



DOCK PLANNING STANDARDS

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DOCK PLANNING STANDARDS

DESIGN THE SITE

Safety

The Material Transfer Zone (MTZ), which acts as a bridge between the truck and warehouse, is a dangerous place where safety must be the most important consideration.

Safety is often considered only after a serious accident has occurred on the dock. To ensure the safety of dock attendants and product, consider all potential problems that could occur.

Consider security. Select the correct dock leveler for your facility. For additional safety at the loading dock, consider adding a vehicle restraint to help prevent unexpected trailer creep during the loading and unloading process.

Perform regular maintenance on the equipment. Equipment should be cleaned, lubricated and checked by a technician for longer product life and better productivity. Plan for maintenance of bumpers, lights, communication packages, and other loading dock accessories. Inventory these items regularly as wheel chocks can be swept away by plows and light bulbs will need to be replaced. Perform regular checks on the seals and shelters to make sure they do not leak. Infiltrating air will raise energy usage and may result in uncomfortable working conditions.

Protect your investment. Choose a barrier gate that prevents loading equipment from colliding with and damaging the dock doors. A barrier gate acts as a protective barrier against costly door damage.

Integrated control panels are useful when combining dock and overhead doors with other loading equipment. If you have combined a dockleveler with a trailer restraint and an automatic door, interconnecting each into a single control panel is an effective way to create a safer work environment.

Select the appropriate dockleveler capacity based on both the gross load and frequency of material handling devices in use at the site for optimal durability and safety. Also consider push button controlled powered docklevelers for ergonomic and ease of operation reasons as they put less physical stress on the dock attendants. If non-powered mechanical docklevelers are already present, consider upgrading the dockleveler to a push button controlled powered dockleveler with a hydraulic conversion kit.

Location of the Loading Docks

Locate the loading docks to minimize forklift traffic inside the building. Rather than transporting individual pallets inside the building, unload trucks at multiple docks.

Shipping docks and receiving docks can be combined, with shipping and receiving together (Figure 1), or they can be separated, with shipping and receiving in different areas of the building (Figure 2).

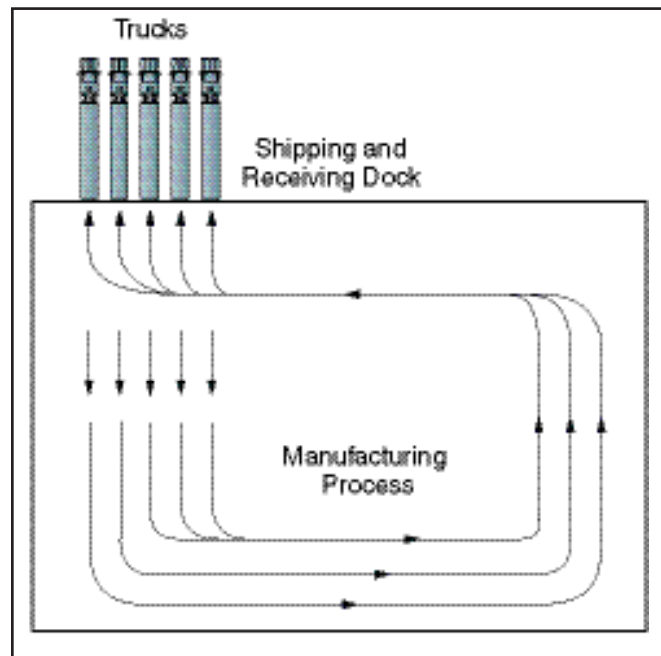


Figure 1

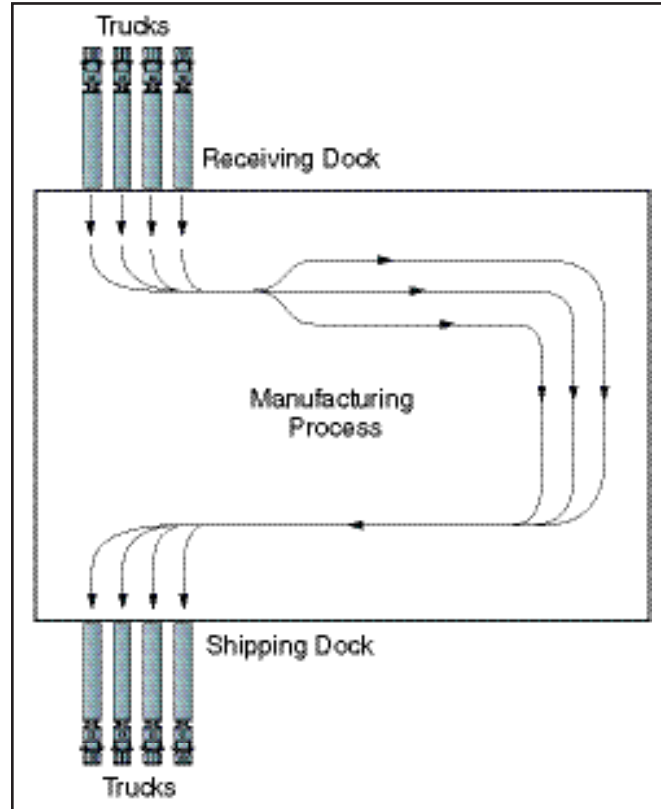


Figure 2

Choose the loading dock location based on the needs of the in-plant process. A combined dock works well in smaller buildings where shipping and receiving is infrequent. However, this design may increase in-plant traffic and travel distance.

A separated dock works well in buildings where the materials enter production in one part of the building and the production is completed elsewhere. This design minimizes transportation of materials inside the building.

Plan On-site Traffic Patterns

Design the traffic patterns around the building so that the truck driver is on the inside of each turn, for best control of the truck. Where traffic is on the right side of the road and the driver's seat is on the left side of the cab, truck movement around the building should be counterclockwise (Figure 3).

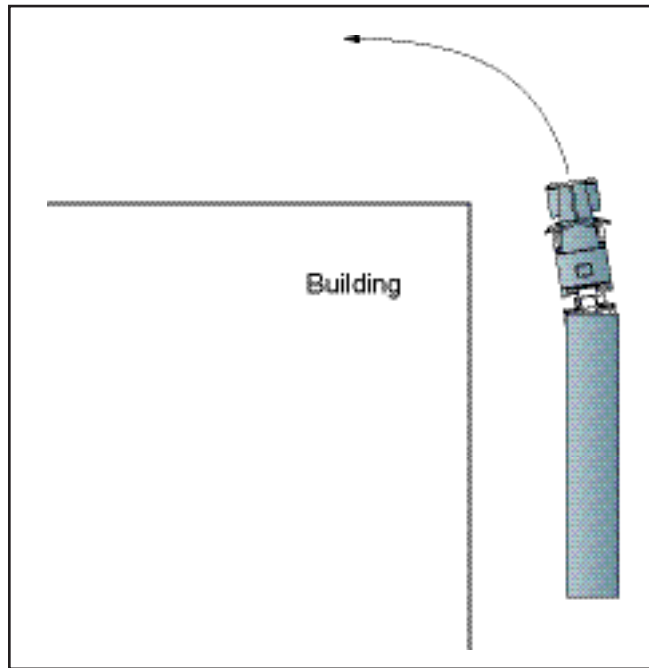


Figure 3

For efficient truck traffic, plan for the following:

- An entrance driveway that accommodates the turning radius of the longest truck expected and allows trucks to be driven forward onto the site, rather than backed up
- Right-angle turns onto the site that have a minimum inside radius of 26 ft and a minimum outside radius of 50 ft (Figure 4)
- One-way access roads that are 13 ft wide minimum (Figure 4)

- Two-way access roads that are 26 ft wide minimum (Figure 4)

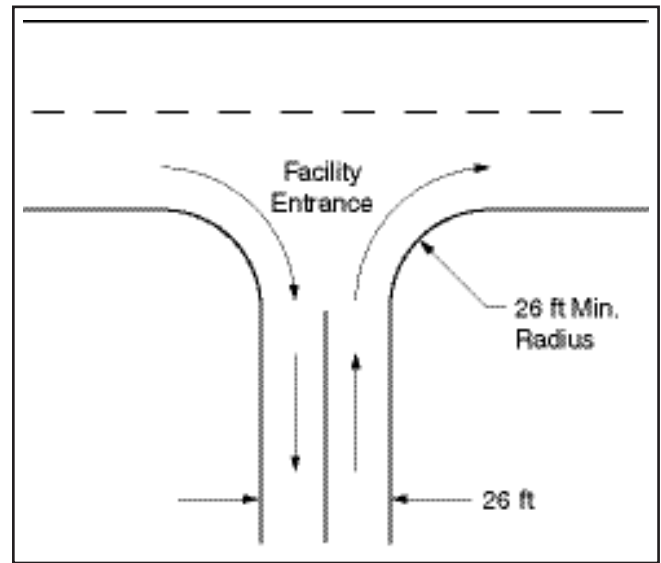


Figure 4

- Separate roads for employee traffic
- Truck waiting areas near the loading docks to accommodate all waiting trucks

Design the Apron Space

Apron space is the space between the loading platform and the nearest obstruction. Apron space includes the parking area where the truck parks at the dock and the maneuvering area, which is the area the truck uses to maneuver in and out of the parking area (Figure 5) and (Figure 6). The recommended center distance between dock positions is 12 ft minimum.

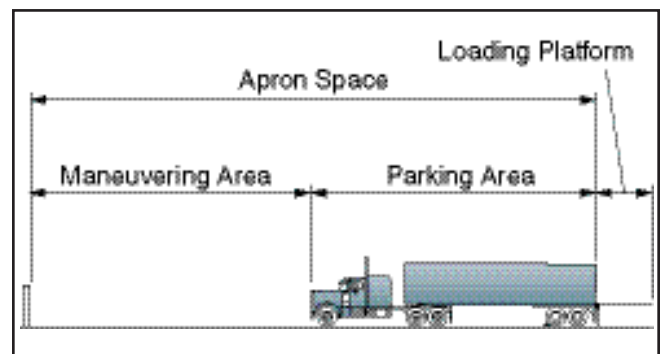


Figure 5

DOCK PLANNING STANDARDS

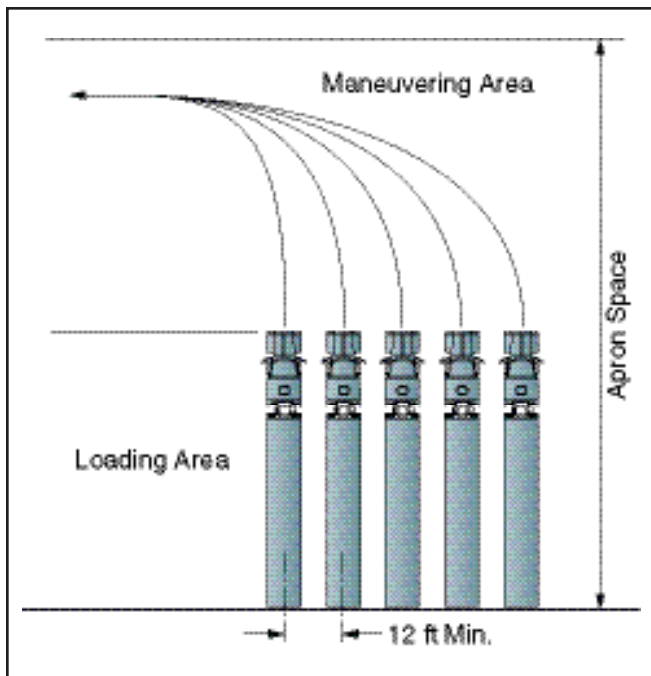


Figure 6

The minimum apron space required depends on the:

- Center line distances between the parked trucks at the dock
- Length of the trucks
- Steering geometry of the trucks

Less apron space is needed if the trailers will be parked with the tractors detached.

The minimum apron space for a typical 40 ft container rig is listed in Table 1.

Table 1

Center Distance	12 ft	13 ft	14 ft	16 ft	18 ft
Apron Space	120 ft	116 ft	113 ft	110 ft	108 ft

If expected trucks are longer than 40 ft, increase the apron space proportionately. For example, if the dock can accommodate 48 ft trailers, increase the apron space in the table by 20%. If the traffic pattern causes the driver to be on the outside of a turn, add 50 ft.

Always provide a concrete landing gear pad to support the trailer's landing gear when the trailer is detached (Figure 7). The landing gear is about 33 ft from the back of the trailer on a standard 40 ft container chassis. The gear is about 11 ft from the back of the trailer on a 20 ft chassis. The pad should be wide enough to accommodate all expected types of trailers. It is helpful for the pad to extend all the way back to the loading platform. The pad should be designed to support two point loads of 25,000 lb each, 6 ft apart, to support a fully loaded trailer.

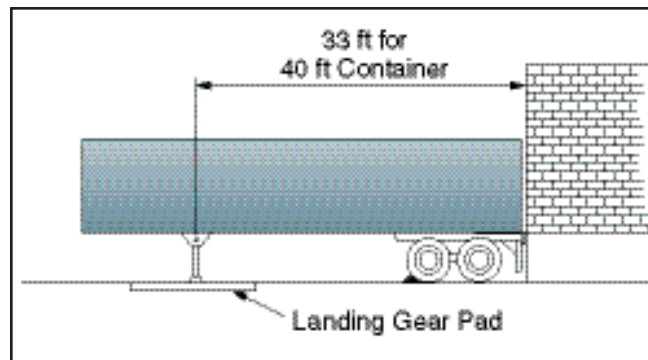


Figure 7

Dock Approach

The maximum grade percentage from the loading dock to the vehicle is determined by the height of the dock (discussed in detail in Set the Dock Height on page 10). When using electric powered loading equipment, the maximum grade percentage is 10%. For gas or diesel powered loading equipment the maximum grade percentage is 15%. If these grade percentages are exceeded, damage to handling equipment and load spillage may result.

If the plant floor is at grade, or has a low grade, recess the truck parking area so that the trailer bed will be at about the same height as the plant floor (Figure 8). The parking area will slope down toward the dock. This slope should be 6% or less. If heavy loads are expected, the slope should not exceed 5%. If necessary, slope may be increased to an absolute maximum of 10%, and only for light loads. Steep slopes may cause loads to topple.

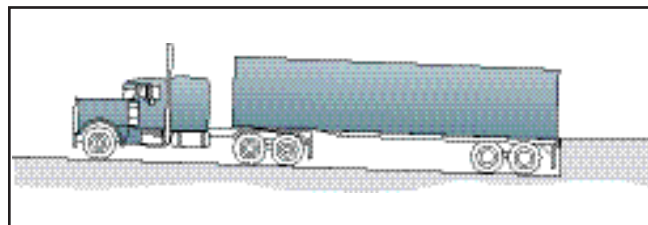


Figure 8

Always provide drainage for recessed parking areas. The area next to the building should slope slightly away from the building for a short distance of 1 to 3 ft (Figure 9). A short distance is preferable so that the position of the trailer's rear axle will have less of an effect on the height of the trailer bed at the dock.

