna-Race "DR" slides)
	2014-T6 aluminum
	Optional part number, Stainless Steel
	Components 2014, 2024, 6061, 7075 aluminum
	Ferrous items 300 CRES
Ball Bearings:	440 CRES
	Acetal plastic

Finish

Channels	Anodized clear
	Hard anodized
	Anodized black
	Optional part number, Anodized, Die Black, Dry Film

Military

Channels	QQ-A-200/2, QQ-A-200/8, QQ-A-200/11

Specifications

Channels	MIL-A-8625A, Type II, class1
	MIL-C-5541
Finish	MIL-A-8625, Type III
	SAE AMS 7200
	SAE ASTM 967

Steel Products*

Material

Channels	Carbon steel
Ball retainers	Carbon steel
Ball spacers	Extruded plastic
	Carbon steel
Ball bearings	Standard part number, Carbon Steel
	Optional part number, Stainless Steel
	Optional part number, Acetal plastic

Finish

Channels	Standard part number, Zinc plated, commercial, RoHS compliant
	Optional part number, Zinc plated, Mil Spec ANSI B-633, Type II, SC 2, SC 3
	Optional part number, Zinc plated, Mil Spec ANSI B-633, Type III, SC 2, SC 3
	Optional part number, Zinc plated, commercial, black
	Optional part number, Black Oxide
	Optional part number, Zinc Nickel
	Optional part number, RoHS compliant finish available on other than standard
Ball retainers	Standard part number, Pre-plated zinc, commercial
	Optional part number, Zinc plated, commercial
Ball bearings	None
Specifications	JES Standards
	Applicable Mil Specs

Stainless Steel Products*

Material	
Channels	Stainless steel 300 Series
Ball retainers	300 Series
Ball spacers	Plastic
Ball bearings	440 CRES
Finish	
Channels	Passivated

Tray Products*

Material	
Tray	Carbon Steel Aluminum
Finish	Powder Paint
Specifications	ANSI EIA 310

Lubrication*

Application	**JES Standard**	**Special Application**	**Other Options**
General Lube	High/Low Temp Polymer	500 Degree temp. lube	
NASA	Available on request	Customer supplied	No lubricant
Clean room	High/Low Temp Polymer		No lubricant
Shipboard	High/Low Temp Polymer		
High Cycle	MPG-2, CLG-2	White Lithium	
Dusty Environment Light Film Lube		Clear dry lube	No lubricant

Contact JES for additional details or specification compliance.
** Unless specified on the individual catalog page, website, or supplied JES drawing*

TRAVEL & TYPES

There are 3 types of slide travel: undertravel, equal travel, and overtravel.

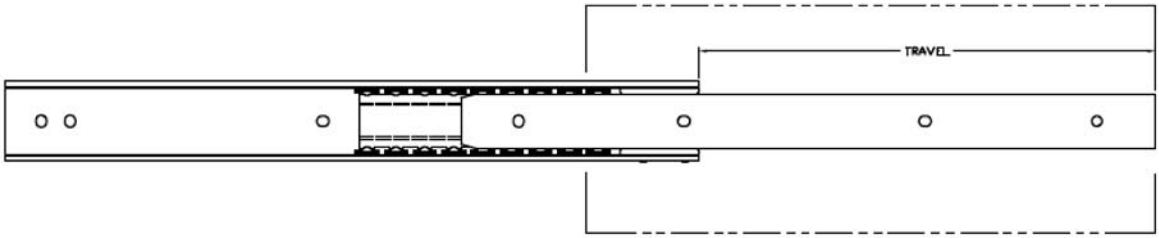
- Undertravel (also known as partial travel or 3/4 travel) is the travel distance of the slides is less than the length of the slides. Undertravel is the default in 2-section slides and can also be realized in 3-section (or more) slides.
- Equal travel is the travel distance of the slides is equal to the length of the slides.
- Overtravel is the travel distance of the slides is greater than the length of the slides. Equal travel and overtravel are only realizable in 3-section (or more) slides.

TYPES

JES offers many different styles of slides for various motions and load carry. The following is a basic outline of construction and general guidelines for establishing lengths and travel relationships.

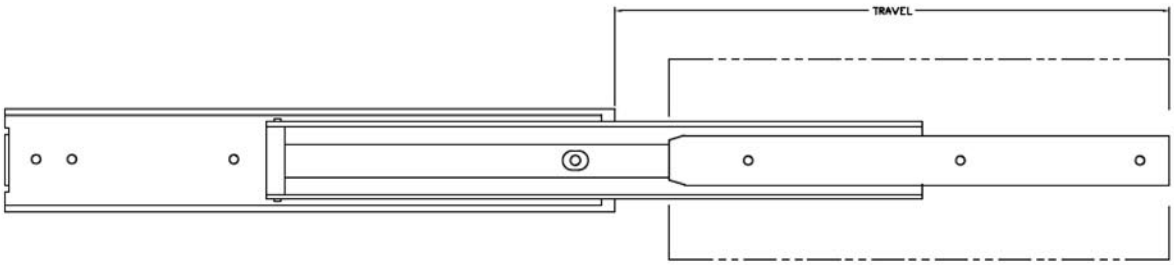
2 Member

2 Member: Slide travel is generally 75% of the slide length. Also known as 3/4 travel slide or partial travel slide or 2 section.



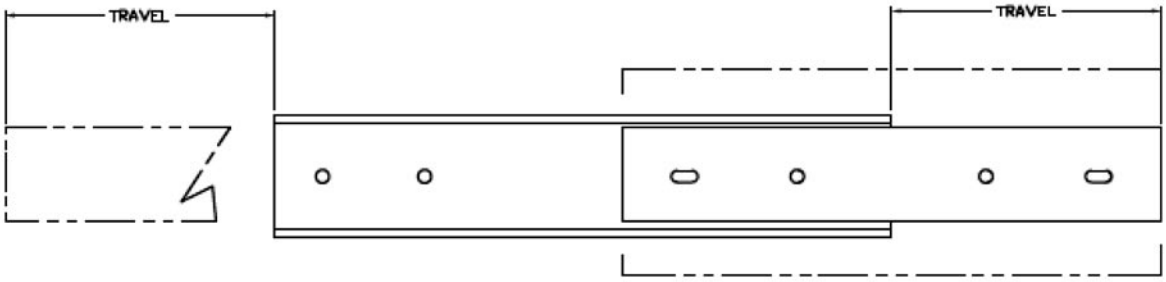
3 Member

3 Member: Slide travel is generally 100% of slide length. This type of slide can have added travel greater than slide length, equal travel to slide length, or under travel where the slide length is greater than the slide travel.



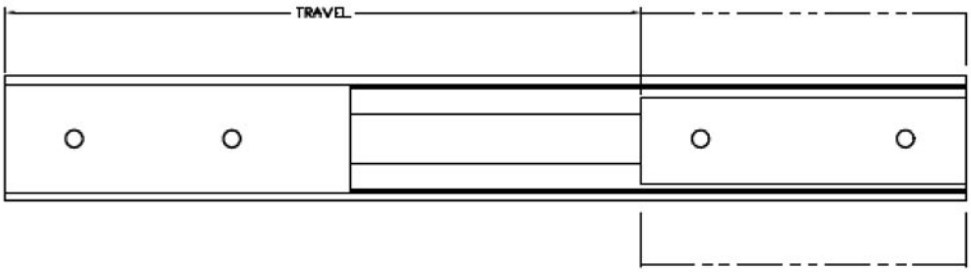
2 Way

2 Way: Based upon a 2 member slide, the slide has ability to move from a centered position to an outward and rearward distance. Slide travel is measured from the centered position to its outward position, back to center, and then rearward slide travel is measured.



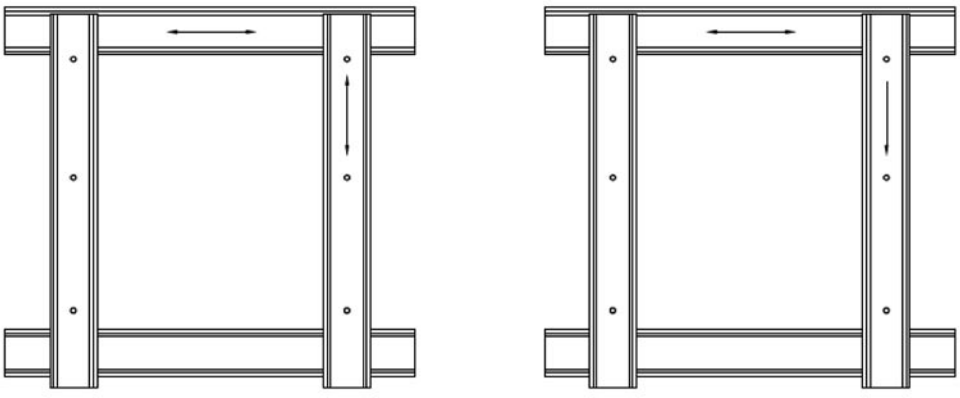
Linear Motion

Linear Motion: Based upon a shorter moving member residing within a longer stationary member. The moving member never goes beyond the ends of the stationary member. Travel is the distance of slide length minus the moving member length.