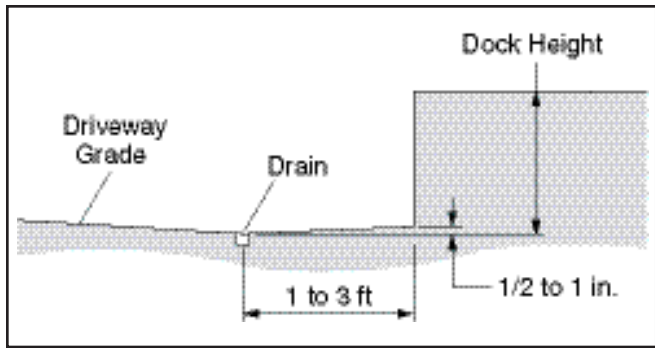


Figure 9

Drawbacks of a declined dock approach include the following:

- Difficult removal of snow
- Drainage of water
- Debris buildup
- High impact forces to the building wall and dock

When a declined dock approach is used, give special attention to other loading equipment. Dock seals must be tapered to match the angle of the trailer. If the seals are not tapered, sealing will not be effective and the seal may be damaged. Truck restraints must also be projected sufficiently to ensure proper operation and safety.

Preventing dock approach impact is easily done. For new constructions, project the dock sufficiently to prevent the top of the trailer from impacting the building wall. When reconstructing an existing facility where it is not possible to project the dock, project the bumpers by using bumper block outs.

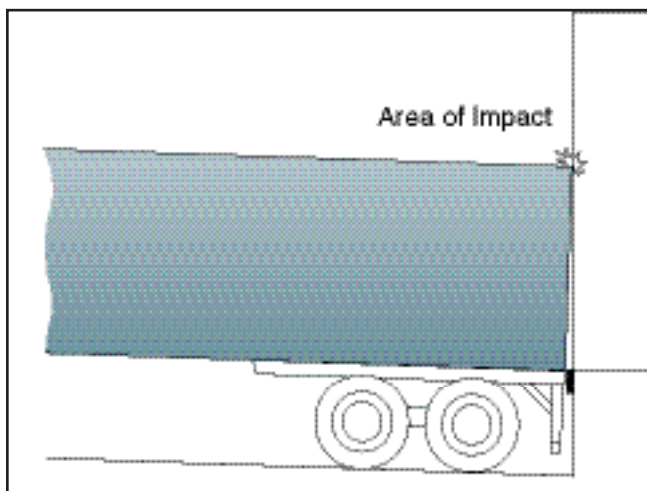


Figure 10

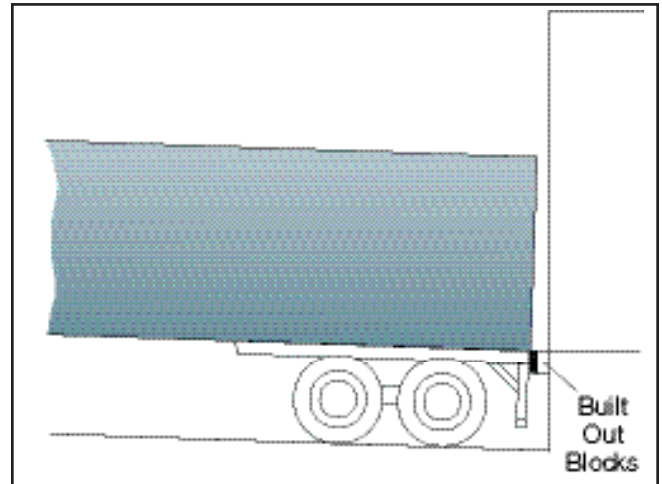


Figure 11

The required projection is calculated based on the grade percentage. To calculate the grade, determine the difference in height between the dock and a fixed point approximately 50 ft directly out from the dock. Grade equals the height difference divided by the length measured.

Example: 22 in. difference over 660 in. distance

$$22 \div 660 = 0.03$$

$$0.03 \times 100 = 3\% \text{ grade}$$

For proper dock operation, declined dock approaches should be no more than 10%.

Use Table 2 to determine the proper projection.

Table 2

Percent of Driveway Grade	0%	1%	2%	3%	4%	5%	10%
Pit Projection	0 in.	2 in.	3 in.	4 in.	5 in.	6 in.	12 in.

Select the Loading Dock Configuration

Important factors in dock configuration include:

- Security
- Traffic control
- Safety
- Worker comfort
- Space availability
- Climate

The two main types of dock configurations are the inside/outside dock and the open dock.

DOCK PLANNING STANDARDS

Inside/Outside Dock

In an inside/outside dock configuration, the loading platform is inside the building (Figure 12). With the proper door sealing system, an inside/outside dock provides excellent weather protection and security. The refrigerated dock is a common version of the inside/outside dock.

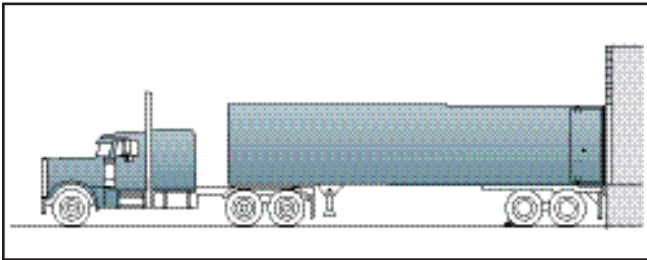


Figure 12

The inside/outside dock design may require the building wall to be set back from the edge of the dock (Figure 13), especially for docks with recessed parking areas. The setback works to:

- Protect the building wall from impact damage
- Protect projections, such as overhangs or signs
- Facilitate the installation of sealing systems
- Minimize injury hazards

Clearance is required between the truck and the building wall. Allow for at least 6 in. of clearance between the rear of the truck and the building wall, measured at 6 ft above the dock platform. Allow a 4 in. minimum clearance between the top of the trailer and the building wall (Figure 13).

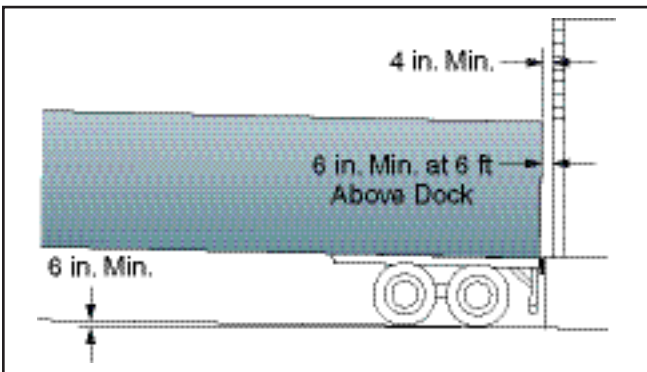


Figure 13

Refrigerated docks require a vestibule between the platform and refrigerated area. The vestibule creates an air lock between the outside and the refrigerated area (Figure 14), which will minimize the inflow of warm air. A carefully designed refrigerated dock will greatly reduce energy usage.

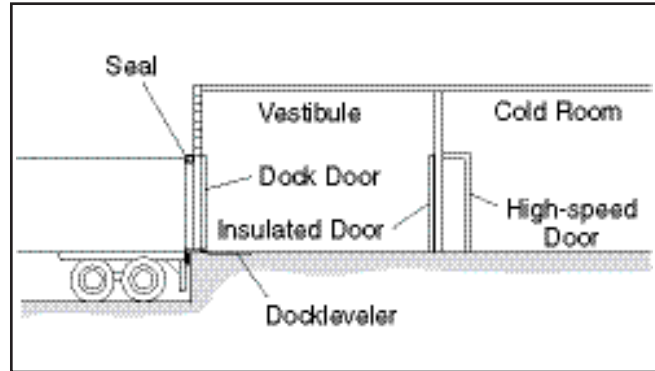


Figure 14

Open Dock

In an open dock configuration, the loading platform is outside the building (Figure 15). Open docks are common in temperate climates. Adding a canopy over the loading platform and curtains around the dock perimeter (Figure 16) will provide some protection. When placing canopies over docks on sloped approaches, the height of the canopy must accommodate the height of the sloped truck.

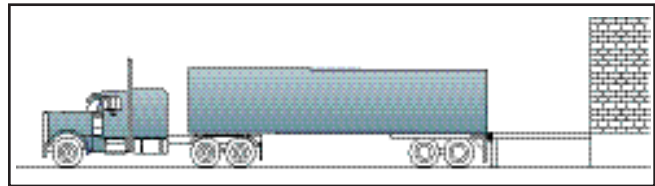


Figure 15

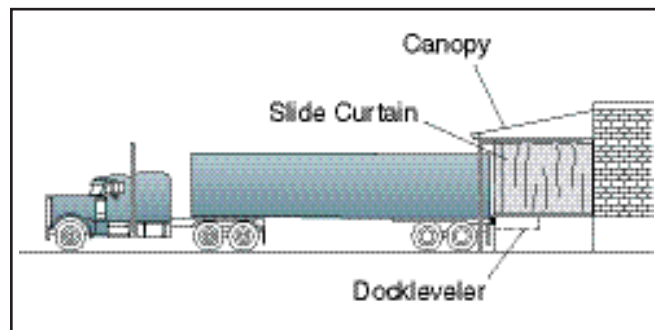


Figure 16

An open dock requires sufficient maneuvering space for forklifts between building wall and the docklevelers. Safety barriers such as concrete posts or chains are necessary to reduce the risk of forklifts driving off the dock (Figure 17).

DOCK PLANNING STANDARDS

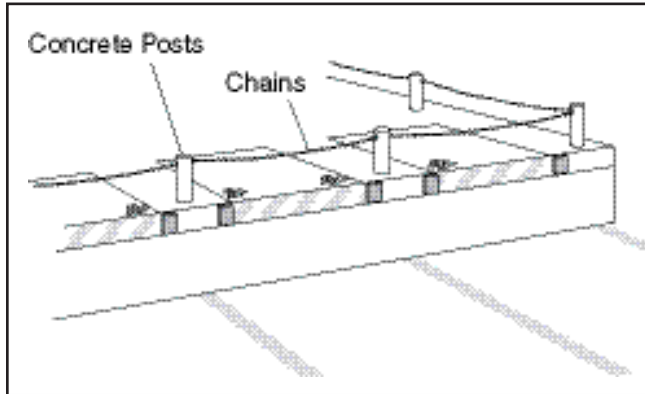


Figure 17

Additional Dock Configurations

Building and property limitations may require other types of loading docks.

Saw-Tooth Dock

A saw-tooth design requires less apron space than an inside/outside or open dock (Figure 18).

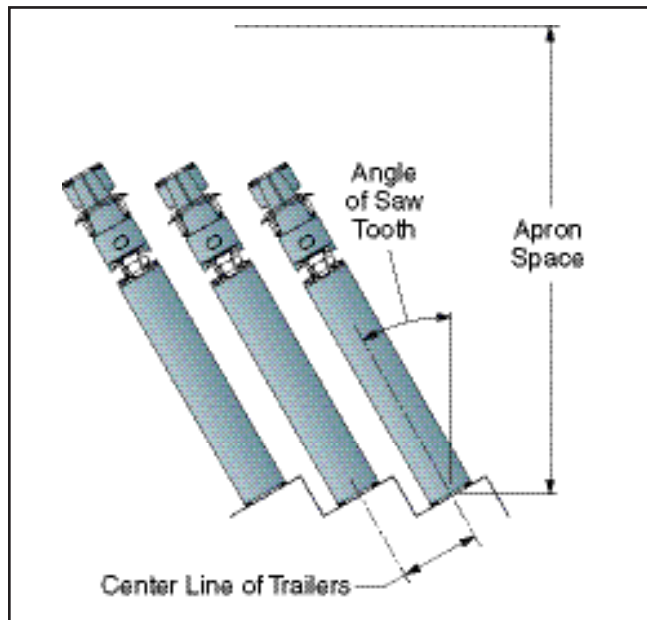


Figure 18

Table 3 shows the required amount of apron space as dependent on center distance and saw tooth angle. The table is based on a 53 ft trailer with the tractor attached during loading.

Table 3

Center Distance	Saw-Tooth Angle			
	15°	30°	45°	60°
12 ft	121 ft	106 ft	88 ft	67 ft
13 ft	119 ft	105 ft	86 ft	66 ft
14 ft	118 ft	103 ft	85 ft	65 ft
15 ft	116 ft	102 ft	84 ft	64 ft
16 ft	114 ft	101 ft	83 ft	63 ft
17 ft	113 ft	99 ft	82 ft	63 ft
18 ft	112 ft	98 ft	81 ft	62 ft
19 ft	111 ft	97 ft	80 ft	62 ft

If smaller trucks will use the dock, decrease apron space proportionately. If tractors will be detached from the trailers, decrease the required apron space shown in the table by 24 ft, 22 ft, 18 ft, and 14 ft for 15°, 30°, 45°, and 60° angles respectively.

Example: If the center distance between the dock positions is 17 ft and the saw tooth angle is 30°, the required apron space is 99 ft minus 22 ft, or 77 ft.

Pier Dock

If dock positions cannot be placed along the building perimeter, a loading dock pier can be used (Figure 19).

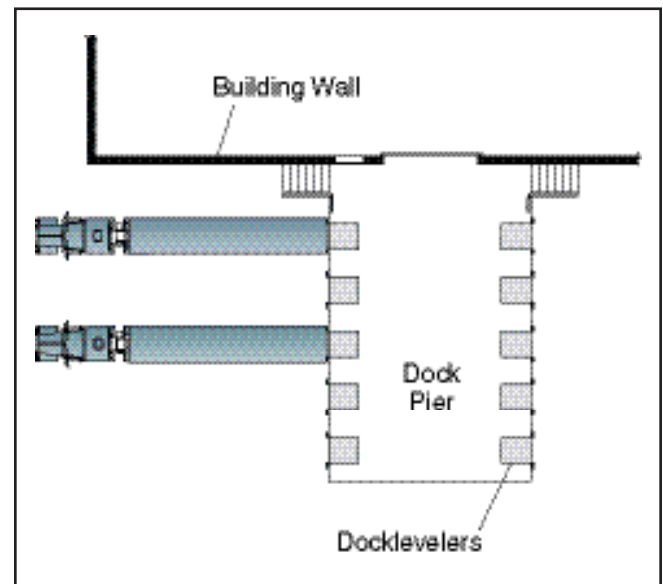


Figure 19

DOCK PLANNING STANDARDS

Self-Standing Dock

If space inside the building does not permit a loading platform, a self-standing dock structure can be added outside the building (Figure 20).

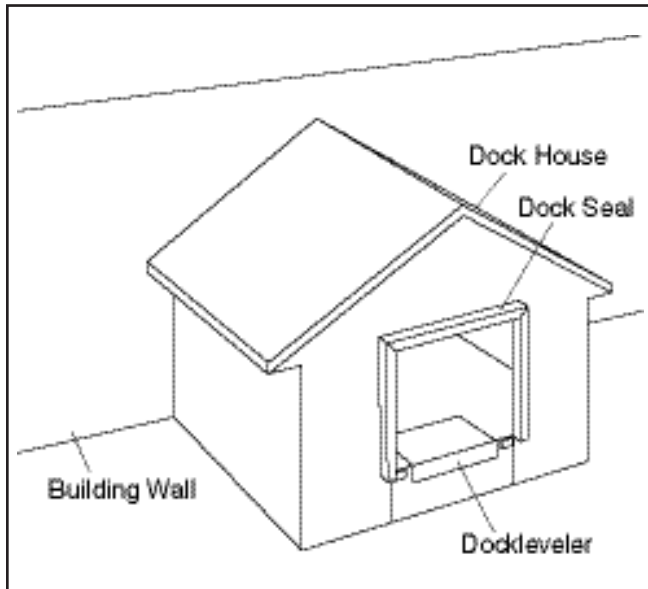


Figure 20

Flush Dock

The face of a flush dock is flush with the buildings outside wall. To prevent wall damage and protect dock seals on a level approach, project the foundation or bumper 4 in. beyond the outside wall. If the building wall extends beyond the face of the dock, add additional foundation or bumper projection.