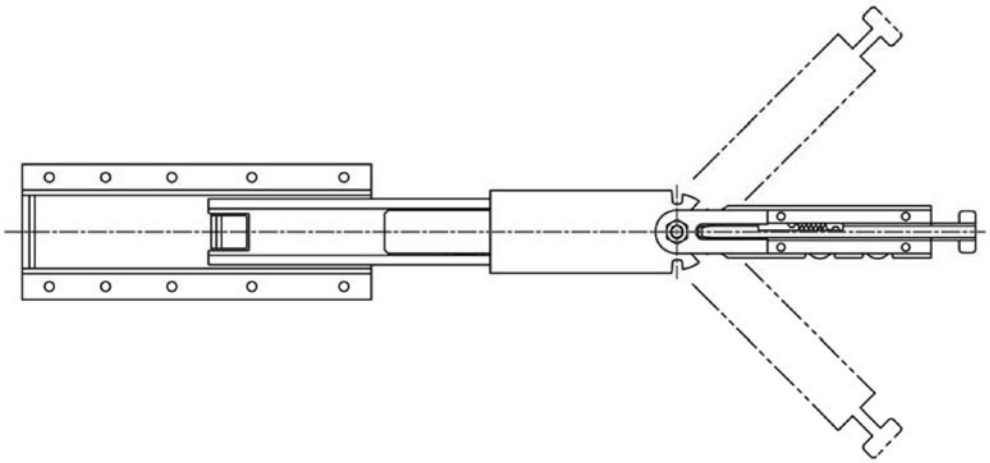
XY Motion

XY Motion: Combination of placing either 3 or more slides on top of each other to gain slide movements in multiple directions. Use of 2 section / 2 way slides or use of linear motion slide can be combined to form multiple travel combinations in a “left / right / up / down” or as a “left / right / up only” or “ left only / up / down”, etc.



Pivoting Motion

Pivot Motion: A 3 member slide with ability to be fully extended and the drawer / chassis are able to rotate upward and / or downward. Typical angles of rotation are 45 degree and / or 90 degree. The pivot ability allows a chassis to be repositioned to gain access to top / bottom / rear of package for servicing.



Multiple Members

Multiple Section Slides: By combining several slides together a gain in load carry or longer travels is available. *Consult JES for this type of slide.*

Features: Most JES products have user friendly features to assist the removal or positioning of the drawer / chassis / package. The following is a general list of features many JES products offer.

- Lock Open
- Disconnect
- Lock Closed
- Detent Closed
- Stop Open
- Multiple Stops
- Pivot
- Detent Open
- Self Close

SLIDE FEATURES

Lock Open
The addition of a lock open feature provides a secure position to allow servicing of a unit while extended ahead of the cabinet structure. This feature keeps the slide rail at a specific dimension and resists the unit from returning to the closed position without a manual release. Typical lock open designs consist of either a button, a leaf spring, a lever, or other mechanical arm. This arm is generally attached to the slide drawer member and connects to the slide adjacent member. In a 2 member slide, the lock feature connects to the slide stationary member. In a 3 member slide, the lock feature on the drawer member connects to the adjacent member. The adjacent member also has a lock feature that connects to the slide stationary member that automatically is released when returning the slide to its full closed position.

Operation: Non-Disconnect Slides
When the slide is fully extended and locked, operate the drawer member lock feature and close the slide fully.

Operation: Disconnect Slides To Return To Full Closed Position
When the slide is fully extended and locked, operate the drawer member lock feature and close the slide fully, this will automatically release the stationary member lock feature.

Operation: Disconnect Slides To Remove Drawer
When the slide is fully extended and locked, the drawer member lock feature can be disengaged and the drawer unit can be removed.

Lock Closed
This feature allows the slide to have a positive lock when the slide is fully closed. Lever arm or latch is added to the slide to retain slide full closed. *Consult the JES catalog or website for slide models that have this feature.* Manual operation of this lock closed feature is needed to allow slide to move forward. Upon closing, the lock closed feature will automatically be re-set for future use.

Stop Open / Free To Close / Disconnect
This feature is not a positive lock but a convenient feature to limit the slide outward travel, be able to close without lock actuation, but with the ability to allow the drawer to be removed from the slide body as a disconnect feature. Upon re-insertion of the drawer slide member to the companion slide member, the slide will be re-assembled without any other manual operation. Slide from full closed position can be opened to its full open position, then either closed without manual operation, or with a manual operation, allow the drawer to be disconnected.

Detent
A momentary force to retain the slides either at the full closed position, or full open position, or in special designs, a mid-point location. Detents are components added to provide a retention of movement without a positive lock feature. Detent forces can have different forces depending on application. Model 311D is example of a detent closed slide. *Contact JES if your design requires a detent function.*

Pivot
To service equipment mounted on slide rails, it is often requested a “pivot slide” be specified. The pivot action of several models JES offers, will bring the equipment to the fully extended position, and by unlocking the pivot bar, the package can rotate to a convenient angle. Typical angles are 45 degree up and down and 90 degree up and down. JES can offer several other angles if requested.

NOTE: Placement of the slide rail pivot point will be critical to performance of this slide series. It is the relationship of the package center of gravity and pivot point placement that compliments the slide function. Slide models 110QDP, 145QDP, 150QDP are examples of this type of slide. *Consult JES technical staff for assistance on pivot point or pivot angle requirements.*

Multiple Stops

Slides with multiple stops or locks are handled on special request. Many customers desire a "user position" and a "service position" to be added to the slides. A user position might be the distance outward enough to allow a common person to operate equipment for limited use and distance away from the cabinet. A service position might be the fully extended slide to allow a technical person to repair the fully exposed package in a safe manner. Often times a keyboard and monitor will be pulled fully outward, the monitor rotated to viewing position and the slide moved back toward the cabinet, a detent or positive lock at this position retains the unit at a convenient location.

II. SLIDE DESIGN CONSIDERATIONS

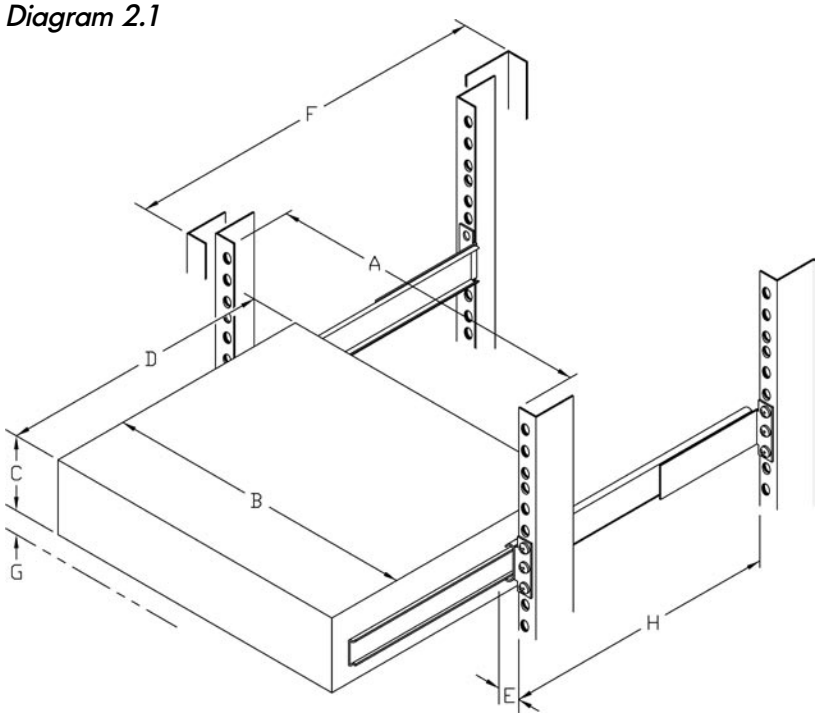
Selection Criteria

Consider the basic questions

1. Load carry = Select a slide with equal to or greater load rating than your requirement
2. Side space available for slide = Select using the slide thickness
3. Height available for slide = Select using the slide height
4. Cabinet depth = Select using slide length
5. Outward movement = Select using slide travel
6. Accessories = Review JES catalog or web site for technical illustrations for Lock Open, Lock Closed, Detent Closed, Disconnect, Pivoting, Captive Screws, Shock Blocks, Adjustable Shock Blocks, and Brackets

Each item is separate to each other but when combined will provide a finalized solution for your application.

Diagram 2.1



Basic evaluation geometry

A. OPENING OF CABINET / CLEAR OPENING OF CABINET
B. WIDTH OF PACKAGE MOUNTED TO SLIDE
C. HEIGHT OF PACKAGE
D. DEPTH OF PACKAGE
E. SLIDE THICKNESS
F. DEPTH OF CABINET
G. SPACE BELOW PACKAGE
H. RAIL TO RAIL DISTANCE

Calculation formulas

A = B + E + E
B = A – E - E
B = A – E - E – Bracket Thickness – Bracket Thickness (when using brackets)
A-B / 2 = E
A-B / 2 – Bracket Thickness – Bracket Thickness = Slide thickness (using brackets)
C = maximum slide height
D = slide travel < package depth
D = slide travel
D = slide travel > package depth
E = A – B / 2
F = slide length maximum or less
G = greater than slide height, bottom mount vertical
G = equal to or greater than slide thickness, bottom flat mounted

Installation Notes

After the selection of the proper slide and mounting approach to the cabinet, the last step in the process is the installation of the components. JES recommends the following installation procedure:

Non-disconnect slide products

- Install hardware in all of the locations provided
- Install the cabinet or stationary member first
- Using the access slots, position and install the remaining hardware
- Tighten all hardware. If electronic rack mounted, see separate section overview
- Use the access slot(s) provided to install covered mounting holes
- Extend the slide to its full open position
- Bring package between the extended slides, install hardware
- Use the slide access holes to install remaining hardware, slide may need to be moved
- Close the slide to its closed position
- Cycle the package in and out several times
- Tighten hardware if necessary
- Note the smooth JES slide movement. If the slide binds, the slide is not installed correctly

Slide products using disconnect

- Install hardware in all of the locations provided
- Install the cabinet or stationary member first
- Using the access slots, position and install the remaining hardware
- Tighten all hardware. If electronic rack mounted, see section below
- Use the access slot(s) provided to install covered mounting holes
- Extend the slide to its full open position
- Pre-install the slide member to package
- Make sure slide member direction to properly positioned on package, tail end / lock direction / correct hand location
- Bring the ball cage, if equipped, to full open position on cabinet member
- Bring package to align the slide members with the extended slide members
- Engage the extended cabinet slide member with the package slide members
- Continue to install and be prepared to disengage any locks as they may activate.
- Unlock locks, if activated, continue to full closed position
- Cycle the package from closed to open to closed several times
- Tighten all hardware if necessary
- Note the smooth JES slide movement. If the slide binds, the slide is not installed correctly