Enclosed Dock

Use an enclosed dock when climate control, freight protection, security, and overhead lift are required. Enclosed docks involve high construction expenses and consideration of vehicle exhaust pollution.

Depressed Dock

Use a depressed dock with a sloped approach where the facility construction does not allow basements and floors at the dock level. Plan the driveway grade cautiously. To avoid the top of the truck hitting the building wall, cargo toppling, or pull-away traction problems resulting from ice or snow, do not allow the grade to exceed 10%.

Determine the Number of Dock Positions

To determine the required number of dock positions, obtain:

- Number of trucks to be served
- Average time to load or unload each truck
- Timing of each truck arrival and departure

Consider peak periods of use when determining the number of dock positions. Peak periods of use can be daily, weekly, monthly, seasonally or yearly.

NOTE: Consider providing one dock position for trash collection.

Use the following formula to determine the number of required dock positions. For the example, we will use 36 trucks served in an 8-hour period (4.5 trucks per hour) with an average turnaround time of 45 minutes (0.75 hours) per truck. Turnaround time includes parking, loading and leaving.

$$\text{Number of Trucks per Hour} \times \text{Turnaround Time per Truck} = \text{Number of Dock Positions}$$

$$4.5 \text{ Trucks per Hour} \times 0.75 \text{ Hours} = 3.375 \text{ Dock Positions}$$

In the example, 3.375 dock positions were calculated; therefore, 4 dock positions are required.

If all the trucks arrive within a peak period of 4 hours, 6.75, or 7, dock positions would be required.

NOTE: If the number of required dock positions cannot be provided, consider providing a truck waiting area.

DESIGN THE LOADING DOCK

To design efficient loading docks, determine the:

- Types and numbers of trucks that will use the docks
- Dimensions of the loading docks and doors
- Characteristics of the facility processes

Then, consider the dock height, loading bay width, and dimensions and layout of the building interior.

Truck Specifications

Determine the types and dimensions of the trucks that will use the docks. List each truck's length, width, height and bed height.

DOCK PLANNING STANDARDS

See Figure 21 through Figure 26 for the dimensions of common truck and trailer designs. Note that weight of freight can cause a variance of up to 6 in. in trailer and bed heights. The dimensions may also be affected by air suspension systems. Use Figure 21 through Figure 26 for preliminary design, but obtain actual truck dimensions before making final design decisions.

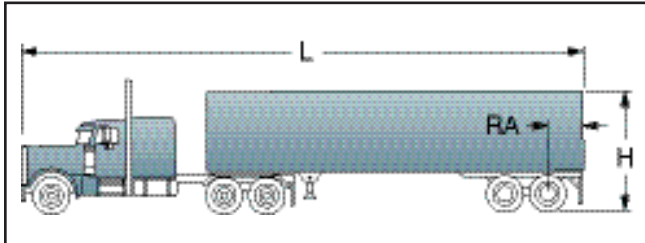


Figure 21: Container Truck

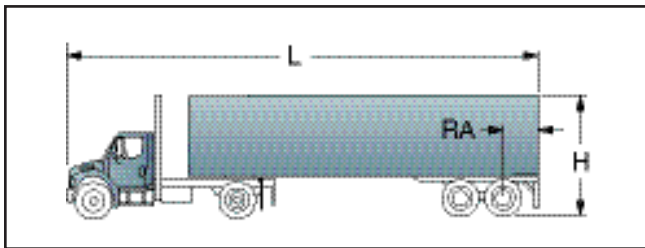


Figure 22: Semitrailer, City

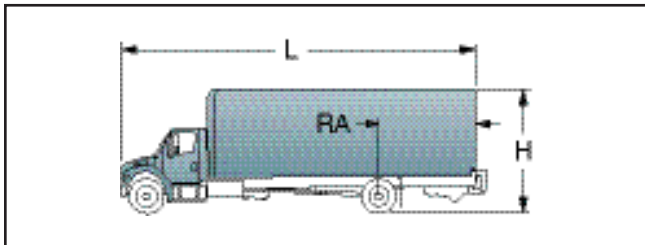


Figure 23: Straight Truck

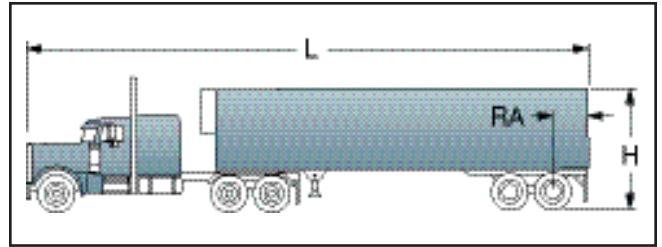


Figure 24: Refrigerated Truck

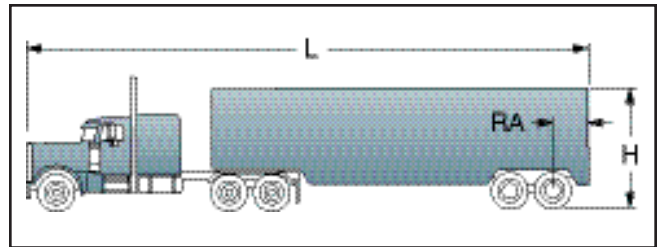


Figure 25: Semitrailer, Road

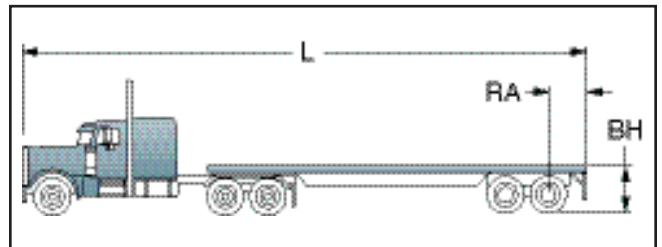


Figure 26: Flatbed Truck

Table 4

Type of Vehicle	Truck Dimensions			
	Overall Length, L	Bed Height, BH	Overall Height, H	Overall Width, W
Container	55'-70'	56"-62"	12'-13'6"	96"
Semitrailer, City	30'-35'	44"-48"	11'-13'	96"
Straight Truck	15'-35'	36"-48"	11'-12'	96"
Refrigerated	40'-55'	50"-60"	12'-13'6"	96"-102"
Semitrailer, Road	55'-70'	48"-52"	12'-13'6"	96"-102"
Flatbed	55'-70'	48"-60"	-	96"-102"

DOCK PLANNING STANDARDS

Sea Containers

Sea containers and refrigerated containers can have trailers with heights of up to 62 in. Facilities that must service sea containers may also frequently service low-bed trucks. The height difference can be from 30 to 62 in. Consider designing docks of various heights or installing equipment such as hydraulic truck levelers or elevating docks. Typical container sizes are listed in Table 5.

Table 5

Equipment	Interior Dimensions	Door Opening
45 ft High Cube Container	L: 44' 6-1/2" W: 7' 8-1/4" H: 8' 10"	W: 7' 8" H: 8' 5-3/4"
40 ft High Cube Container	L: 39' 6-1/2" W: 7' 8-1/4" H: 8' 9-1/2"	W: 7' 8" H: 8' 5-3/4"
40 ft Dry Freight Container	L: 39' 6-1/2" W: 7' 8" H: 7' 9-1/2"	W: 7' 6" H: 7' 5-1/2"
20 ft Dry Freight Container	L: 19' 5" W: 7' 8" H: 7' 9-1/2"	W: 7' 6" H: 7' 5-1/2"
20 ft Open Top Container	L: 19' 5" W: 7' 8" H: 7' 6"	W: 7' 6" H: 7' 4-1/2"
40 ft Open Top Container	L: 39' 6" W: 7' 8" H: 7' 5-1/4"	W: 7' 5-1/2" H: 7' 5-1/4"
45 ft High Cube Reefer Container	L: 42' 11-13/16" W: 7' 6-5/16" H: 8' 2-3/4"	W: 8' 1-1/8" H: 7' 6-1/8"
40 ft High Cube Reefer Container	L: 37' 11" W: 7' 6" H: 8' 2"	W: 7' 6" H: 8' 1/2"
40 ft Reefer Container	L: 36' 9" W: 7' 4" H: 7' 2"	W: 7' 3" H: 7' 2"
20 ft Flat Rack Container	L: 18' 8-1/2" W: 8' H: 7' 7-1/2"	-
40 ft Flat Rack Container	L: 35' 9-1/4" W: 7' 6" H: 6' 10-1/2"	-
40 ft Artifical Tweendeck	L: 39' 7" W: 7' 3-1/4"	-
40 ft Collapsible Flat Rack	L: 39' 7-1/2" W: 6' 11-1/2" H: 6' 8-1/4"	-

Underride Protection Bars

The underride protection bar, called the Rear Impact Guard (RIG) bar, is mounted at the rear of the trailer (Figure 27). Restraint devices attach to the RIG bar to prevent the truck from being driven away before loading or unloading is complete.

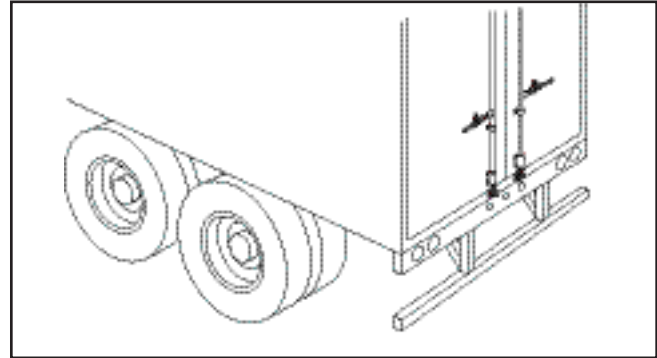


Figure 27

Set the Dock Height

The most important characteristic of the loading dock design is the height of the dock. The dock height must match the height of the docking trucks. The height difference between the dock and the trailer bed should be as small as possible. The dock leveler bridges some height difference, but the incline should not be too steep. A steep incline can cause insufficient forklift underclearance, and it increases maintenance demands on the equipment.

To determine the dock height, find the midpoint of the bed heights of the expected trucks. Most trucks require a dock height of between 46 and 52 in.

See Table 6 for dock heights that create level docks for common types of trucks.

Table 6

Type of Truck	Dock Height
Container	55 in.
Semitrailer	48 in.
Straight Truck	44 in.
Refrigerated	52 in.
Flatbed	52 in.

NOTE: Truck beds will rise and lower during loading and unloading.

DOCK PLANNING STANDARDS

If the driveway is recessed, the dock height should be lower (Figure 28). A recessed parking area may lower the truck bed height by 6 to 10 in.

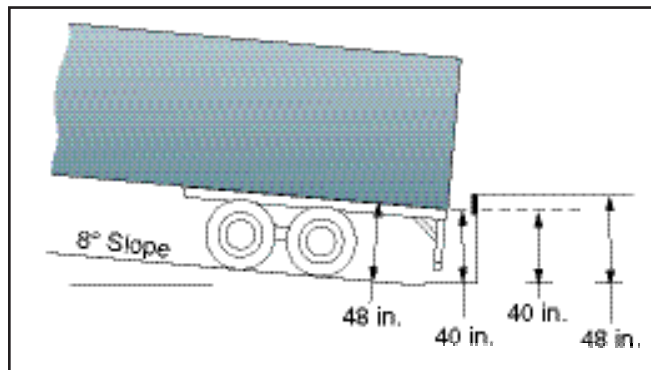
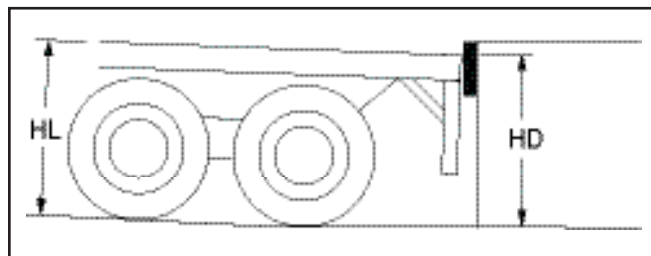


Figure 28

This is particularly important when a driveway approach declines to a level surface in front of the dock, and when the truck or trailer has its wheels positioned well forward of the rear of the vehicle.

For example, in Figure 29, the drive approach is an 8% decline leading to a level concrete pad at the dock. A typical trailer bed, which is at a 48 in. height (HL) from the decline drive, will be at approximately 40 in. (HD) at the dock. Therefore, if the dock is intended to service trailers with 48 in. bed height, the dock height should be at 40 in.



HL = Bed height when level

HD = Bed height at dock

Figure 29

Design the dock height based on the specific parameters of driveway slope, geometry of the recessed parking area, and bed heights of the expected trucks unique to your building.

If the expected trucks have very high or low bed heights, provide dedicated dock positions with special driveways and equipment, such as an elevating dock (Figure 30).

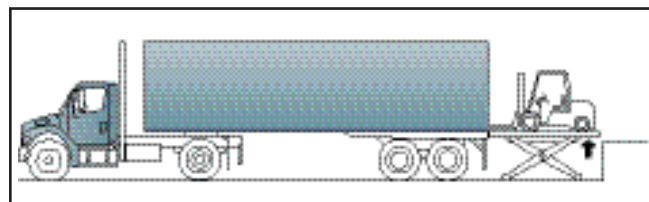


Figure 30

For open docks, where the trailer doors are commonly opened after the trailer is parked, design a dock height low enough for the door clamp hooks to clear the dock as they are opened (Figure 31). 51 in. is a common dock height for this situation. If the driveway is recessed, lower the dock height further since the doors swing down slightly as they are opened. Lower the dock by about 1 in. for each 1% of recessed driveway grade.

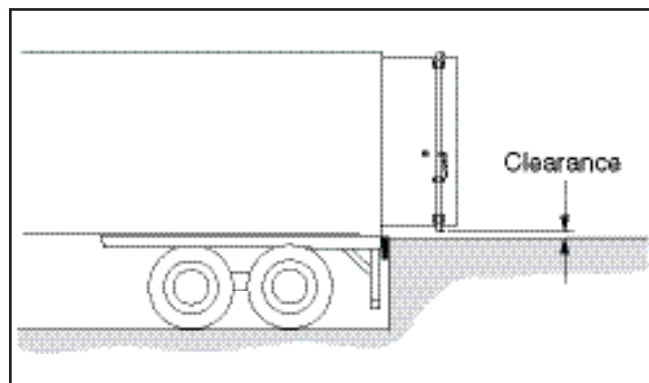


Figure 31

Set the Loading Bay Widths

Each truck bay should be at least 12 ft wide to provide enough space for the trailers, which are 8'0" to 8'6" wide, to back squarely to the dock. To reduce congestion, design 14 ft wide bays. If swinging trailer doors will be opening or closing at the dock, the center distance should be at least 14 ft (Figure 32).