Slide products mounting into electronic enclosures using rack brackets

- Separate the front brackets and rear brackets
- Remove slide inner member, if disconnect is available
- Using the access slots provided in the cabinet members assemble the front bracket to slide rail stationary member. It may be necessary to move the slide members or ball retainers to gain clear access to the mounting holes located on the stationary slide member.
- If location of bracket to front of slide is known, tighten hardware
- Determine if the slide rail mounting bracket flanges are going to seat against the outside surface or inside surface of the cabinet vertical rails.
- Measure the cabinet rail to rail distance and use this distance to set the rear bracket into position
- Install the rear bracket with loose hardware. Hardware will be fully tightened later.
- Locate the proper position vertically within the cabinet rails
- Install any cabinet mounting aids onto the cabinet vertical rails (bar nuts, cage nuts, clip nuts, etc)
- When installing the slide rail, make sure it is level front to rear, and the left side is aligned with the right side slide rail.
- Bring slide rail with pre-installed mounting brackets into location on cabinet
- Attach the slide rail front bracket to cabinet while supporting the rear of the slide rail
- It is not necessary to install all hardware at this time to the front bracket
- Move to the rear of cabinet and while supporting the slide rail, install the rear attaching hardware
- Install all of the hardware at the rear.

- Do not fully tighten hardware at this time
- Install the front cabinet rail hardware but do not fully tighten at this time, 1/4 tight is suggested
- Move to the rear bracket and fully tighten the hardware between slide rail stationary member and rear bracket
- Install the other slide rails in similar sequence
- Bring chassis to the non-disconnect type slide and align / install chassis to slide rail moving member screws. It may be necessary to move the extended slide members slightly to gain access to the mounting holes
- On disconnect type slides, bring the ball retainer cage to the full forward location
- Bring package to align the slide members on disconnect type slides
- Continue to install and be prepared to disengage any locks as they may activate
- Unlock locks, if activated, continue to full closed position
- Cycle the package from full closed to full open to closed several times
- Tighten all remaining hardware on cabinet front and rear rails
- Note the smooth JES slide movement. If the slide binds, the slide is not installed correctly.

LOAD RATING

Load rating should be considered when selecting slide rails for an application. Variables that affect load rating include: center of gravity (CG) location, slide travel, life cycle requirements, and mounted slide orientation.

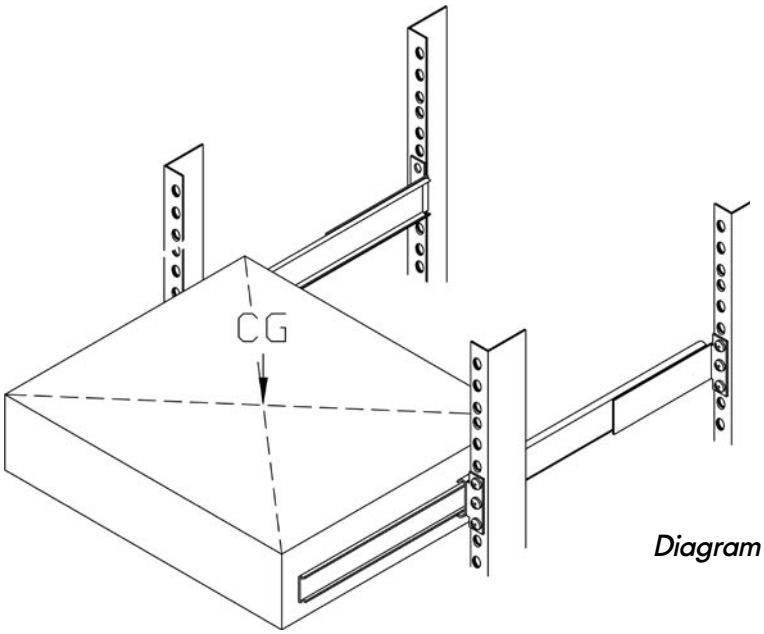


Diagram 2.2

Center of Gravity (CG) Location

The load rating of slides varies with the location of the CG of the load that is imposed on / or supported by the slides. JES bases all load rating to be centrally located as shown in Diagram 2.2.

Catalog load ratings:

1. Load ratings are dynamic load ratings; they are based on dynamic opening and closing of the slides from their fully closed and fully open positions, respectively.
2. Load ratings listed in the catalog are for a cycle life of 10,000 cycles. One cycle is defined as the distance traveled by the slides in one motion from their fully closed-to-fully opened-to-fully closed position.
3. Load ratings listed in the catalog are for one pair of side-mounted slides, except for the 300 series aluminum slides and 9000 steel series. Both of these slides have a “per slide” load rating.
4. The location of the CG of the load carried by the slides is based centrally along the slide centerline, with respect to the length of the slides / at mid-point of extended slide member length and the separation distance of the side-mounted slides.
5. Chassis’, drawers, or other load-bearing packages are attached to the inner members of the slides using a mounting pattern (e.g., mounting holes for screws, keyslot/pin attachment scheme, D-pocket/lance attachment pattern, etc.) that is spread across the length of the inner members.
6. The depth of the chassis, drawer, or other load-bearing package is equal to the slide length.
7. The maximum separation distance of the pair of slides is 25 inches.

Static Load Rating Safety Factors

Catalog load ratings have static safety load factors, as follows.

8. All slides are rated for a 2x open-position static safety load. When a pair of slides is extended to its fully open position, a total load that is equal to 2x its load rating can be supported by the slides, momentarily. When the open-position slides are relieved of this 2x load, and the load is returned to the load rating, the slides will continue to operate safely, both mechanically and structurally.
9. All slides are rated for a 5x closed-position static safety load. When a pair of slides in its fully closed position, a total load that is equal to 5x its load rating can be supported by the slides. This rating applies to slides that

are “hard mounted directly to cabinet sidewall” and not “mounted to adapter brackets between slide and cabinet structure”. When the closed-position slides are relieved of this 5x load, and the load is reduced back down to the load rating, the slides will continue to operate safely, both mechanically and structurally.

Slide Stacking

Slide stacking means two or more pairs of side-mounted slides are stacked on top of one another, on opposite sides of a load-bearing package. Load ratings of slides can be substantially increased by slide stacking. As a rule of thumb, the dynamic cycle load rating of a pair of stacked slides (2 side-mounted slides per side of a load-bearing package) is 2x the load rating of a single pair of slides and 4x the load rating in the static open position. *Consult JES for this type of mounting.*

LIFE CYCLE

One cycle of a pair of slides is defined as the complete opening and closing of the slides from a fully closed–to–a fully open–to–a fully closed position. Load ratings listed in the catalog are for a cycle life of 10,000 cycles. Applications that require greater than 10,000 cycles typically mean the load rating for the slide pair will decrease, because the mechanical wear and tear realized by the slides is prolonged over a longer application life. High-cycle applications may require heavier-duty slides. Added features increase the durability of a slide such as the aluminum series model 350DR which use metal strips in the ball bearing raceways. *Contact JES for assistance in high cycle application requirements.*

SHOCK AND VIBRATION

JES has a variety of methods to protect a slide and its application from shock and vibration that will be induced into the unit – whether by transportation methods, crash testing, or military barge testing.

Aluminum slides

JES has 2 types of standard shock protection devices, Type II and Type A, that can be integrated into most aluminum slides.

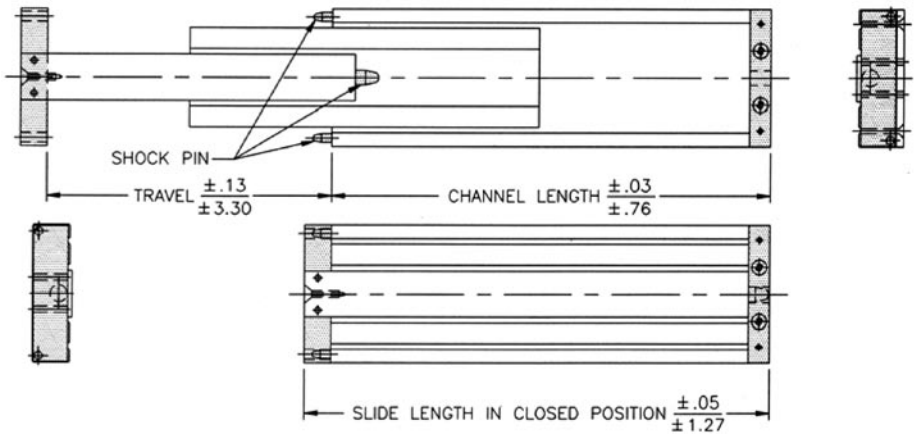
The best shock protection JES offers is through the usage of “Type II Shock Blocks”, such as shown in Model 300 SB, and may be necessary whenever high “G-loads” are anticipated in an application.

Type II

Shock and vibration devices have been integrated in the design of several slide models. This type of shock protection is known as Type II Shock Blocks. The high level of shock protection is provided by the use of reinforced stainless steel blocks attached to outer and inner member of the slide. Additionally, precision alignment pins are match drilled into the inner and outer members to fit securely into the steel blocks when the slide is in the closed position, providing a direct load patch from the inner member to the cabinet member of the slide. This prevents excessive amplification of transferred shock or vibration to the chassis.

Type II Shock Blocks can be added to the following series of slides:

61	130	181	DR150
62	131	182	DR351
63	138	300	600
67	145	350	
81	150	351	
82	170	DR350	



The Type II Shock Block option is available for Quick-Disconnect (QD) models but not recommended because the slides will no longer be interchangeable. Contact our technical staff if further assistance is required in this area.

Type-A

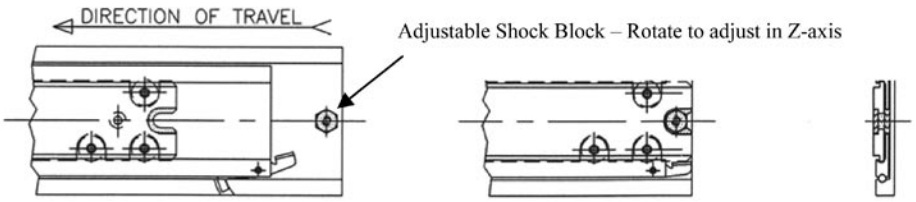
Another type of available shock or vibration protection is the Type "A" or Adjustable Shock Block. An adjustable, double-flanged, self-locking post attached to the rear of the outer cabinet member secures the inner chassis members in the closed position, providing protection against transportation shocks in the horizontal and vertical plane. It is designed specifically for use on standard JES Quick-Disconnect slide types without loosing interchangeability, and eliminates the need for costly shimming. The adjustable rear shock block features horizontal adjustment as shown below. Rotating the shock block to adjust the location in the z-axis and optimize the shock blocks alignment to the moving chassis member when installed in the cabinet.

Adjustable Shock Block

Adjustable Shock Block, available on specially designed models 130QD, 145QD and 150QD, as well as the use of captive screws through the front panel in the chassis, should be discussed with an Application Engineer before finalizing the design.

Type "A" Shock Blocks can be added to the following series of slides:

128QD	131QD	515QD
250QD	138QD	600QD
170QD	145QD	
130QD	150QD	



JES also has several design alternatives that can handle low and high levels of shock, vibration and high "G loads".

The selection of the "Dyna Race" feature, designated as DR, is well suited for this type of applications. The addition of a "high strength stainless steel strip" located in the ball bearing race will prevent it from "brinelling" or "scuffing" the aluminum surface.
The use of the JES "Align-A-Load" pin and bushing is a catalog item.
Usage of high strength aluminum alloys in our slides have met the requirements of military specifications, such as MIL-S-901C and MIL-STD-167, successfully in thousands of applications on ground based airborne and mobile vehicle mounted installations.

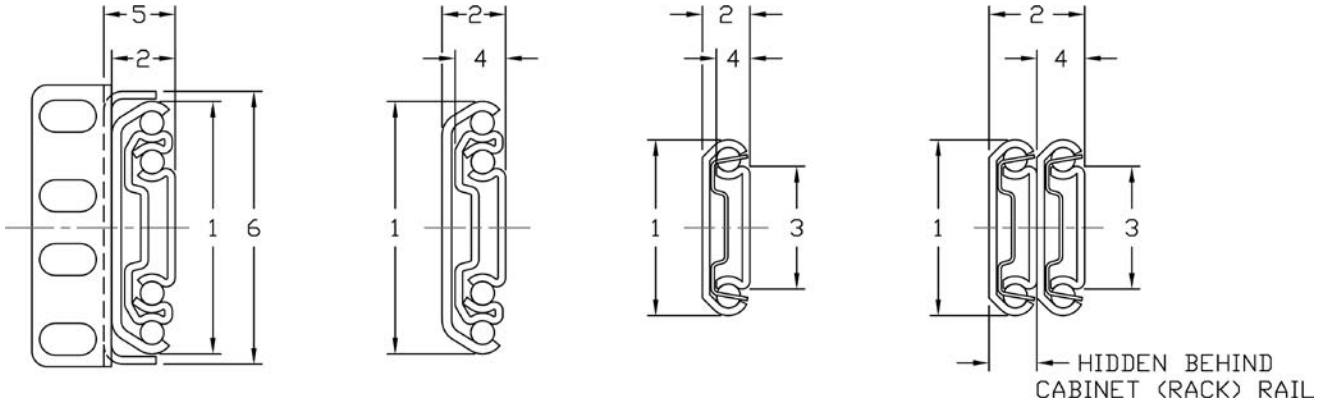
Steel Slides

In many instances, steel slides must also withstand unexpected shock and vibration not only during its normal operating range, but also during the shipment of the product. In order to eliminate this hazard, proper precaution such as blocking the drawer, fastening the drawer securely in its closed position and other methods should be thoroughly considered to guarantee safe delivery of the product.

If necessary, the JES technical staff will suggest a modification to an otherwise standard catalog item to ensure the integrity your product deserves. In many instances, shock pins, which are highly effective in the closed position, have been added to steel slides and are acceptable for air, ship and ground based installations.

SPACE REQUIREMENTS

1. Slide Height
2. Slide Thickness
3. Moving Member Height
4. Moving Member Thickness
5. Adding Brackets to Slide Thickness
6. Adding Brackets to Slide Height



When adding slides to an application, various slide profiles can be hidden to yield a slightly thinner profile. Slides as illustrated here show different dimensions to be considered when reviewing your application. As noted, the stationary members of the slide can be hidden within stationary structures.

One area often overlooked is the use of accessory brackets added to the slide profile. These brackets will add to the overall thickness of the slide or when using wrap-around brackets will add to the overall height of the slide profile. Use of these guidelines will assist in maintaining smooth slide movement.

MOUNTING TYPES

To meet a wide number of applications with varying types of mounting positions, the following is a brief, but not a total, example of potential installations.

Configurations: There are numerous mounting configuration possibilities for slides. Each mounting configuration bears an affect on the load rating of slides.

Two common mounting configurations of slides are side-mounted and undermounted. The side-mounted configuration of slides means slides are attached to opposite sides of a chassis, drawer, or other load-bearing package. The undermounted configuration of slides means slides are attached to the underside of a chassis, drawer, or other load-bearing package. Slides attached underneath a load-bearing package can be oriented vertically (height of slide oriented is in the up/down direction) or flat (height of slide oriented is in the side-to-side direction). Some rules of thumb apply for load ratings to side-mounted and undermounted slides:

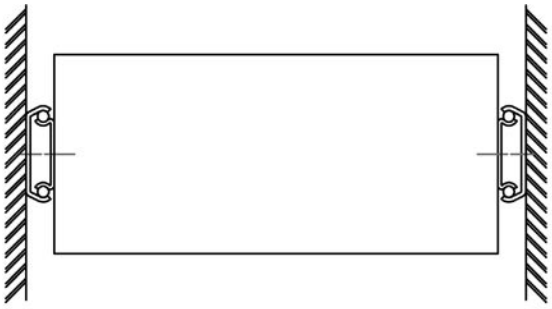
1. Catalog load ratings are based upon side-mounted slides.
2. Load ratings for flat undermounted slides are substantially less than side-mounted slides.
3. Not all slides are suitable for the flat undermounted configuration. Two important variables to consider when specifying slides for a flat undermounted application are the load to be carried by the slides and internal clearances within the slide.

Typical mounting methods include

Side Mounted
Bottom Mounted As Flat Slides
Bottom Mounted As Vertical Slides
Guide Slides
Same Side Mounted
Tray Mounted

Side Mounting

Side mounting installations use 2-section or 3-section as well as linear motion or 2-way models. There is no “exact location” presented for mounting side mounted slides. General considerations suggested;



- Middle of the drawer height less 1 inch / 25 mm. This places the slide pair just below the drawer’s center of gravity if drawer is completely loaded bottom to top.
- Slides placed at the extreme bottom of drawer will exhibit a top heavy condition on tall drawers with full load inside.
- Slides placed at the extreme top of the drawer will exhibit a rocking motion while slide is pulled outward or pushed inward. This is due to the center of gravity location being lower than the slide centerline.
- Slides installed in non-parallel positions to each other are dependent upon customer evaluation to verify limitations. *Contact JES if this type of installation is being considered.*

Bottom Mounted As Flat Slides

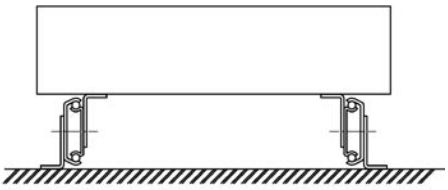
Applications that have space limitations to install slides as side mounted often are placed at the bottom of package. Several limitations are present;

- Actual load to be carried
- Center of gravity locations
- Outward travel required to meet application
- Access to install hardware to the package onto the slides in the full open position
- Access to lock components
- Space available to install the slides

Consult the catalog or website Load Rating Section as guideline to JES slide models suggested to allow flat mounting and the estimated load rating depending on slide model.

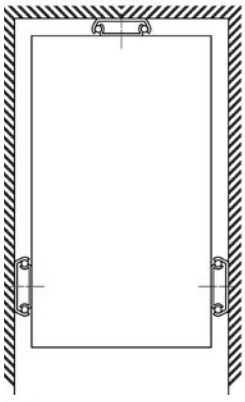
Bottom Mounted As Vertical Slides

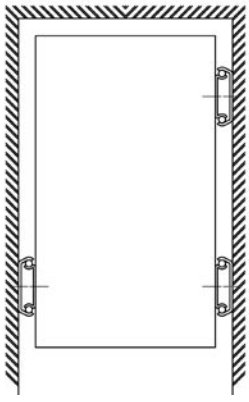
Applications that have sufficient space below the package with an increased load requirement not met by flat mounted slides, can have slides placed below the package in a vertical position. Load rating is fairly close to side mounted slides and is a convenient method where side mounting nor flat mounting can be completed. *Contact JES if technical assistance is needed for this type of installation.*



Guide Slides

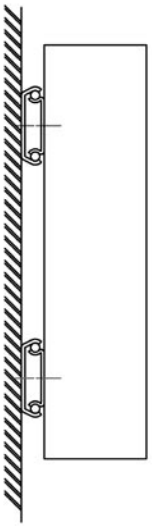
In tall drawer or flat panel type applications, the use of an upper glide slide can be suggested. The main load carry is handled by the lower mounted slides and the purpose of the upper guide slides is to stabilize the overall installation. Guide slides can be mounted as a side mount or flat mount. *Contact JES for guidelines in this application.*





Slides On Same Side

Applications that must have slides mounted to a common side can be accomplished with the limitations in consideation. These items would be;



- Center of gravity of load – generally no further that 8 inches away from the slides
- Height of moving item – additional slides may need to be installed to handle loads.
- Amount of travel application requires – unstable movement perpendicular to slide travel when slides have over-travel. Guide slide may be required.
- Use of locking components – to keep lower slide(s) outward

/

Tray Mounting

For equipment that is narrow or too wide or lack suitable mounting directly to slides, JES Trays are specified. Trays mount directly to electronic racks and provide a suitable platform for support.