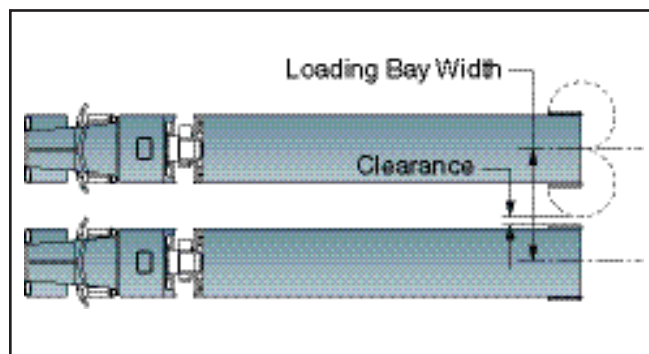


Figure 32

DOCK PLANNING STANDARDS

Select Dock Doors

A dock door is required for inside/outside loading docks. The most commonly installed doors are manually operated and are either an overhead sectional door or a roller door. A sectional door is smoother and quieter than a roller door because of rollers that run inside of tracks. Other advantages of a sectional door are:

- They are thicker and stronger than a roller door
- They can be insulated

NOTE: Install door track protectors to protect the door tracks.

Common dock door dimensions are 8'0" in width with 8 ft, 9 ft or 10 ft heights. Consider extending the door 13 ft to 14 ft above the driveway and a minimum of 8'6" wide if full access to the truck's interior is required. Dock doors dimensions are determined by:

- Type of trucks being serviced
- Sealing system
- Environmental concerns

Determine Door Sizes

NOTE: The maximum trailer size limits are 8'6" wide x 13'6" high (varies by state). With a special permit, a flatbed may exceed the maximum width.

Widths

Determine the door sizes along with selecting the sealing system. Keep doors as small as possible – usually narrower than 8 ft – in temperature-controlled docks, where energy is lost through doors. Space the doors 12 ft apart to accommodate most trucks, sealing systems, and communication light systems.

Dock doors narrower than 8'0" are commonly installed with compressed foam dock seals for temperature control of refrigerated operations.

9 ft wide doors should be used to service 8'6" wide trailers. Side-by-side palletizing is simplified, potential for product damage is reduced, and oversized loads can be serviced.

The doors should be between 8'6" and 9'0" wide to allow for trucks to park off-center. A 10 ft wide door can be designed for oversized loads. Note that wider doors require more building space, which may not be available.

NOTE: Compression of seals may reduce the effective width and full access to trailer.

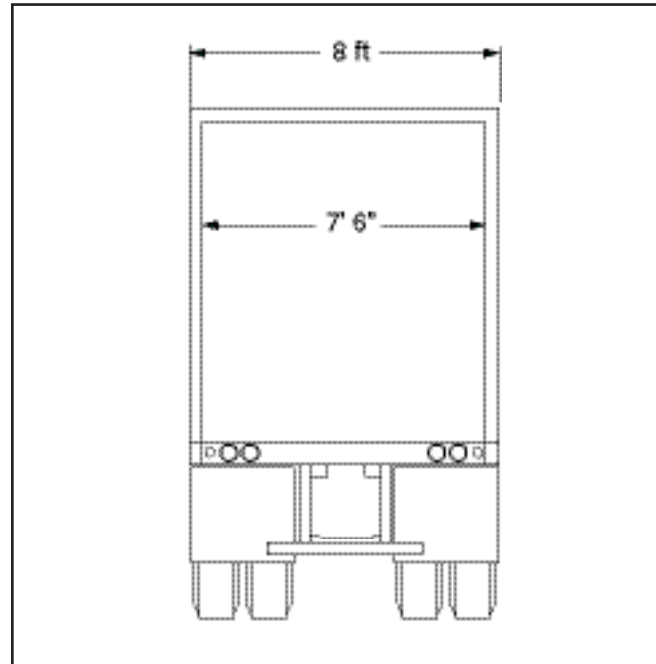


Figure 33

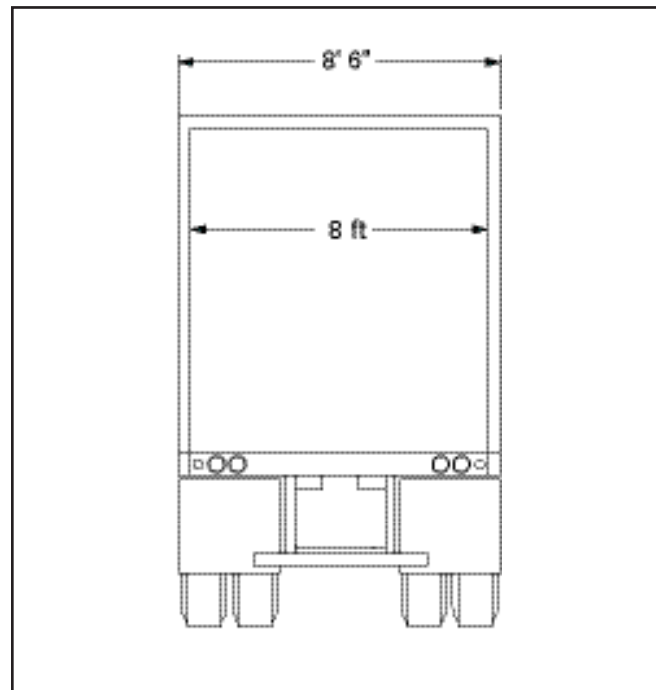


Figure 34

Heights

Doors are typically 8 ft, 9 ft, or 10 ft high. 8 ft high doors can accommodate many loading and unloading operations where height is not critical, but cannot accommodate floor-to-ceiling loading (Figure 35). 8 ft high doors do not maximize the usage of the available height in the trailer, which leads to higher freight costs.

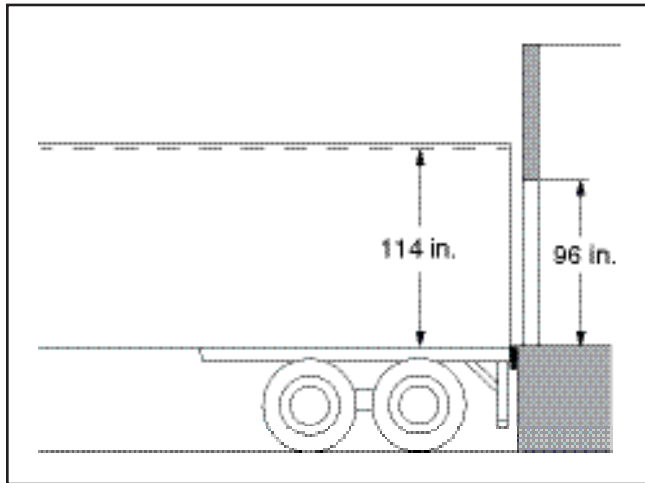


Figure 35

A 9 ft high door allows for improved floor-to-ceiling loading (Figure 36) as a higher load can pass through the door. Fuller, tighter loading makes for better space utilization with a decreased risk of product damage due to door impact. The 9 ft height suits a wide range of applications. However, in trailers with lower height there may be a gap between the trailer and the top of the door. The gap can be closed off with a dock seal or shelter.

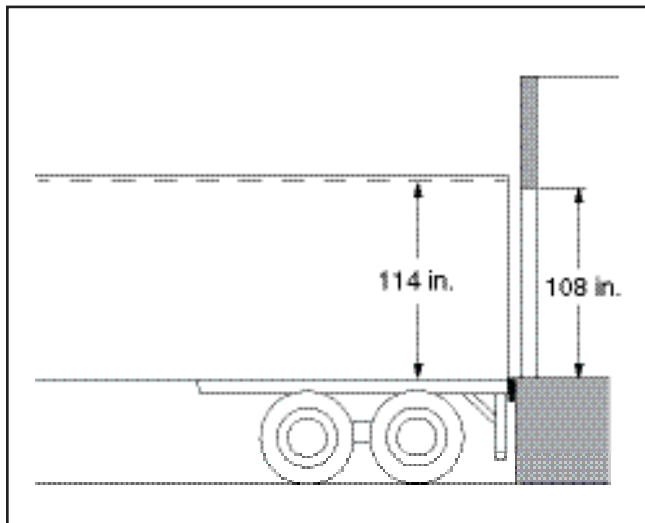


Figure 36

A 10 ft high door services the full range of loading and unloading operations (Figure 37). 10 ft high doors accommodate trailers of heights up to and including high cube trailers and high cube sea containers.

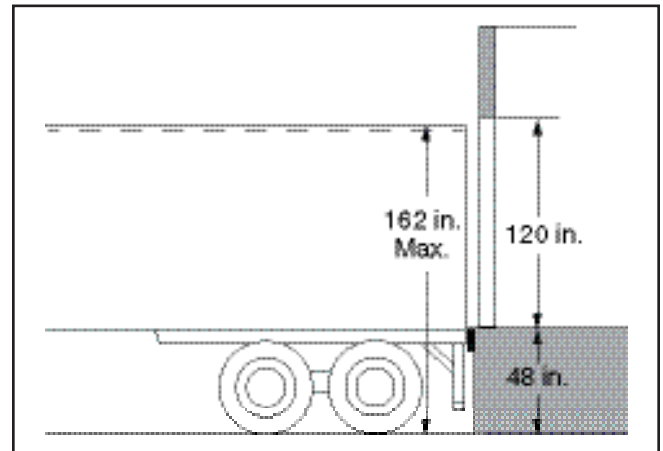


Figure 37

To provide full access to the entire width and height of a full-size trailer, the dock door should extend the full height of the trailer (13 to 14 ft) above the parking area.

Design the Dock Interior

Design a forklift traffic aisle, 15 ft wide minimum, behind the loading ramps. This aisle provides better visibility, allows forklifts to maneuver behind the trailers, and permits two-way traffic parallel to the dock face. Aisles that are 15 ft or wider allow forklift drivers to drive straight onto the docklevelers, which reduces injury hazards and equipment stress (Figure 38).

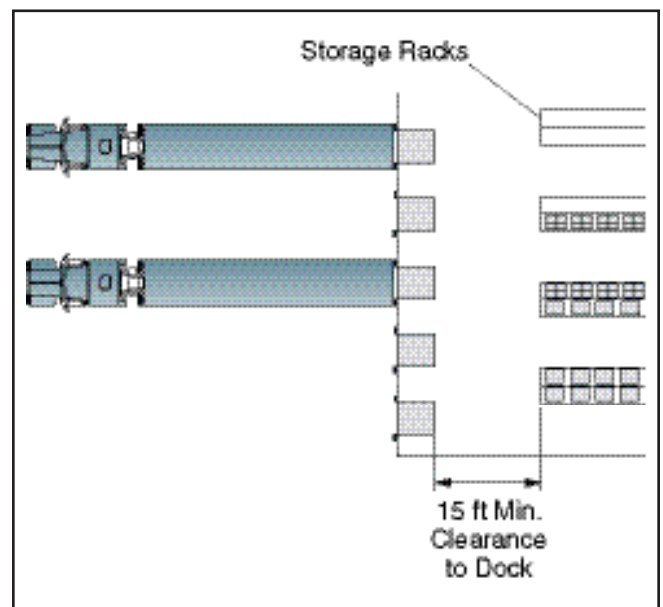


Figure 38

DOCK PLANNING STANDARDS

Put restrictions into place that deter forklift drivers from driving parallel to the dock face (Figure 39), which can result in collisions with forklifts backing out of trailers.

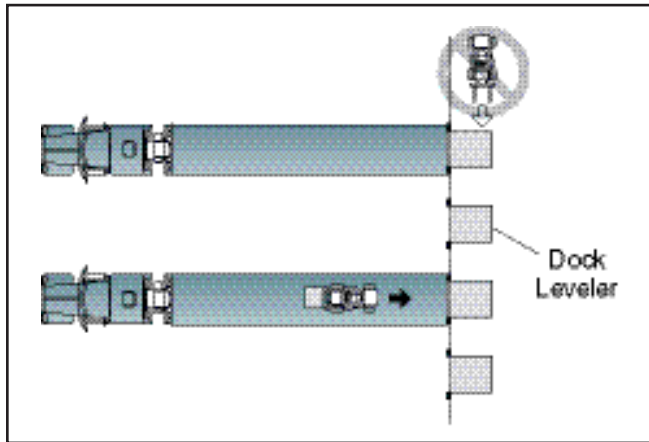


Figure 39

DOCKLEVELERS

A dockleveler forms a ramp to bridge the distance between the dock and truck. It must be able to compensate for the up-and-down movement of the trailer during loading and unloading. A dockleveler must support extremely heavy loads, service a wide range of truck heights, and compensate for tilted trucks. A dockleveler includes a ramp and a lip. The ramp is hinged at along its rear edge, and the lip is hinged at the front of the ramp. To use a dockleveler, raise the ramp. The lip will swing out. With the lip extended, lower the ramp until the lip rests on the truck.

The two common types of docklevelers are recessed and edge-of-dock. A recessed dockleveler is installed in a pit formed in the loading platform and is generally a minimum of 6 ft long (Figure 40). An edge-of-dock dockleveler is normally installed on the face curb of the loading platform (Figure 41).

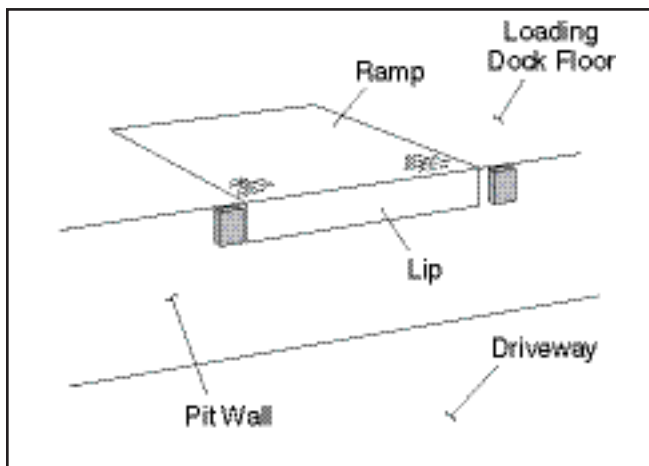


Figure 40

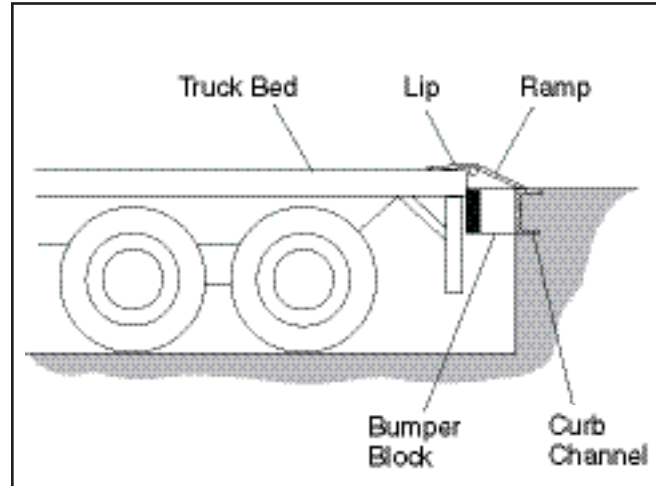


Figure 41

Recessed Docklevelers

The recessed, or pit-style (Figure 42), dockleveler is the most common type of dockleveler because it has a greater operating range, load range, and life expectancy. Docklevelers are most often installed into pits that are formed into the concrete ahead of time. The pits are sized to meet the exact requirements of the docklevelers being used.