- Unit can be installed either as a Tray or Shelf
- Cable carriers can be easily installed
- Straps, hardware, pads are available to complete the installation

III. PROCESS SPECIFICATIONS

The following areas are basic guidelines.

ENVIRONMENT

Temperature Parameters

JES products will perform to a temperature range of -40 F to +400 F (-40 C to +200 C) constant or fluctuating. Slides designed with plastic components are exempt from the high temperature ranges.

Salt & Humidity Exposure

Aluminum slides will meet most salt and humidity test requirements. A combination of aluminum alloys, anodize finish, use of stainless steel components will provide extended time of resistance to corrosion.

Carbon steel slides with standard zinc finish will meet 12 to 96 hour salt exposure durations. Other finishes and use of non-carbon materials can be substituted.

Stainless steel slides will meet most salt and humidity test requirements.

Dust & Dirt

JES' unique ball bearing design protects ball raceways by removing contaminants between the balls. Our slides have excelled in copy machines under constant use and exposure to swirling magnetic particles or in postal mail applications with paper dust. For outdoor dirt environments the use of JES friction models are suggested.

Shock & Vibration

Numerous JES products can be outfitted with components to meet rugged shock and vibration specifications. Components such as Shock Blocks, Adjustable Shock Blocks, Captive Screw Closed, Align-A-Load Pins, can be suggested to be added to the basic slide series. These devices will isolate the slide and its ball bearings / rollers from shock impacts and vibration durations away from the equipment the slides are mounted to. These features do not add to the forces implied and minimizes damage to attached equipment. Customers install JES products and pass typical Mil-Spec 901G or 810 type testing.

Outdoor Exposure

Depending on the application, the use of JES stainless steel and aluminum slide models have found excellent durability in outdoor, exposed weather conditions.

Magnetic Resistance

JES' products using non-magnetic aluminum and stainless steel have been installed in numerous applications where magnetic resistance is required. X-ray and other non-magnetic installations have employed JES products to provide smooth slide movement within an environment of magnetic surroundings.

Material and Process Specifications

JES materials and processes conform to military and commercial applications. Our quality procedures are in compliance with the following certifications:

AS9100
SO 9001
AWS D1.1/ D1.3
MIL-STD-130

Consult with the JES Application Engineering Team if you have special needs. In many instances the design parameters dictates a high frequency of use for slides, a large number of products will meet or exceed the test requirements of local, national, international, and customer specific specifications

PROTOTYPING & TESTING

JES maintains an in-house prototype and testing facility.

Prototyping

Prototyping is used to demonstrate the feasibility and functionality of new mechanical technologies and concepts. Prototype designs range from individual components and mechanisms (such as lock mechanisms, detents, tool less features, sheet metal attachments) to complete systems and assemblies (battery trays, articulation monitors swivels and pivots.)

Testing

Mechanical testing is used to validate and mimic the operation of designs in operating environments.
The intended goal is to assure that the proposed design solution safely meets the application requirements throughout its life cycle.

JES maintains an in-house test lab to perform the following tests.

1. Load rating
2. Deflection
3. Life cycle
4. Component functionality
5. Pull / Push Forces
6. Side loads / Impact
7. Safety loading
8. Other mechanical tests

Other tests are available, contact JES.

1. Load rating

Certain applications exceed catalog load ratings. Such applications warrant their own mechanical testing to assure a desired load carry can be met. Detailed data collection and monitoring throughout custom load rating tests assures a thorough understanding of the mechanical behavior of the slides under the applied load rating throughout their life cycles.

2. Deflection

Deflection is the amount of downward distance the slide and package will see between a no load and applied load comparison. For example: if objects reside in proximity to open-position slides carrying a package, slide deflection could create interference with the objects. It is possible to duplicate custom test plans to measure deflections in numerous loading scenarios. Deflections can be monitored at an instant of time, or over time and throughout cycling, to assess the mechanical behavior of slides throughout their life cycle.

3. Life cycle expectancy / duration

Catalog load ratings are for one pair of slides cycled 10,000 times. Applications that require a cycle life that is substantially different than 10,000 cycles may require its own testing. For example, an application that requires very few cycles may be tested if the slides can safely support a higher load rating, since the applied load will impose a wear and tear on the slides over only a few cycles. By the same token, applications that require extremely high cycles may be tested to assure that the slides remain to operate safely, mechanically and structurally, throughout their life.

4. Component-level functionality

Many applications require new slide features, such as locking mechanisms, detents, disconnect mechanisms, tool-less attachment features, etc. New components can be tested to validate their proper mechanical functionality throughout an anticipated application life.

5. Pull / push forces

When an application requires push and / or pull forces to be quantified, data can be collected throughout the cycle life of slides to assure their continuous ease of use throughout an anticipated life. As another application example, pull / push forces can be measured as a guideline to specify a slide design that requires a tight or loose movement.

6. Side loads / impact

In some applications, the ability of an open-position pair of slides carrying a load-bearing package to withstand a side load / impact is of importance. For example, an open-position pair of slides may be inadvertently bumped by a person. Another force may be encountered as a momentary applied load. In such applications it is essential to assure the integrity of the slides against structural failure. Side loads / impact tests can be simulated by the open-position slides with a brief-duration force, and measuring the response, or by imposing a long-duration side-load on the open-position slides, and monitoring the response over time.

7. Safety loading

Catalog load ratings have intrinsic static safety load factors of 2X load rating and 5X load rating, for the open and closed positions, respectively. In some applications, safety loading requirements that differ from these are required. Custom test plans can be written and executed for applications unique safety loading requirements.

8. Other mechanical tests

Many other mechanical tests can be performed in JES' Prototype & Testing Facility on individual components and mechanisms, slides, and complete linear movement systems (e.g., systems that include slides, trays, brackets, cable management systems, etc.). Detailed test plans are written that clearly articulate a custom test set-up that mimics the actual application environment as closely as possible. Mechanical testing can be performed to monitor the functioning of a single facet of the linear movement system, or of multiple facets, such as those described above. Data collection and monitoring during test execution assure that at the end of the test, a thorough mechanical engineering understanding of the behavior of the tested system is well understood.

JES provides suitable stationary structures (adjustable widths) to mimic and mount various JES products similar to end use applications. It is highly suggested customer provide actual, anticipated, or mock-up of units (stationary and moving structures) to JES to simulate anticipated final application. JES does not certify these tests, but will provide a test report to validate results.

JES can set-up and provide test results to the following specifications

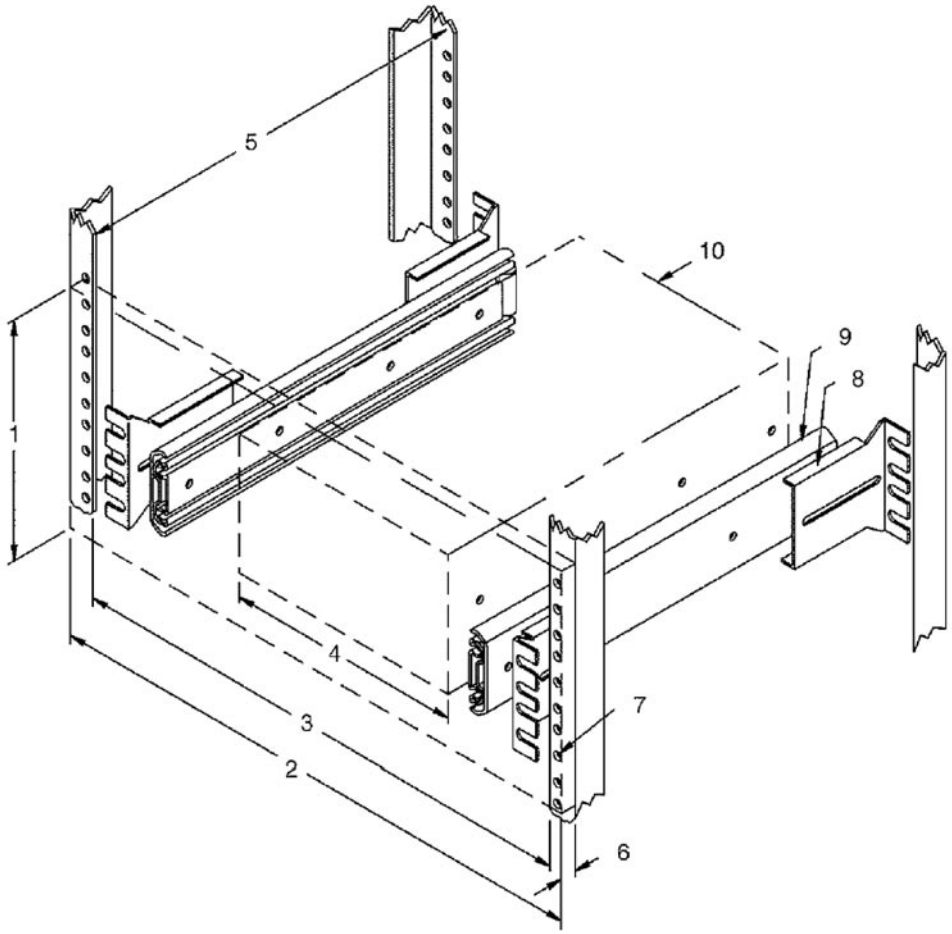
- Underwriters Labs UL/IEC 60950-1, Second Edition
- ANSI / BIFMA metal office furniture tests
- SEFA, scientific and laboratory tests
- KCMA, kitchen cabinet

IV. ENCLOSURES & RACK MOUNT

General

2 types of enclosures are independent to each other. An electronic device "enclosure" contained within a sheet metal "cabinet" is typically called a chassis. A stationary structure called a cabinet is considered an "enclosure" or rack cabinet. Chassis are typically mounted to slide rails to mount into rack cabinets.

Commercial and military electronic systems are often packaged into and within a stationary structures called racks, cabinets, electronic enclosures, or frames. Most generally, the construction of the enclosures is dependent upon the individual manufacturer supplier / vendor with his own interest in mind. The mounting of components to be continued in the rack are generally in conformance to ANSI EIA / 310 with several revisions issued. ANSI EIA / 310 C was issued as an inch / metric type dimensioning, called soft metric conversion, based on 2 types of hole patterns called Wide and Universal. ANSI EIA / 310 D included both the Wide and Universal and added a metric Hard Metric pattern. Mil-Std-189 follows ANSI / EIA 310 C patterns.



1. Panel Height
2. Front Panel Width
3. Clear Opening
4. Chassis Width
5. Rail to Rail
6. Panel Thickness
7. Mounting Rail Pattern
8. Bracket
9. Slide
10. Chassis

Cabinet Rails

Rack manufacturers will follow the ANSI EIA 310 specifications but offer construction features not realized within the specification. A good example is the types of columns racks incorporate. Simple formed Standard Rail, or a configured In-Line Return Flange Rail, or an Offset Return Flange Rail, or an Extrusion Rail, with construction becoming a 2 post (single column), a 4 post, or 6 post (mid-rail) configurations. Depths of cabinets are treated as the overall outside dimensions but for slide rails to be installed, the "rail to rail distance" is most important. Often the term "19 inch rack" is mentioned but the distance between the left & right rack rails is key to successful slide rail & chassis installation.

Current rack manufacturers will offer a wide range of cabinet column rail shapes as well as numerous attaching sizes. The spacing between the attaching points is based on 2 basic repetitive relationships:

Soft Metric

Inch: 1/2 inch, 5/8 inch, 5/8 inch, 1/2 inch, 5/8 inch, 5/8 inch, 1/2 inch, repeat
Inch: .500 inch / 12.7 mm, .625 inch / 16 mm, .625 inch /16 mm, 500 inch, repeat

Hard Metric: 25mm, 25mm, repeat

Hole sizes:

Tapped #10-32, #12-24, M5, M6
Clearance Holes: #10, #12, M5, M6
Window Holes: .38 inch / 9.4 mm square, .35 inch / 9 mm square

Universal Spacing includes all Soft Metric locations.
Wide Spacing has the removal of one 5/8 inch locations within the Soft Metric outline.

Critical Dimensions

When choosing and specifying slides to be installed to equipment and mounted to the framework of the cabinet, careful attention should be given to the space available. The "space available" is defined as the space between the fixed opening width of the cabinet uprights (rails) and the actual width of the component (chassis). The minimum space available is required to allow the slides' extending member(s) to pass freely to the open position. The following data is shown as examples of the rack specification standard. Noting the cabinet dimensions between the cabinet rails (clear opening), the rail to rail distance (depth), the outside dimensions of the cabinet depth (length), and the number of units the equipment will reside in, all will allow the proper JES slide and mounting bracket to be selected.
Chassis height is defined by the total height between the following rack mounting points.

Soft Metric Rack Unit is called RU = the top and bottom edges of equipment that split any of the 1/2 inch / 12.7 mm locations. A maximum 1RU is 1.75 inches / 44.4 mm. Multiples of this maximum is called 2RU, 3RU, 4RU, etc. 2RU is 2 times 1RU, 3RU is 3 times 1RU, 4RU is 4 times 1RU, etc

Hard Metric System Unit is called SU = the top and bottom edges of equipment are based on 25mm multiples. 1SU = 25mm height. 2SU is 2 times 1SU; 3SU is 3 times 1SU, etc

Slide Selection, Electronic Rack / Chassis / Slide Rail

In most applications involving JES slides that support a package, slide length is normally determined by the depth of the cabinet. Brackets added to the slides to mate with cabinet rails are limited by the distance of the front cabinet rail and the rear cabinet rail. Slide lengths can be less than, equal, or greater than the rail to rail distance but will be limited to the actual depth of the cabinet. Rarely do slides project beyond the extreme front or rear of the cabinet structure.

To determine proper JES products, the relationship between the cabinet, package, mounting distances, and available space is to be considered.

- Example: The cabinet clear opening distance and the chassis will establish slide thickness on either side of the chassis.
- Example: If the slide needs mounting brackets as the link between the slide and cabinet, the bracket thickness is to be considered in reviewing the available space between cabinet and chassis widths.
- Example: Slide brackets can be positioned to be less than, equal to, or greater than the slide length.
- Example: In certain installations the slide can be hidden or recessed behind the cabinet rails to allow a thicker slide profile to fit into a restricted space.
- Example: Chassis depths can be less than, equal to, or longer than the cabinet rail to rail distance.

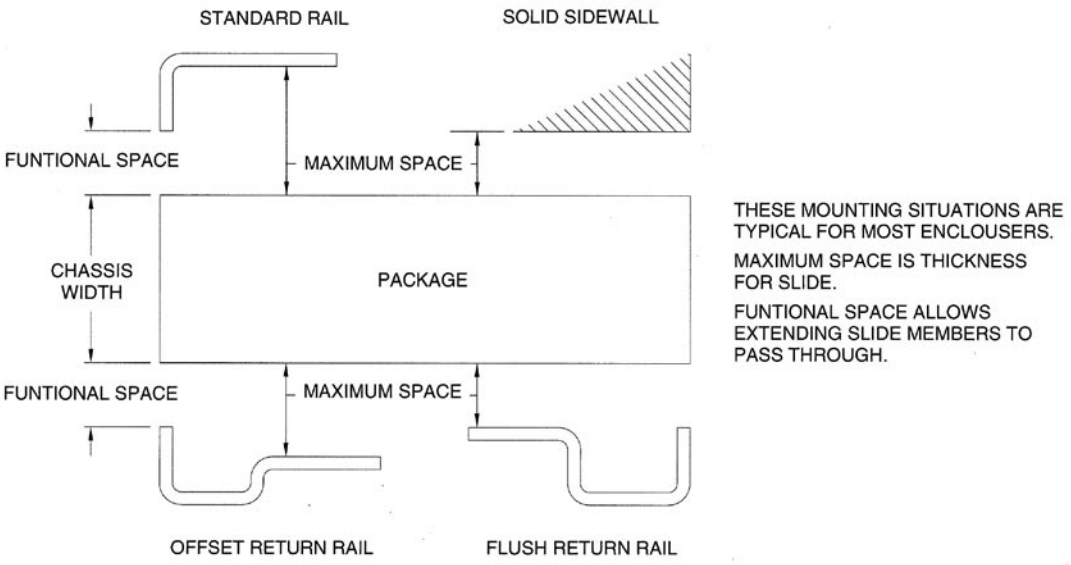
The following guidelines will assist in reviewing the total installation items

- The slide is allowed to be mounted in a space located between the structure and chassis (see the illustration outlining differences in a rack rail construction)
- The slide may or may not be utilizing rack brackets
- The slide and rack brackets can be mounted to the ahead or behind surface of the rack rail
- Tapped holes from the rack builder are provided on the cabinet rail, or through holes, or the end user will install an additional mounting component (JES Bar Nuts, Cage Nuts, Clips, etc) to aid in mounting the slides to cabinet rails.
- Slides must fit within a "package height" increment, reference chassis heights.
- Slide location onto a chassis will be determined by the selection and location of the rack brackets.
- Rack bracket selection may be selected based on where the slides mount to the chassis. In this case the chassis locates the slides, the slides position to the rack mounting points determines the type of slide bracket required.

All of the above parameters contribute to the proper location and final installation of the hardware. In addition, look for the following features during the design review stage:

Location:
Top View, top looking down

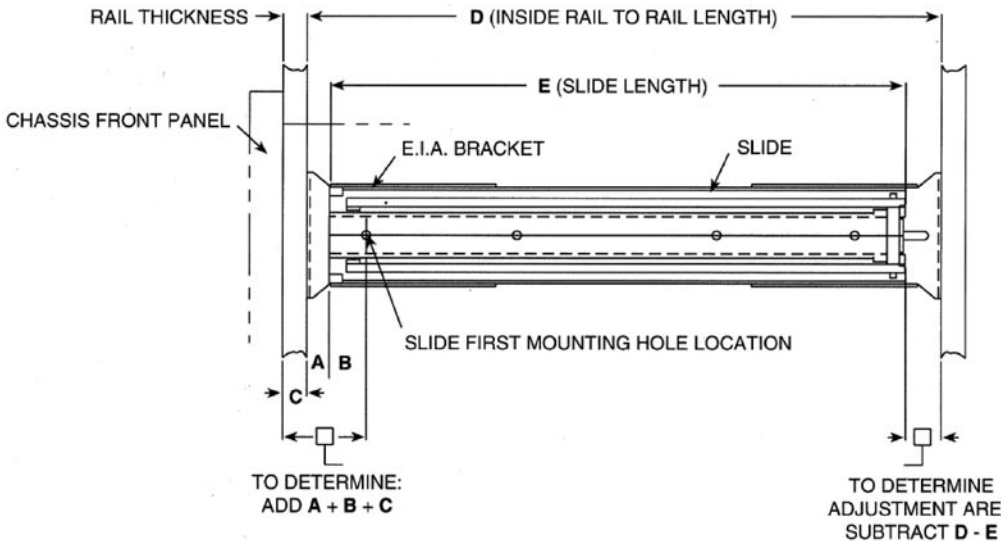
To Determine:
Type of cabinet rail construction to determine space available and slide thickness.