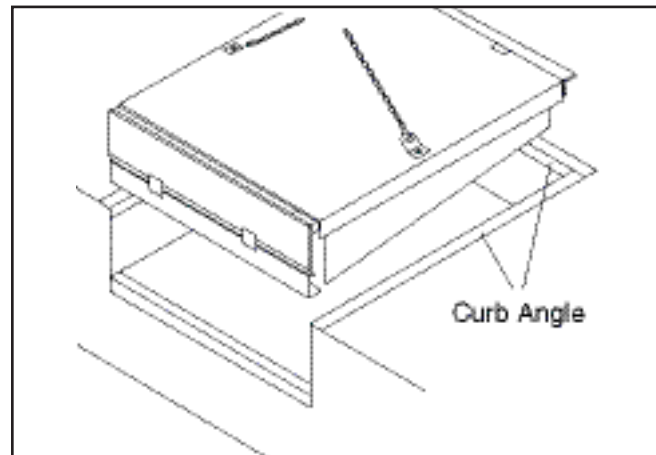


Figure 42

The standard range a recessed dockleveler can serve is 12 in. above and 12 in. below dock height. Special configurations of docklevelers can serve as much as 18 in. above and below, depending on ramp length and pit depth.

Recessed docklevelers are available with a spring-loaded mechanical activation system or powered with a push-button activation system. Powered, push-button models are easier to operate and are activated by either an air or hydraulic system. Although the initial cost of a mechanical dockleveler is less than a powered dockleveler, the long-term operating cost for a powered dockleveler can be lower.

Mechanical Docklevelers

Mechanical docklevelers are suitable for most applications. Mechanical docklevelers do not require expensive electrical provisions and hookups. They will operate even during power failures.

A mechanical, spring-loaded dockleveler (Figure 43) is upwardly biased with a spring and linkage system. It is held down by a releasable hold-down device. To raise the ramp, pull the release chain connected to the hold-down mechanism. Then, walk out on the ramp to force it down onto the truck bed. Once on the truck bed, the ratchet mechanism re-engages to prevent the ramp from rising again.

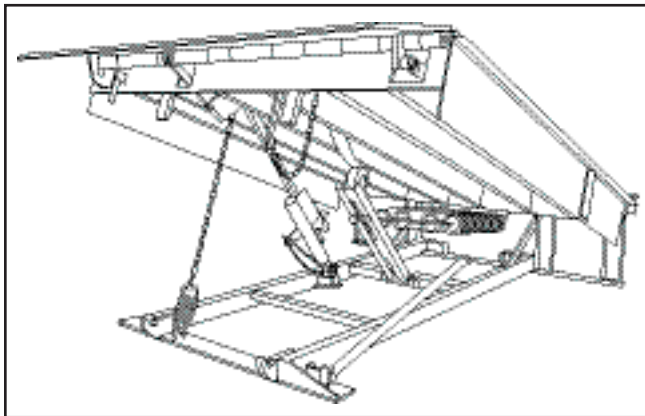


Figure 43

A mechanical dockleveler requires routine maintenance, lubrication and adjustments for reliable operation.

Safety Features

Mechanical Free Fall

Mechanical safety legs prevent the ramp from falling more than 4 in. below dock level. The legs must be manually retracted to permit servicing a trailer below this level. Although safety legs do improve safety, safety can be better addressed by using hydraulic docklevelers with hydraulic free fall protection.

Full-Range Toe Guards

Full-range toe guards close off the sides of the dockleveler when the ramp is in the fully raised position. Full-range toe guards eliminate pinch points at the sides of the ramp during lowering. Full-range toe guards are standard on hydraulic and air-powered docklevelers, while mechanical docklevelers include toe guards that cover the working range of the dockleveler with full-range toe guards as optional equipment.

Powered Docklevelers

Powered units are initially more expensive, but they offer many benefits.

Powered docklevelers are easy to operate and do not require the operator to bend and pull a release chain to operate. Activation takes place through constant-pressure push button controls.

Powered docklevelers are also safer than mechanical docklevelers due to the flexibility of the power source. Powered units also facilitate interlock to other loading equipment.

Hydraulic

A push-button hydraulic dockleveler (Figure 44) is powered by a hydraulic system that raises the ramp. This design is very reliable but requires more maintenance than an air-powered design.

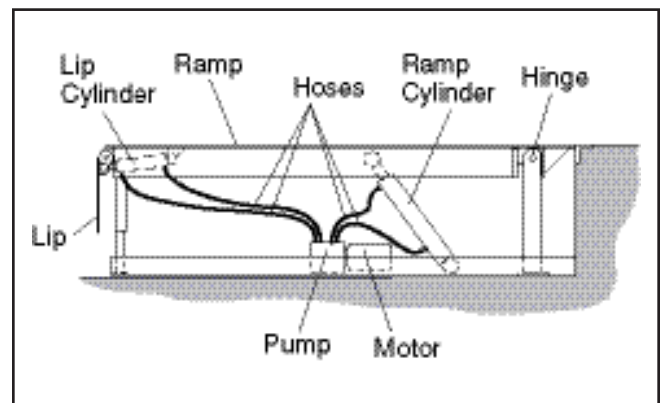


Figure 44: Hydraulic Unit

DOCK PLANNING STANDARDS

Air Bag

Air-powered docklevelers (Figure 45) incorporate the use of a low-pressure, high-volume air system to raise and lower the platform. A single push button activates the air power system to raise the leveler and extend the lip. This simple, very reliable design requires only minimal maintenance.

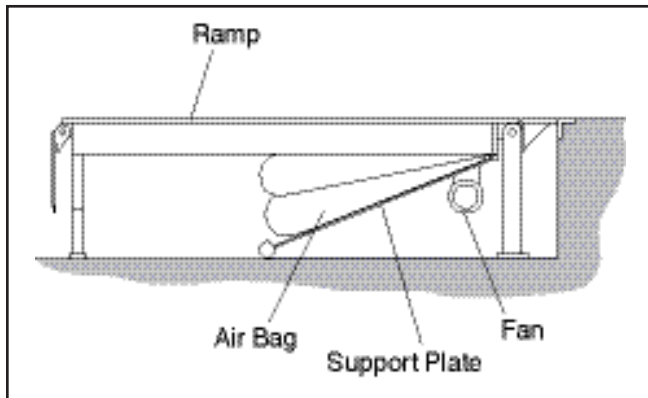


Figure 45: Air Bag Unit

Safety Features

Auto Return

Auto Return is a safety feature on hydraulic units that automatically returns the dockleveler to its stored position when the truck leaves. This feature is important because powered docklevelers are downward biased. The energizing of the hydraulic system causes hydraulic docklevelers to move upward.

NOTE: An air bag dockleveler moves up as the bags are inflated by the electric air pump.

The dockleveler is moved downward by its weight and the force of gravity. A powered dockleveler in its raised position lowers unless it is supported by pressure, the truck bed or another device such as a maintenance stand. If a dockleveler does not have Auto Return, when the truck drives away, the dockleveler's ramp and lip settle on the dockleveler's bottom support stops. This causes a hazardous slope toward the door in the floor. If a dockleveler does have Auto Return, the dockleveler automatically returns to the stored position.

E-Stop

The emergency ramp stop is a safety feature that allows the operator to immediately stop the ramp at any time by pressing a button on the control panel.

Hydraulic Fallsafe

Hydraulic fallsafe protection prevents the dockleveler from lowering to avoid the loading vehicle rolling off the dock. A velocity fuse on the base of the hydraulic cylinder locks the cylinder and limits the ramp in place when a loading vehicle is on the ramp and the truck pulls away.

Interlock Features

Powered docklevelers can be interlocked to other pieces of loading dock equipment such as truck restraints and overhead doors. Interlocking the loading dock equipment increases safety. When interlocked to a vehicle restraint, the dockleveler can operate only if the trailer is restrained. If the trailer cannot be restrained, an override switch allows independent operation.

Full-Range Toe Guards

Full-range toe guards close off the sides of docklevelers when the ramp is in the fully raised position. Full-range toe guards eliminate pinch points at the sides of the ramp during lowering.

Edge-of-Dock Docklevelers

The Edge-of-Dock (EOD) dockleveler (Figure 46) is a low-cost alternative with a short ramp. An EOD is mounted to the face of the dock and secured to a curb channel embedded in the concrete. They are available in standard load capacities of up to 35,000 lb.

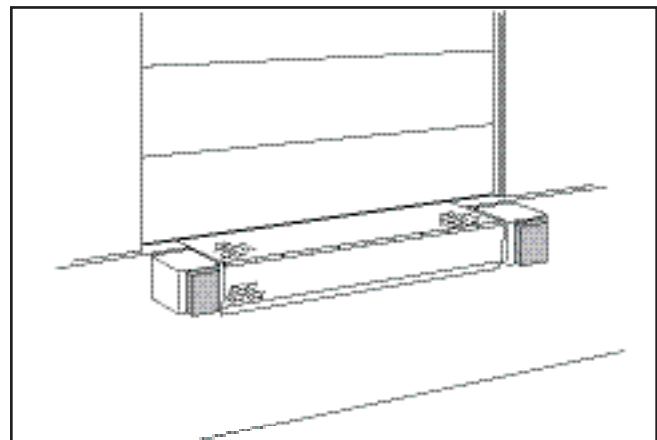


Figure 46

Due to its short ramp, the EOD is restricted to a narrow service range of 2 in. above or below the dock. It is suitable only for applications where there is little variation in bed height and where pallet truck under-clearance is sufficient (Figure 47).

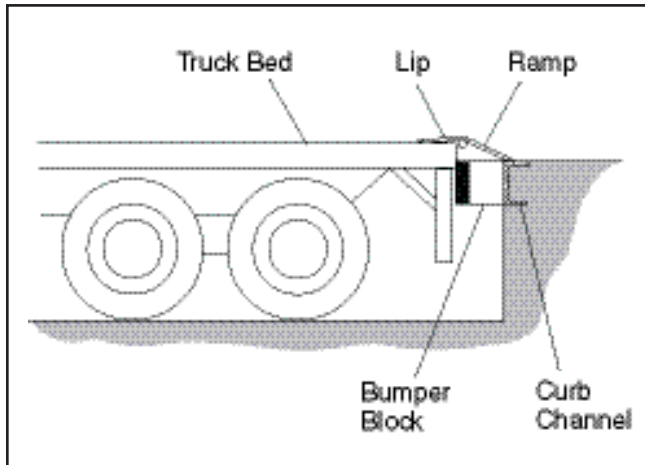


Figure 47

NOTE: Using manual hand pallet carts with even a 2 in. difference in height between the dock and trailer can be difficult. If using an EOD with a hand cart, make sure the dock and trailer are at the same height.

EODs are commonly 72 in. and 66 in. wide. Width selection is primarily based on the loading method. The 72 in. wide EODs offer the most flexibility, but the 66 in. wide EOD is the most popular choice.

Two types of EOD activation systems are available: mechanical and hydraulic.

To activate a mechanical EOD, the operator pulls the lip and ramp into the raised position. Then, the lip is lowered down onto the truck bed. Once the truck pulls away, the EOD retracts into the stored position.

To activate a hydraulic EOD, the operator presses the button to raise the lip. Once the EOD is fully extended, the operator releases the button and the dockleveler lowers to rest on the trailer bed. Once the truck pulls away, the EOD retracts into the stored position.

Specify the Correct Dockleveler

Because a recessed dockleveler has a wider range of operation, it is the best choice to accommodate a wide range of bed heights. Only choose the EOD dockleveler if the facility operates within the EOD's narrow range of applications.

Docklevelers have long lives and contribute significantly to facility efficiency. It is important to provide accurate specifications for the docklevelers, including:

- Length
- Width
- Lip projection
- Load capacity
- Activation system
- Environmental capability

Length

The length of the dockleveler is an important determinant of the dockleveler slope. This slope must be less than the maximum grade capability of the loading equipment. The length of the dockleveler is based on the maximum height difference between the loading platform and the truck beds.

Docklevelers are available in lengths from 5 to 12 ft. The most popular length is 8 ft, which is suitable for most applications.

The normal maximum grade operation for a manual pallet truck is 7%. For an electric pallet truck, normal maximum grade is 10%. For an internal combustion forklift, normal maximum grade is 15%. Consult the equipment manufacturer for maximum grade recommendations.

NOTE: These normal maximum recommendations may vary depending on equipment specifications or design changes.

The lengths shown in Table 7 are the minimum dockleveler lengths required to keep the dockleveler ramp slope within the capability of the loading equipment.

Table 7

Height Difference Between Truck Bed and Dock	Loading Equipment			
	Hand Pallet Jack	Electric Pallet Jack	Electric Forklift	Gas Fork Truck
2 in.	5 ft	27 in.	27 in.	27 in.
4 in.	12 ft	5 ft	30 in.	27 in.
6 in.	–	8 ft	5 ft	30 in.
8 in.	–	10 ft	6 ft	5 ft
10 in.	–	12 ft	8 ft	6 ft
12 in.	–	–	10 ft	8 ft
14 in.	–	–	12 ft	10 ft
16 in.	–	–	–	10 ft
18 in.	–	–	–	12 ft

DOCK PLANNING STANDARDS

For height differences or loading equipment not shown in the figures, the minimum dockleveler length is the height difference divided by the equipment's maximum grade capability.

Forklifts and pallet trucks must have sufficient ground clearance to move freely and safely over a dockleveler (see Figure 49 and Figure 50). It is especially important to check ground clearances of pallet jacks on EOD docklevelers (Figure 46). Pallet jack clearance is less of a concern on recessed levels. If there are concerns about clearances, consult with the loading equipment supplier.