Location: Side View, looking into the side of the chassis in the full closed position

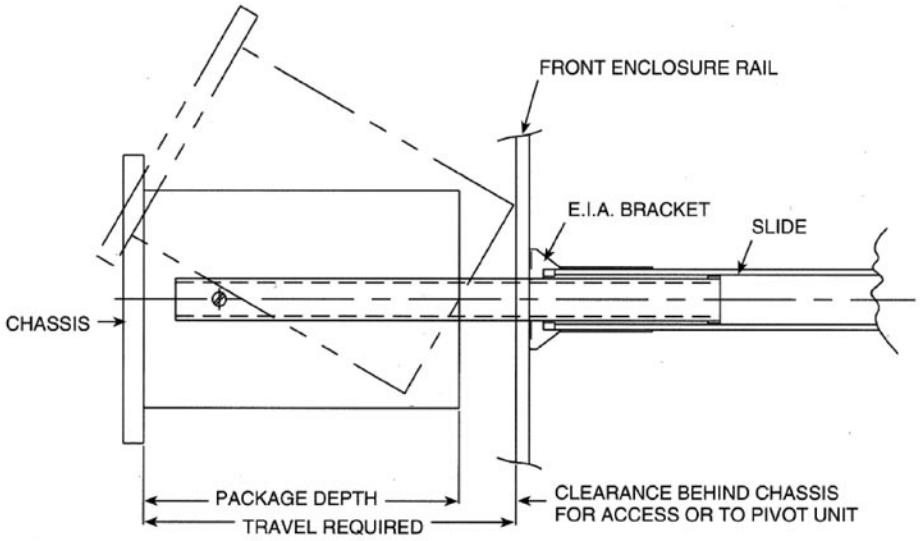
To Determine:
Locate the first chassis mounting hole of the slide

- Slide length and extending brackets
- Determine where to locate the front edge of the slide
- Determine if the front panel is flush to the front cabinet. Note: Rail face of "recessed brackets" will decrease length of slide
- Determine rack brackets in front of or behind cabinet rail



Location: Side View, with the chassis at its full open position.
To Determine:

- The required travel distance
- Accessibility to the back of the chassis to disconnect wiring
- If the chassis pivots, does it clear the front face of the stationary structure or chassis fronts, above or below.

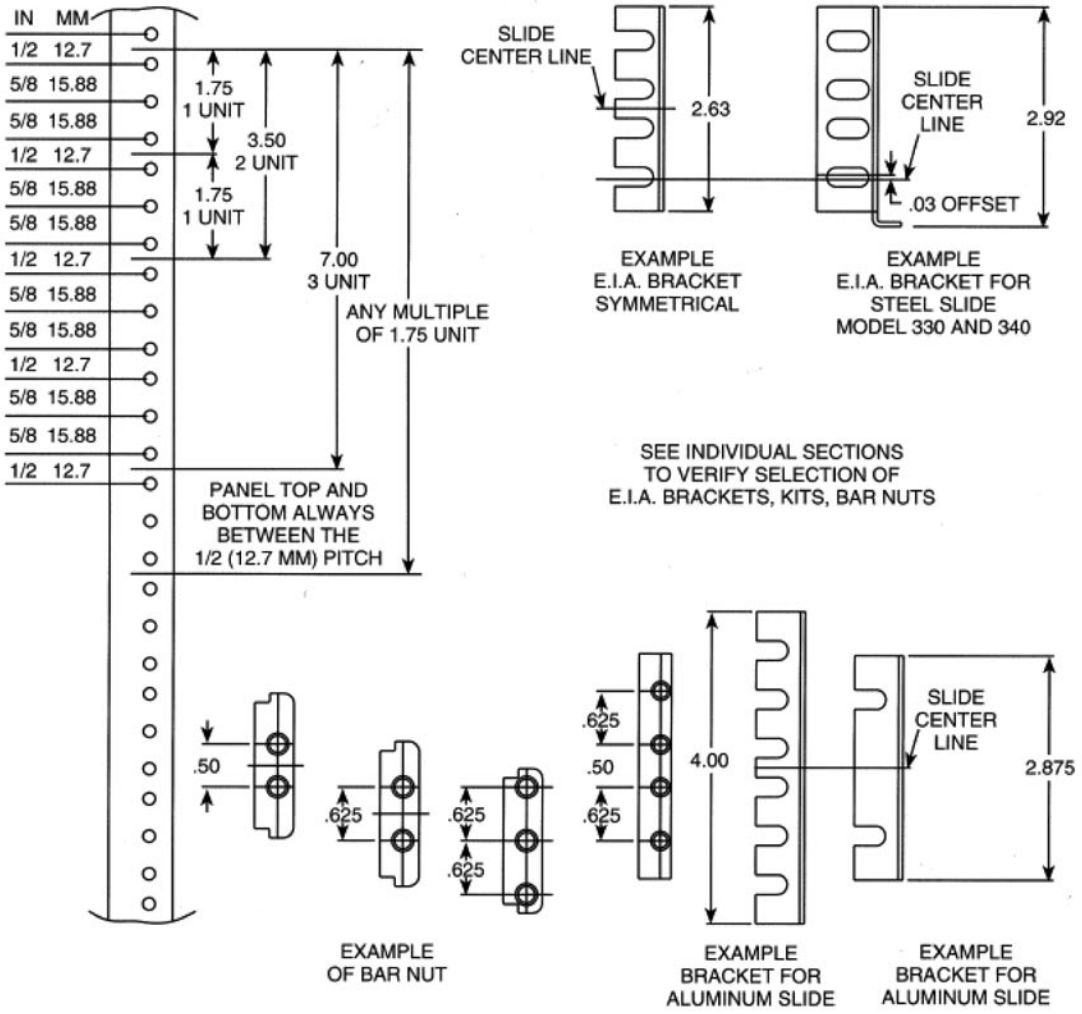


Location:

Front View, chassis and structure

To Determine:

- Vertical placement of slide corresponding to available rail mounting hole location and increment for attaching brackets
- Slide is within panel height
- Available rail hole locations to allow installation of other accessories
- Location on chassis where slide is to be located based on bracket location to rack rail



V. MOUNTING

Several types of mounting exists using JES products. Slide rails can be hard mounted directly to cabinet structure and drawer without use of adapter brackets, or bracket mounted using various adapters between the slide rails and cabinet structure, or tray mounted where the package is placed onto / into a pre-installed slide out platform, or use of angle brackets between both the stationary and moving slide members. Tool-less Mounting is often specified where installation uses no hardware, no tools are utilized, and is noted as a "snap-in installation".

In addition, many styles of mounting JES products can be suggested depending on slide model, or application demand, or reduction of installation time.

Typically a slide is fully extended and by depressing or unlocking a latch, the slide drawer member is withdrawn directly from the adjacent slide member. This allows a drawer / chassis to be removed for servicing outside of the cabinet. By reinstalling the slide members to the full closed position, the slide is ready for deployment outward.

Types of disconnect available:

Screw Hardware Disconnect
T-Section Disconnect
Roller Disconnect
Friction Disconnect
Ball Bearing Disconnect
D Pocket Disconnect
Tool-Less
Tray

Screw Hardware Disconnect

Majority of JES slide models accept screws or other related hardware. Careful attention to sizing of fasteners within the slide members is highly recommended. Screw heads, style of screw heads, length of thread projection, use of washers, hardware installation drive methods, inch vs. metric sizes, and clearances within (ball cages, locks, other hardware, stops) should be carefully reviewed during the slide process. Use of JES catalog, data sheets, customer drawings, and the website can be referenced. *Contact JES with specific questions if necessary.*

Items to consider;

- Head heights – example pan head slotted compared to pan head phillips.
- Countersink angles, inch sizes – example 82 degree compared to 100 degree
- Inch and Metric – metric countersinks are typical 90 degree.
- Washers – do not place washers under screw heads.
- Special hardware or factory installed hardware – JES can handle special requests for alternate fastener considerations. Many variations are possible.
- Alternate holes sizes
- Threaded fasteners (nuts, studs, standoffs, etc) installed
- Countersinks or counterbore holes
- Alternate locations for fasteners
- Alignment of access holes in slide members to provide faster installation time

T-Section

This type of slide separation consists of a member attached to chassis drawer and is captured within a slide member. The T-section alone does not extend outward and is contained within a slide member that does extend outward. JES slides that have this T-section disconnect are models 129, 130, 300, 350, 145, 150, 600, 138, 170, 128, 131, 60 Series, 80 Series, and 180 Series.

Roller
This type of slide consists of a slide member that is constructed using rollers as the motion method. Rollers typically contain ball bearings inside for smooth rolling load carrying ability. Once the slide is fully extended, this slide member with rollers can be removed from the companion slide member. Roller type slides can be found in JES models 110QD / 110QDP, 150QD, 120QD, 130QD, 600QD among others.

Friction
Friction slides are also known as "Solid Bearing" slides and have telescopic motion without the use of ball bearings or rollers. Slide members are placed within each other and provide great benefits in harsh environments, provide interchanging of slide drawer members, and reduce the number of components typically found within other products. JES models 510 and 515 are friction slides.