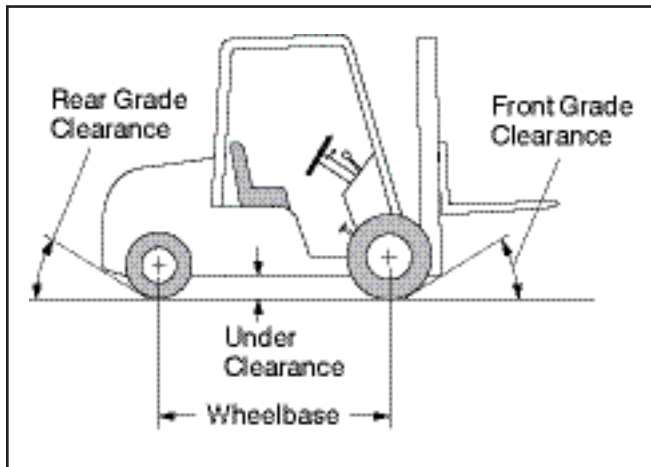


Figure 48

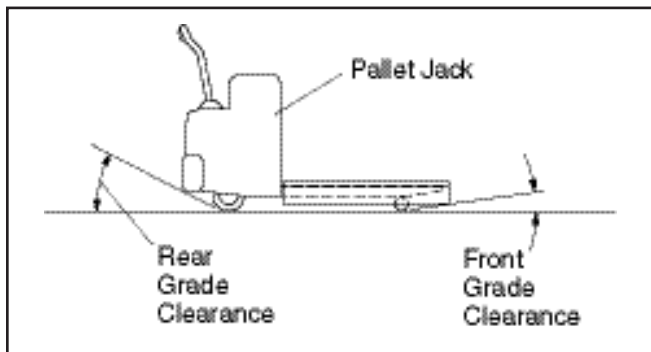


Figure 49

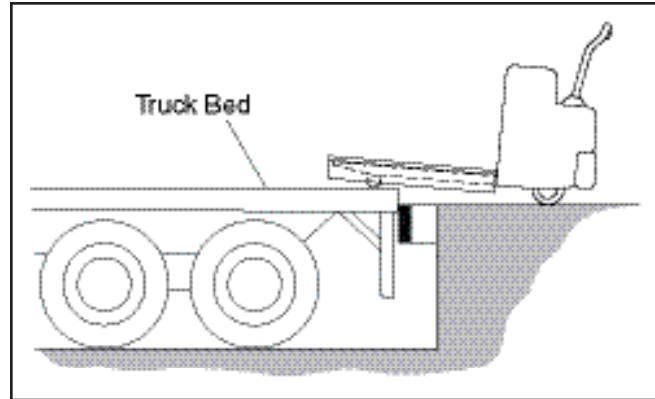


Figure 50

Width

Docklevelers are available in standard widths of 6 ft, 6-1/2 ft and 7 ft. The most common width is 6 ft, which suits most applications. However, 6-1/2 ft and 7 ft wide docklevelers are becoming more popular for wider trailers and side-by-side pallet arrangements (see Figure 51, Figure 52 and Figure 53).

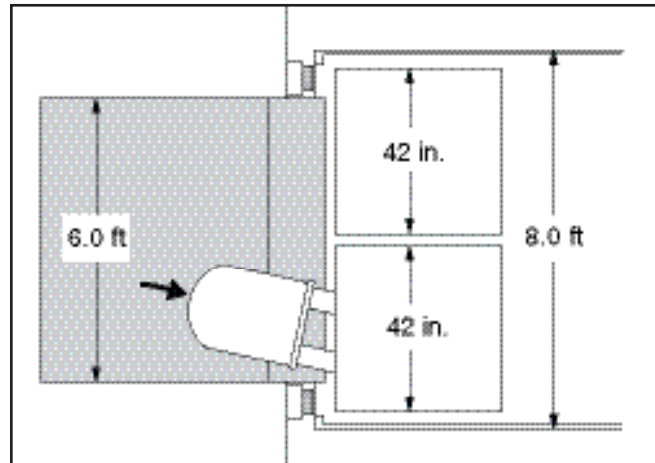


Figure 51

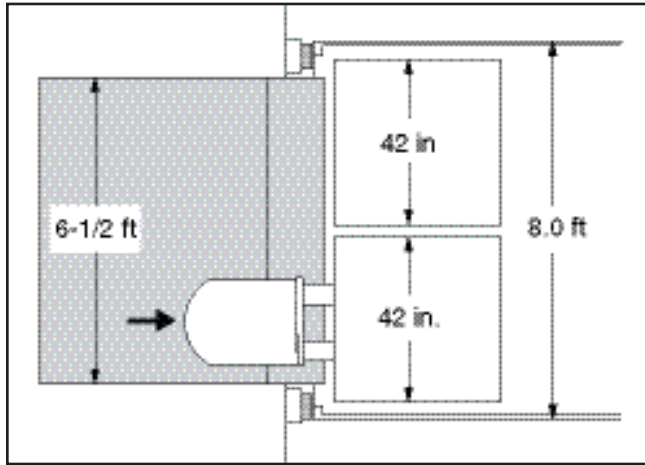


Figure 52

7 ft wide docklevelers provide the best access for below-dock loading and end-loading side-by-side pallets. The end of the dockleveler lip should taper from 7 ft to 6.5 ft wide in order to service narrow trailers. However, it is not always necessary to taper the lip due to the standard trailer width increasing to 96 in. Maintaining the full width allows for the greatest maneuvering space and eliminates the drop-off area created by the taper.

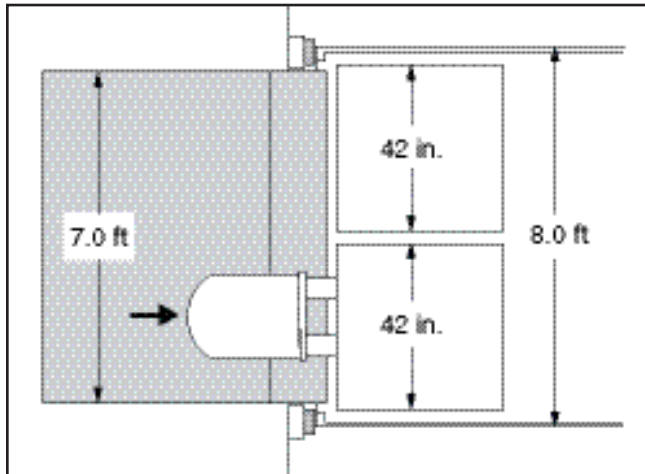


Figure 53

Lip Projection

The dockleveler lip must extend at least 4 in. into the truck per ANSI MH30.1 (Figure 54). A standard lip is 16 in., which projects 12 in. in front of the dock bumpers. Longer lips may be needed to accommodate the special rear step and rear door configurations on some trailers. The step of a refrigerated trailer may require a lip projection that is 14 in. or longer past the bumpers.

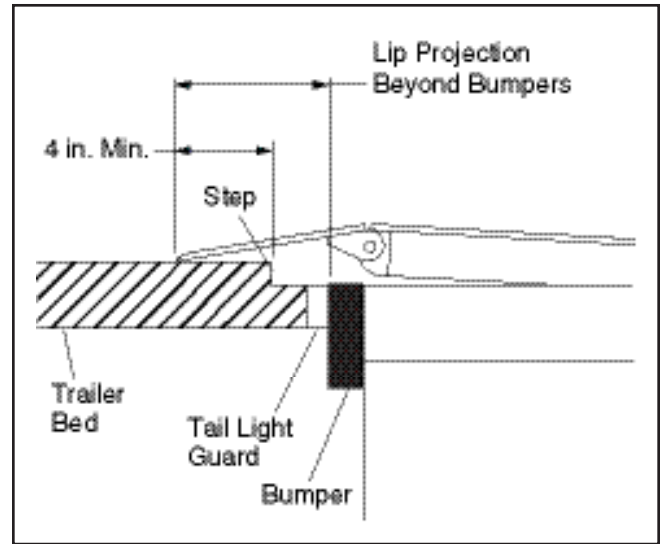


Figure 54

Load Capacity

The load capacity of the dockleveler depends on the gross vehicle weight (GVW) of the forklift. For light to normal usage, the minimum required dockleveler load capacity equals the forklift GVW \times 2.5. For normal to heavy usage, use a multiplier of 3 to 4.

$$GVW = \text{Weight of forklift} + \text{Weight of maximum load}$$

$$\text{Load Capacity} = GVW \times 2.5$$

$$\text{Example: } 12,000 \text{ lb forklift gross weight} + 6,000 \text{ lb gross load} = 18,000 \text{ lb} \times 2.5 = 45,000 \text{ lb load capacity}$$

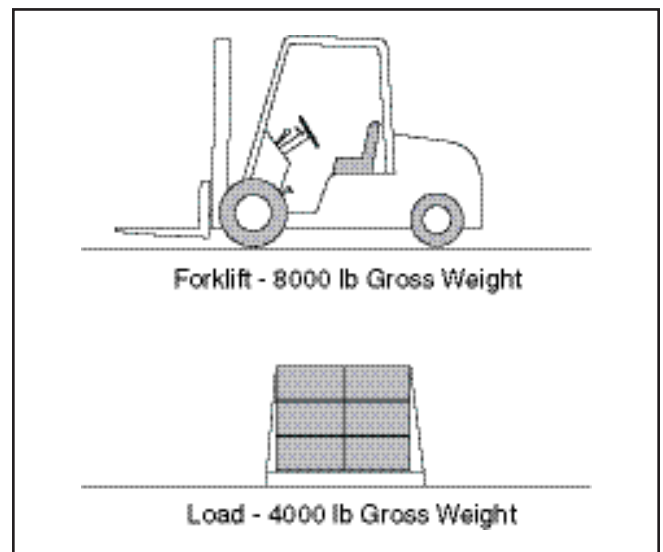


Figure 55

If the exact capacity is not available, use the next higher capacity. Using a higher-than-required load capacity will extend the life of the dockleveler.

DOCK PLANNING STANDARDS

The following conditions affect load capacity:

- Each dock position serves eight trucks or more each day
- Forklifts do not drive straight onto the dockleveler
- Forklifts with three wheels are used
- Forklift speeds exceed 4 mph
- Forklifts are equipped with front end attachments or fork side shifters

Activation System

Push button activation is the most ergonomic and safest type of dockleveler activation system. Manual or spring counterbalance activation should be used only when electrical power is not available. Push button-operated docklevelers may be less expensive over the long term as they require less service.

Environmental Capability

On inside/outside docks at temperature-controlled facilities, use perimeter weather seals to help prevent outside air from entering the building.

At refrigerated facilities, the underside of the dockleveler ramp should be insulated. Condensation on the underside of the ramp causes corrosion and structural problems. Expanded foam insulation helps prevent the warmer outside air from condensing on the underside of the ramp. Insulation also saves energy by minimizing the loss of refrigerated air.

Optional Features

Consider adding optional features to increase the effectiveness of the installation.

Increase Lip Length

Dock levelers are normally supplied with a 16 in. lip plate that will suit the majority of applications. Lip length can be increased to 18 in. to 20 in. projecting out further from the dock face. Increased lip projection is necessary to deal with bumper projections of more than 4 in., substantial dock and truck bed height differences, and setback internal truck beds – typical with refrigerated trucks and trailers.

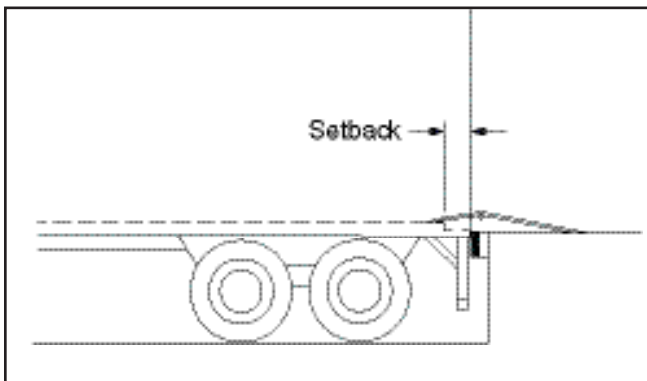


Figure 56: Setback Internal Truck Bed

When loading or unloading a truck with a setback internal truck bed such as trailer with swing doors, the lip must be sized to ensure lip contact with the internal bed. If the lip does not project over the internal setback and therefore rests on the step below the internal truck bed, the material handling equipment will strike the edge of the step up to the bed on every entry, making product transfer both rough and inefficient.

Side/Rear Weatherseal

Neoprene strips attach along the sides and/or rear of the deck assembly to better control the climate. The preferred weatherseal to protect against rodent entry is brush seal.

Galvanizing

The zinc metalized spray process produces the optimal finish. Each dockleveler component is galvanized before assembly to provide complete protection. Galvanizing is commonly used in facilities that handle corrosive materials or are near harsh environments such as salt water.

Benefits of Hydraulic and Air Bag Docklevelers over Mechanical Docklevelers

Hydraulic docklevelers have lower lifetime ownership costs. Including maintenance, the estimated 10-year ownership costs for a dockleveler are \$3200 for a mechanical dockleveler, and \$1000 for a hydraulic or air bag dockleveler.

Air bag docklevelers are ergonomically correct, reducing the potential of employee injuries, and easier to use with their push button configuration.

Air bag docklevelers have a "stump-out" safety feature where fall safe legs impede below-dock and dock-level situations. The safety legs come to rest on the floor while the dockleveler is being used.

Hydraulic and air bag docklevelers log fewer hours and therefore have longer working lives. Because mechanical docklevelers are upward biased and the springs and holdown are in the stressed condition, the moving parts wear over time. However, hydraulic and air bag docklevelers are working only when they are being used and while the button is being pressed.

Hydraulic docklevelers increase safety on and around the loading dock. There is improved fall safe protection due to the velocity fuse fall safe over mechanical legs. The fuse will stop within 3 in. of drop.

Hydraulic docklevelers can accommodate higher load capacities. Mechanical and air bag docklevelers can handle a maximum rating of 55,000 lb, while hydraulic docklevelers can be used for load capacities of up to 100,000 lb.

Specifying the Elevating Dock

Hydraulic elevating docks lower forklifts from the loading dock down to the ground. They allow forklifts to enter trucks with very low or high bed heights that are outside the range of docklevelers.

Elevating docks are typically a scissor-lift design. A 6 ft vertical travel is common for a standard dock. Lips on the dock allow movement of the forklift to the dock and to the truck (Figure 57). Elevating docks also make it possible to load from the ground (Figure 58).

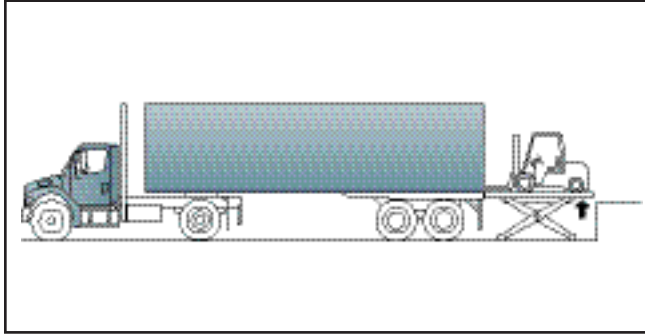


Figure 57

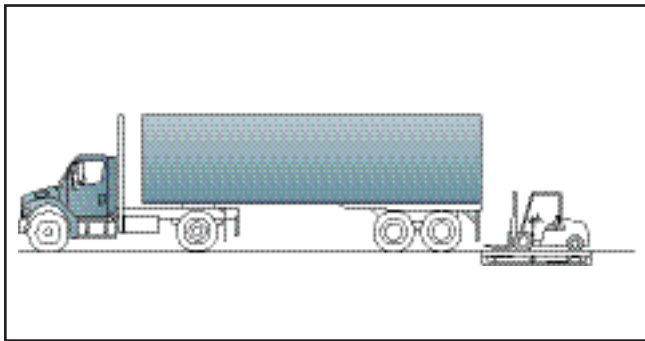


Figure 58

Elevating docks are rated for maximum gross vehicle weight (GVW); 10 tons is the maximum capacity for standard elevating dock.

The most common installed elevating dock has a 6 ft wide, 8 ft long table with a capacity of 4500 lb.

The most common installed elevating dock using a rider forklift has a 6 ft wide, 10 ft long table with a capacity of 5 tons.

BUMPERS

Bumpers can absorb 90–95% of the impact of a backing truck colliding with the dock. Bumpers protect against impact damage (Figure 59) and against up-and-down movement of the truck bed during loading. Since bumpers limit how close the truck is parked to the dock, they affect dockleveler lip and seal and shelter projections.

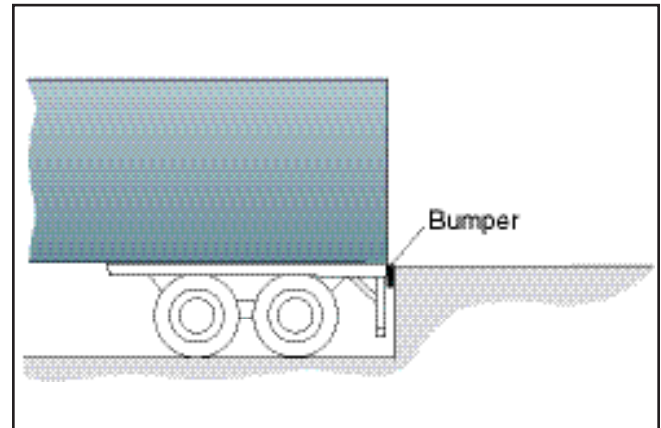


Figure 59

Bumpers are available in molded (Figure 60) or laminated (Figure 61) rubber. Standard bumpers are 4 in. thick, but laminated bumpers are also available in 6 in. thickness. The 4 in. bumper reduces the gap between the trailer floor and the dock face. Additional thickness may be required for recessed docks or special applications.

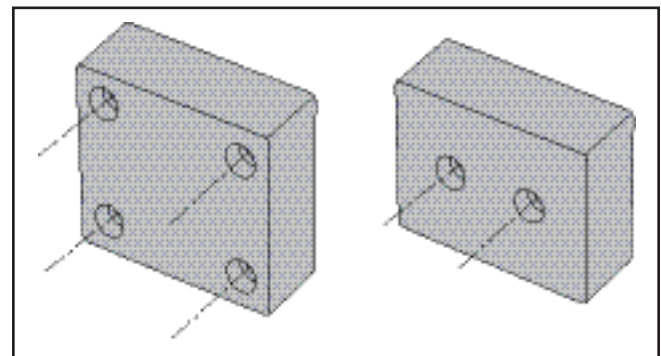


Figure 60: Fabric Reinforced Masticated Rubber, Shaped with Lag Bolt Holes

DOCK PLANNING STANDARDS

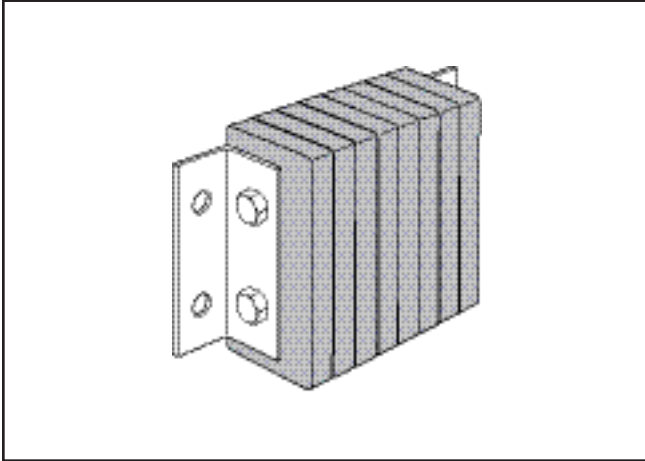


Figure 61: Fabric Reinforced Rubber Pads, Laminated and Secured Between Steel Angles

Use steel-face bumpers for high-frequency or heavy-impact applications, or where jockey trucks are used for truck positioning. The steel plate face on the bumper protects against the unusual wear and biting out of the rubber.

TRAILER RESTRAINTS

A trailer restraint prevents a truck from moving during loading and unloading. If a truck leaves the loading dock before loading and unloading is complete, workers can fall into the gap between the truck and dock, causing serious personal injury or death, and freight and equipment can be damaged.

A trailer restraint should be able to interlock with a powered dockleveler so the dockleveler cannot operate when the vehicle is not restrained. If the vehicle does not have a RIG bar or the trailer restraint cannot engage with the RIG bar, an alternate method such as wheel chocks must be used. The attendant must use the override function to allow the dockleveler to operate. In such cases, the vehicle's wheels should be chocked and precaution should be taken.

Trailer restraints come in two designs: RIG-dependent (Figure 62) and wheel chocks (Figure 63).

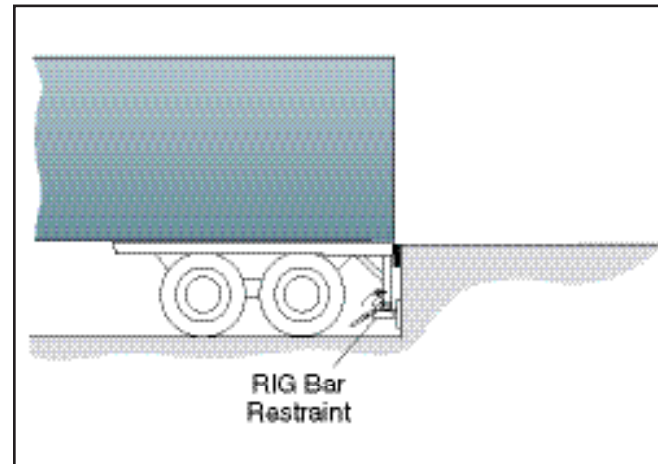


Figure 62

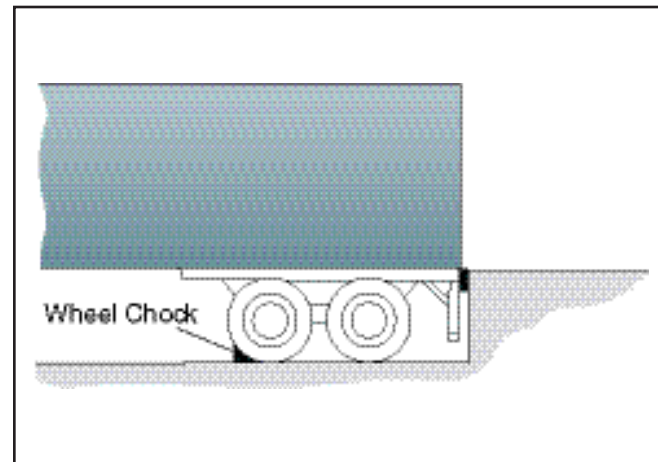


Figure 63

RIG-Dependent Restraints

The most common type of trailer restraint is the RIG-dependent system. Most over-the-road trailers have rear impact guards, or RIG bars. RIG-dependent restraint systems use a restraint barrier that rises up, captures the trailer's RIG bar, and uses it to lock the trailer in place (Figure 63 and Figure 64).

A powered-activated restraint can use programmable controls that offer flexibility between the restraint and other loading dock equipment.

A RIG restraint engagement sensor is standard on a powered-activated restraint system and optional on a manual restraint system.

A manual wheel chock is a tapered block that is wedged in front of the wheels to prevent accidental movement.

RIG-dependent restraints are available in manual and powered activation designs. These restraints can engage underride guards from 7-1/2 to 30 in. off grade.

A manual restraint uses a push bar to raise and lower the release latch on the restraint.

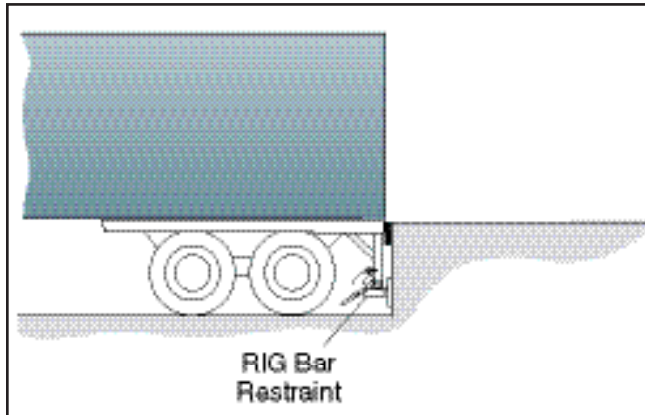


Figure 64

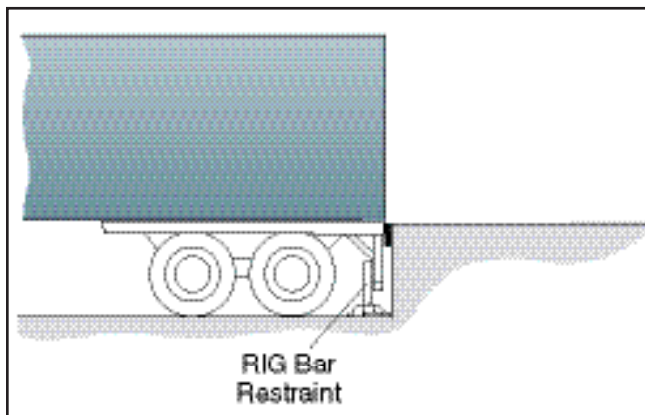


Figure 65

A powered-activated restraint uses push buttons to operate an electric motor, pneumatic cylinder, or hydraulic pump and cylinder to raise and lower the restraint (Figure 66). A powered-activated restraint can use a control system that offers flexibility between the restraint and other loading dock equipment.

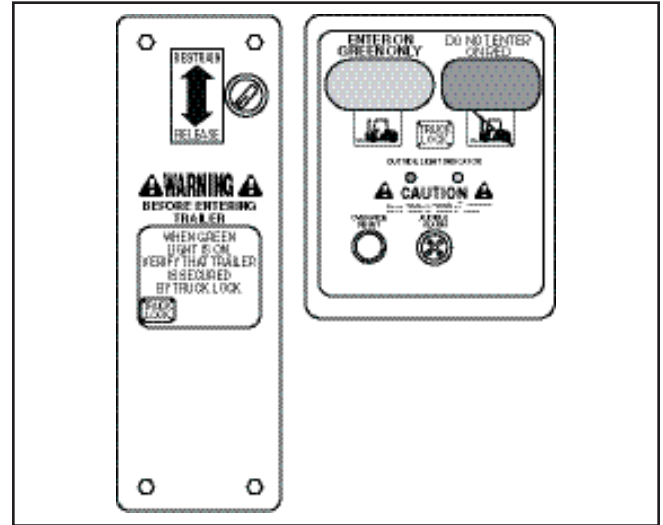


Figure 66

A RIG restraint engagement sensor is standard on a powered-activated restraint system and optional on a manual restraint system.

Table 8

Restraint Barrier Position	Outside Communication Light	Inside Communication Light
Stored	Green	Red
Engaged	Red	Green

Manual restraint installations without a restraint engagement sensor require manually changing the communication lights.

Manual Wheel Chocks

A manual wheel chock is a tapered block that is wedged in front of the wheels to prevent accidental movement. Since wheel chocks do not rely on an underride structure at the rear of the trailer, they are more universal. Wheel chocks can restrain trailers with underride guard systems and also those with hydraulic lift gates, tandem hitches and damaged guards. All loading docks should have wheel chocks available.

DOCK PLANNING STANDARDS

Manual wheel chocks have disadvantages:

- Dock workers may find wheel chocks inconvenient and not use them.
- The trailer cannot be secured if the wheel chocks are lost or stolen.
- Manually positioning the wheel chocks can be time-consuming.
- A truck can pull a trailer over the wheel chocks, whereas a typical RIG vehicle restraint will withstand a force of more than 30,000 lb and is more effective at preventing unintended trailer departures.

COMMUNICATION LIGHTS

Communication lights greatly contribute to the overall safety of the loading dock.

A two-way communication system consists of the following components:

- Outside signal light
- One regular and one reversible instruction sign (Figure 67)
- Interior control panel
- Sign indicating to the operator to load or unload on the green light only

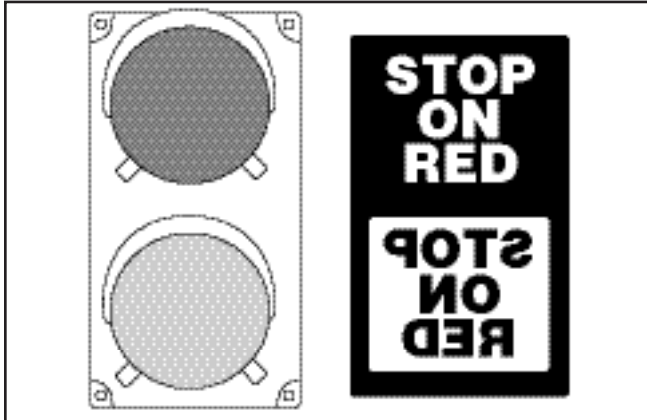


Figure 67: Outside Signal Lights and Signs

DOCK RUN-OFF PROTECTION

Provide run-off protection on unoccupied dock positions so that loading equipment will not accidentally drive off the edge of the dock, which can cause serious injury or death, and damage the forklift, freight, and building. Types of dock run-off protection include gate barriers and lip barriers.

NOTE: Barriers are not effective at stopping loading equipment traveling faster than 4 mph.

Gate Barriers

Gate barriers are safety gates that are placed in front of the dock door to protect the dock door and door tracks from collisions with forklifts, and to prevent pedestrians from walking off the dock. The gates should extend the full width of the door. When the gates are open, the full width of the door is available for pass-through. Gates increase the life of the door by preventing door damage.

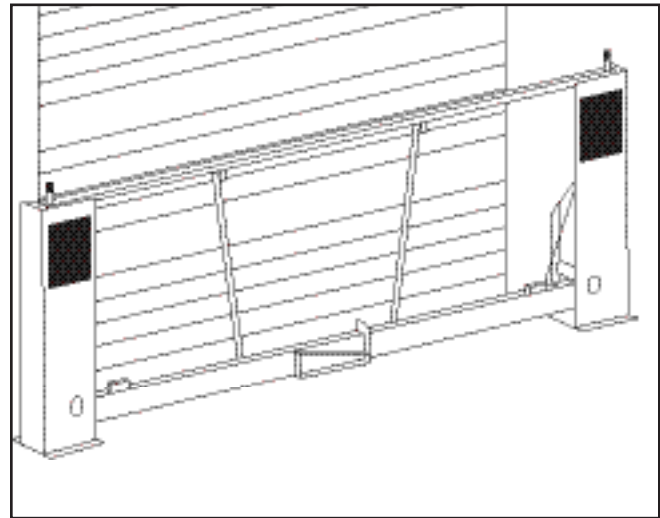


Figure 68

Lip Barriers

Lip barriers provide run-off protection through a barrier that extends 5 in. above floor level when the leveler lip is stored (Figure 69).