Ball Bearing
Slides with ball bearings captured within the slide members may have the drawer chassis member removed if the slide is equipped with a cage to contain the balls after the slide member is removed. Slides without ball cages (plastic strips, full packed balls, metal strips) cannot have a ball bearing disconnect. The key item when reinstalling this type of slide is to bring the ball cage to full forward position, carefully align the drawer chassis member with the balls, keep the slide member level and parallel while inserting, slowly insert until several balls are engaged, keep slide members parallel while moving slide member to the full closed position. Failure to bring the ball bearing cage forward and mis-alignment of slide members cause most installation issues. Slide model 370EZ has features to assist in keeping the ball cage forward and to provide excellent alignment features. Typical ball bearing disconnect slide models would be 330QD, 340QD, 370QD, 311LM, 320LM.

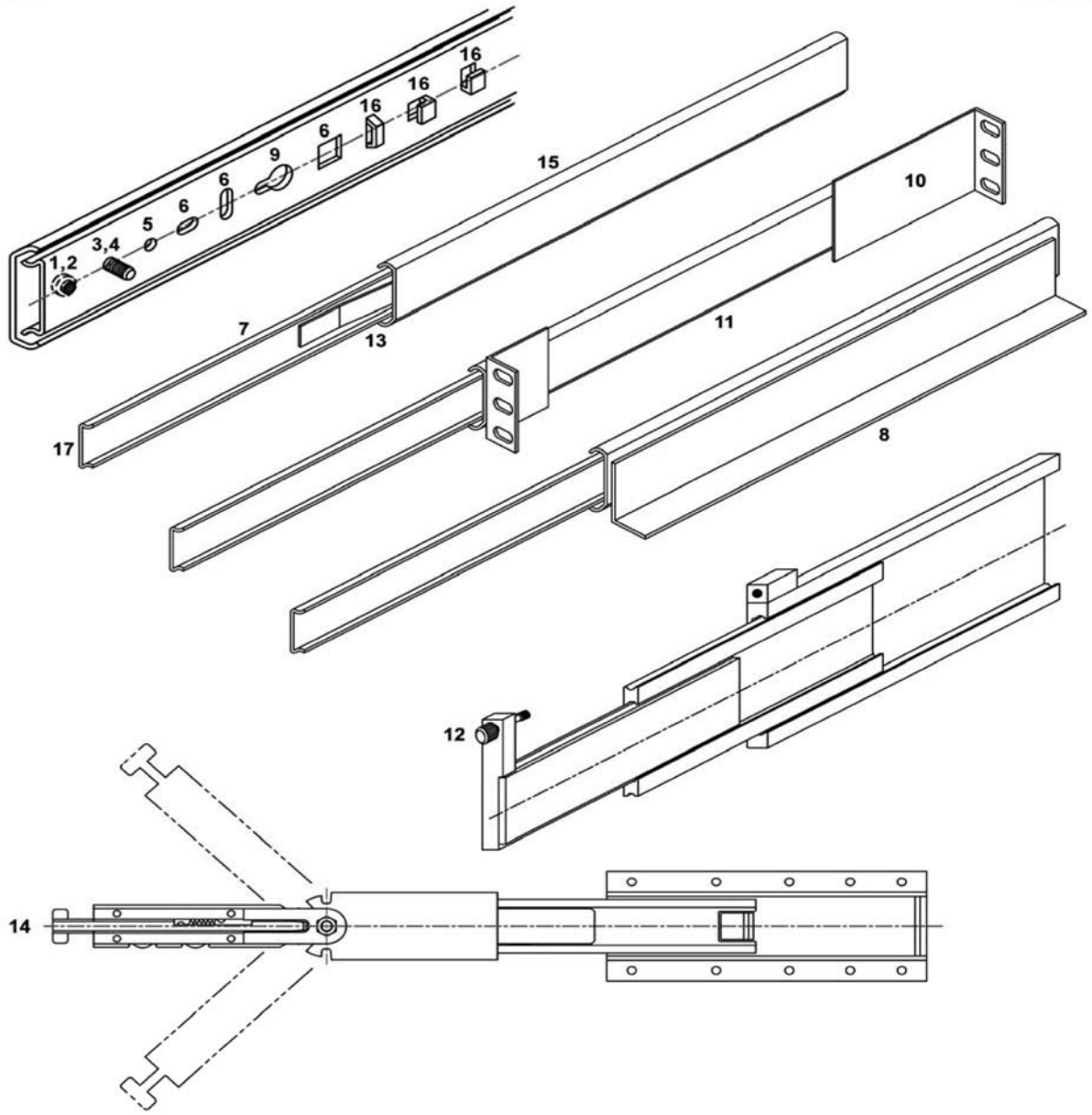
D Pocket
JES offers several slide models with formed shapes pressed outside of the slide thickness. These forms provide a method to accept sheet metal brackets / clips / tabs attached to the drawer. These formed shapes on the slide members allow a mechanical connection to each other without tools or added hardware. This allows fast installation and removal methods to be met. JES slides such as 370D or 310D have horizontal or vertical forms that accept accessory clips or tabs that can be punched directly from a drawer sidewall.

Tool-Less
In an effort to reduce the amount of installation time, customers have asked for complete pre-assembled slide products with mounting brackets attached with features that use little to no additional fasteners to install slide rails to the cabinet and / or the chassis to the slide rail. These features generally are on special request and may include "brackets that snap into the cabinet rails", "keyslots added to the slide inner member to accept a chassis equipped with mating pins / spools", "front bracket attached to slide rail outer member in a fixed position", "a rear bracket attached to give a pre-determine adjustment range", "generally in a single complete installation kit". JES will work with you to determine the best component strategy mix to bring a total installation method with your goals met.

Trays
JES designed pre-packaged tray assemblies offer a solution when intended equipment is too wide or too narrow to accept slide rails or space below a package is limited. Available in 1U and 2U form factor the JES Trays are constructed using side mount slide rails in various materials and movement (friction, ball bearing) with cabinet mounting bracket also pre-installed. Optional tool-less Cable Management Cable Carriers are available. Single packages or multiple packages can be placed on top or within the moving tray. Unique bolt patterns or straps with retaining pads will complete the installation. Consult the JES data pages for various tray models and features offered. JES Trays are rack mountable and provides the ability to pull equipment outward that normally would be hard mounted. The Trays may be installed as either a flat surface or as a pan that equipment is placed into.

VI. CUSTOM OPTIONS

To provide products that begin with standard configurations, JES provides you the opportunity to make changes to reduce installation time, provide value added features, enhance performance, or to reduce your purchased item bill of materials. These features illustrated give you an example of typical modifications and JES welcomes the opportunity to quote on your requirements.



1. Thread nuts in standard locations
2. Thread nuts in special locations
3. Thread studs in standard locations
4. Thread studs in special locations
5. Mounting hole locations different than standard locations
6. Mounting hole sizes
7. Change in travel
8. Added sheet metal
9. Longer rear brackets
10. Pre-assembled brackets to slide
11. Captive screw closed (specific slide models only)
12. Multiple lock locations
13. Alternate pivot angles (specific slide models only)
14. Cross reference to competitive slide models or specific design
15. Added lance tabs or pockets
16. Change in finish on adjacent members

VII. ACCESSORIES

Align-A-Load Pins
Door Stops
Cable Carriers
Bar Nuts
Tool-less Brackets
Trays
Straps
Pad
Velcro loops
Recessed Brackets

VIII.QUICK GLOSSARY

STEEL PART NUMBER MODIFIERS

D = Disconnect Pockets
DO = Detent Open
DC = Detent Closed
EZ = EZ-RAIL
HD = Heavy Duty
L = Lock Open
LC = Lock Open & Lock Closed
LD = Lock Open & Disconnect Pockets
LM = Linear Motion
TW = Two Way Travel
QD = Quick Disconnect
QDP = Quick Disconnect & Pivot
QDR = Quick Disconnect & Recessed Mounting
QDS = Quick Disconnect & Stop Open
SS = Stainless Steel

ALUMINUM PART NUMBER MODIFIERS

DR = Dyna Race
DC = Detent Closed
E = Executive Series
FB = Full Ball Bearing
L = Lock Open
PTC = Power Track Cable Carrier
SB = Shock Blocks
SC = Self Close
T = T-Section Disconnect
TS = T-Section Spring Open Device
PB = Polymer Balls and Black Anodize
QD = Quick Disconnect
QDA = Quick Disconnect & Adjustable Shock Block
QDP = Quick Disconnect & Pivot
QDT = Quick Disconnect & T-Section
U = Utility

IX.SHIPPING WEIGHT CHART

SERIES	WEIGHT LBS / INCH	SERIES	WEIGHT LBS / INCH
61	.175	300	.390
62	.143	300SB ****	.390
63	.184	300T	.390
65	.204	310	.125
67	.214	311	.083
68	.173	320	.076
81	.464	330	.056
82	.395	340	.112
93	.120	350	.265
98	.135	DR 351	.316
110 QD-1	.170	DR 353	.333
110 QDP-1*	.170	360	.087
110 QD-2**	.170	370	.131
110 QDP-2***	.170	372	.058
120 QD	.063	375QD	.085
120 QDP	.063	432	.278
125	.041	433	.278
128 V	.038	476	.163
128 QD	.038	477	.163
129	.037	510	.091
130	.075	510 SS	.100
130 QD	.078	515QD	.052
130 QT	.078	600 QD	.267
131 QD	.062	9000	.713
131 QDT	.061	CRS-25	1.75 TOTAL
138	.105	CRS-30	1.75 TOTAL
145	.122	PCR-350	.625 TOTAL
145 QDP	.122	T1U-100 TRAY	.80
150	.144	T1U-200 TRAY	.38
150 QD / QDP / QDA	.143	T2U-100 TRAY	.90
156	.172	T2U-200 TRAY	.45
170 QD	.055		
170 FB	.053		
170 T	.054		
175	.062		
181	.639		
182	.570		
250QD	.039		

* Add 0.062 lbs to total weight for QDP style
** Add 0.250 lbs to total weight for brackets and 0.062 lb for QDP style
*** Add 0.250 lbs to total weight for brackets
**** Add 1.125 lb to total weight for Shock Blocks