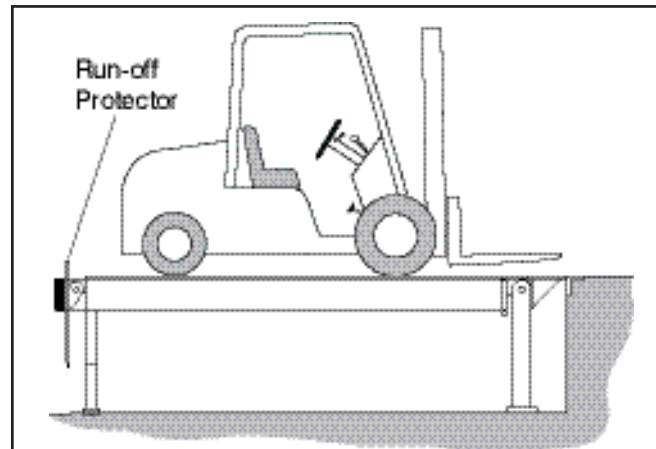


Figure 69

SEALING SYSTEMS

Sealing systems seal off the space between a parked trailer and the building (Figure 70). They help to maintain the internal climate, and they protect the freight against damage.

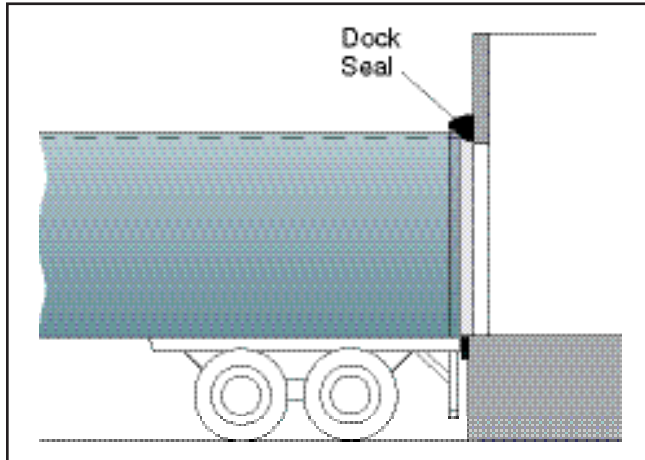


Figure 70: Sealing System

Sealing systems have many benefits:

- Energy savings – The system can quickly pay for itself in reduced heating and cooling costs by maintaining the building's interior temperature.
- Safety and productivity – Eliminates dangerous precipitation from the loading areas. Worker productivity correlates to the workplace environment and its safety.
- Freight protection – Protects freight against harmful weather and minimizes entry of vermin.
- Security – Prevents product theft and unauthorized entry.
- Storage – Docked trailers become secure, climate-controlled extensions of the building.

There are two types of sealing systems:

- Compression foam dock seals – The seals are made of foam covered with fabric. They are mounted to the wall at the loading door and seal against the back of the truck.
- Truck shelters – Truck shelters have a rigid or flexible frame equipped with curtains. The frame is installed to the building wall. The curtains extend and seal against the wall and the rear of the truck (Figure 71).

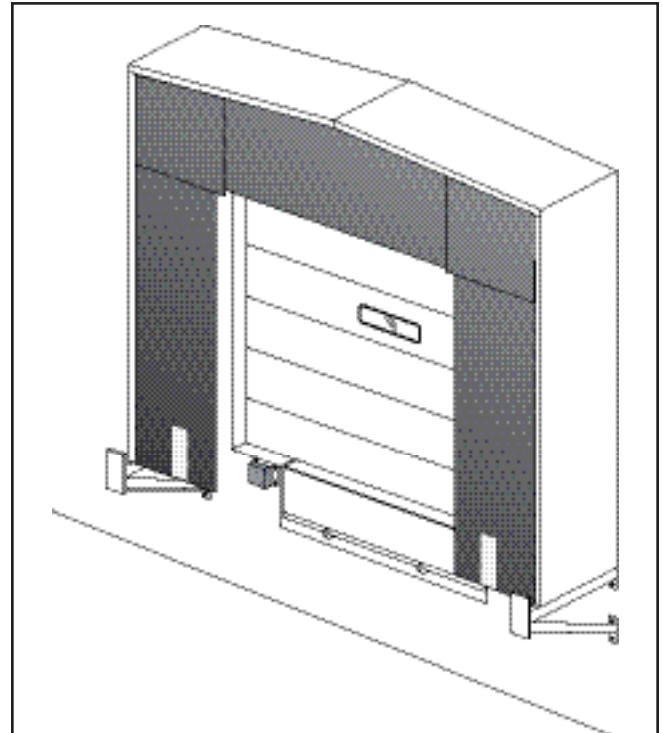


Figure 71

Both seals and shelters use abrasion-resistant industrial fabrics on their sealing surfaces due to the trailer movement during loading and unloading.

The wall construction may determine the most suitable type of sealing system. Dock shelters are most suitable where walls are not designed to handle the high compression forces of traditional seals.

Selection Criteria

Proper selection is the most important aspect of sealing system installation. Improper selection can result in not only a poor installation, but also product damage and decreased productivity. When selecting a sealing system, choose a system that is the most effective at sealing the majority of vehicles being serviced.

Grade of Approach

The grade of approach might be level, declined or inclined.

If necessary, seals can be tapered to ensure parallel compression along the entire face of the side pads, which creates an effective seal.

Overhead Door Dimensions

The size of the door opening determines the most suitable sealing systems.

DOCK PLANNING STANDARDS

Dock Bumper Projection

The dock bumper projection is the distance between the wall and the front face of the bumper. On declined driveways, the bumper must project far enough to prevent trucks from impacting the upper wall.

Dock Height

The dock height is the distance between the grade and the top of the dock floor.

Mounting Surface

The wall construction may determine the most suitable type of sealing system. Dock shelters are most suitable where walls are not designed to handle the high compression forces of traditional seals.

Compression Foam Dock Seals

Compression foam dock seals are more effective for sealing than using a shelter system. Compression foam dock seals have limitations:

- Cannot be used on doors wider than 9 ft
- Only accommodate a narrow range of trucks
- Do not work well with trucks with rear loading platforms (Figure 72)
- Limit access to interior of the truck

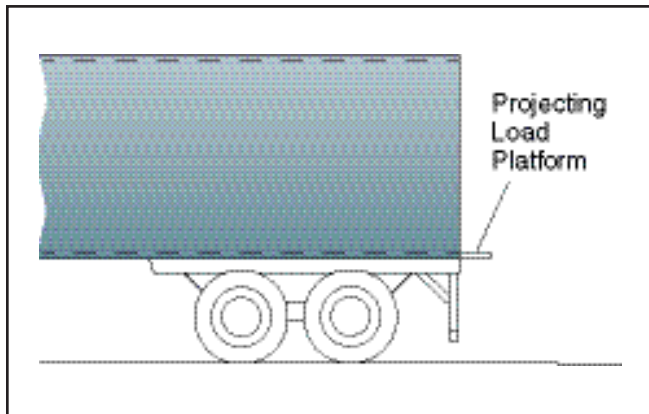


Figure 72

Install the seals with an opening between 7'4" and 7'8" (Figure 73). Use bevel seals for a loading door wider than 7'8" (Figure 74).

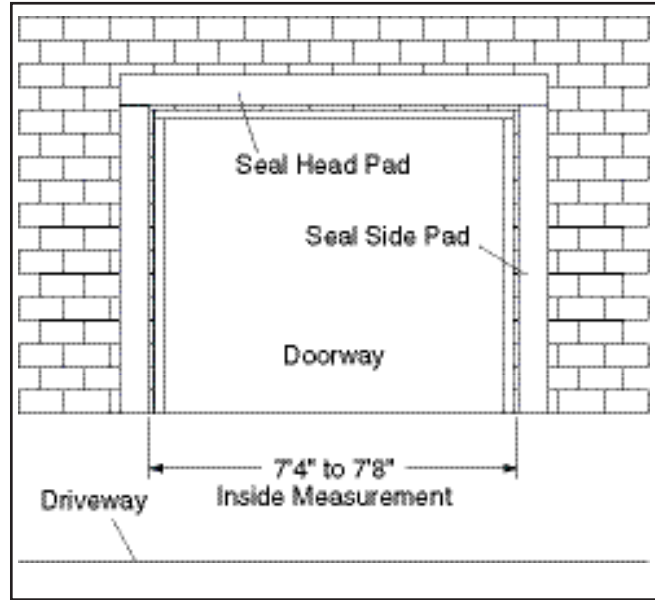


Figure 73

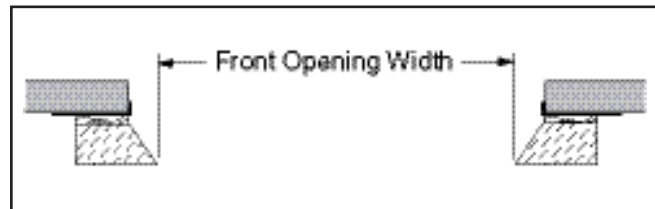


Figure 74

Maintain a minimum of 3 in. between the bottom edge of the head pad and the top of the truck (Figure 75). Adjustable head pads are available. Use a fixed head curtain instead of head pads for tall doorways and a wider range of trailer heights (Figure 76).

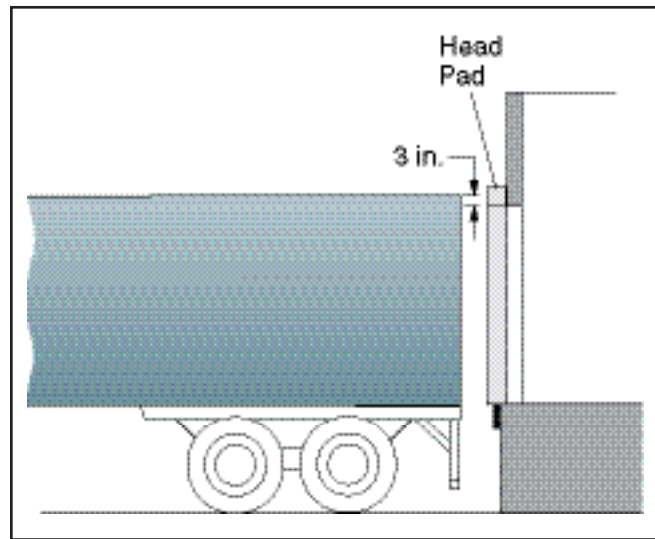


Figure 75

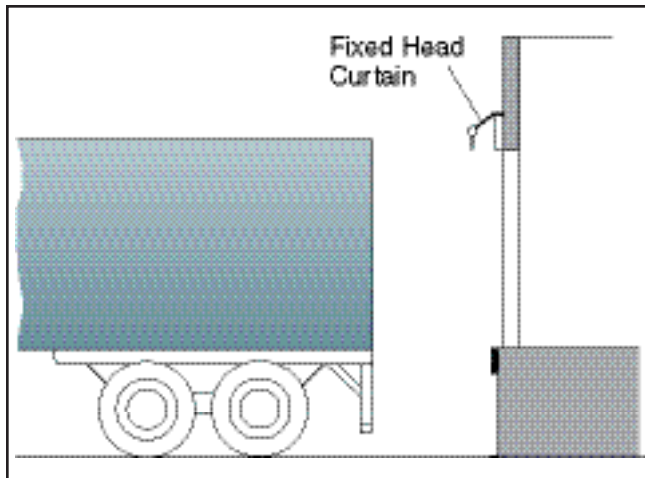


Figure 76

Guidelines for compression foam dock seals installation:

- Per square foot of pad length – approximately 80 lb of compression force on building
- Distance from wall to the face of the dock bumper – minimum of 4 in.
- Pad projection beyond the bumper – Minimum of 4 in., maximum of 8 in.; 6 in. is nominal
- For recessed driveways with a slope of more than 2% – specify a taper seal. For every 1% of driveway grade, taper the seal 1 in. for overall length (Figure 77).

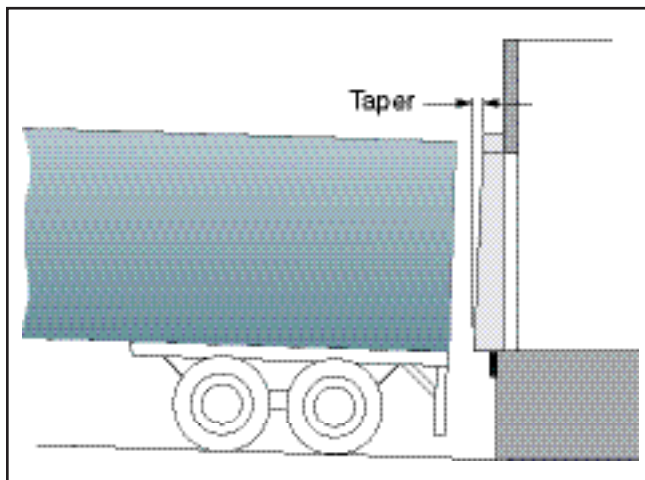


Figure 77

Truck Shelters

A truck shelter allows for full access to the interior of the truck. An air gap will still be present around the hinge area of the truck's door.

Dock shelters can be installed on nearly any door, but are usually installed on doors between 9 ft wide x 9 ft high and 12 ft wide x 12 ft high.

Use truck shelters for:

- Loading doors wider than 9 ft or higher than 10 ft
- Trucks with extended tailgates
- Trucks with rear platforms (Figure 72)
- Full access of truck's interior

Guidelines for truck shelter installation:

- Minimum shelter width – 11'6" (O.D.) measured across the side frames
- Standard opening width – 7' measured between the insides of the side curtains
- Position of bottom edge of head curtain – 6 in. below height of the lowest expected truck (Figure 78)

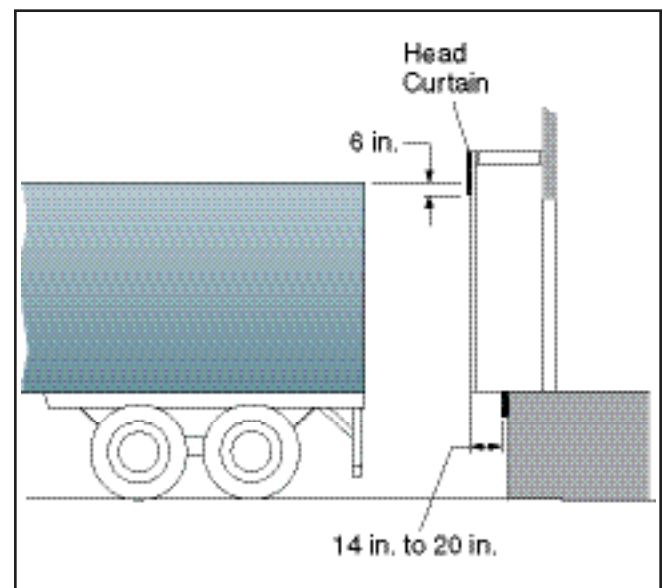


Figure 78

- Top of shelter – minimum of 18 in. above top of highest expected truck. Commonly 15 ft off top of grade.
- Shelter extension in front of dock bumpers – 14 to 20 in. Increase the extension to 20 in. minimum for shelters wider than 12' 0".
- Install the support brackets for a rigid shelter on the building foundation, flush with the dock floor. The support brackets should project past the shelter frame by 6 in.

DOCK PLANNING STANDARDS

Dock Lights

Because trailers do not usually have interior lights, they are dark and hazardous. Provide loading lights at each dock position to improve visibility and reduce injury hazards.

CONTACT NOVA

The information in this manual addresses standards for dock planning. If you have a unique situation not addressed in this manual, please contact NOVA Technology at 800-236-7325 or visit their website at www.novalocks.com.



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