ADVANCE LIFTS®

TURNTABLE APPLICATION GUIDE

A White Paper

This section covers the full range of turntables manufactured by Advance Lifts. The basic information necessary to select an appropriate turntable for an application includes all of the topics listed below:

- **Turntable types**
- **Capacity**
- **Nature of the load**
- **Means of loading and unloading**
  - **Edge loading**
  - **Derating oversize platforms**
  - **Increasing edge load capacity**
  - **Rolling axle loads**
  - **Mounting conveyors**
  - **Sliding loads**
  - **Placed or stacked loads**
- **Platform size and shape**
- **Speed requirements**
- **Power and duty cycle requirements**
- **Special features and accessories**

The following discussions will be used to clarify the meanings of these topics, point out special considerations to be aware of, and provide us with a common vocabulary.

Turntable types: The two main categories of turntables are “standard duty” and “heavy duty ring bearing”. The standard duty tables have several sub-groups within them and both duty classes are divided into powered and non-powered (or manual). For high capacity, extra stable, more accurate positioning requirements, the heavy duty ring bearing turntables are the obvious choice. However, the more economical standard duty units offer most industrial customers satisfactory performance and a better value for less demanding applications.

Capacity: The capacity of a unit is the total weight being placed on a unit and consists of the total live load + the total dead load as described below:

Live load weight and description: Live loads are the items that will be placed on the unit and removed from the unit. It is important to know the maximum weight. It should also be noted if the load will be unbalanced due to a lopsided or irregular configuration or a loading operation that can cause temporary uneven loads.

Dead load weight and description: The dead load is the weight that is applied to the unit on a permanent basis such as conveyor, weight scales, or fixtures. A good description including how the dead weight will be supported by the platform and attached to the platform is necessary so that our engineers can determine if the structure of our standard platform can satisfactorily support the i ncurred loads without deflection or twisting. Any unbalanced loads such as offset conveyor drive motors must be mentioned so that the center of balance for fully loaded and minimally loaded configurations can be determined.

Nature of the load: This requires a good description of what the load consists of, the weights of the load components, the location of the center of gravity of the load, and the physical dimensions of the load.

Our concern here is that off centered loads can reduce turntable life dramatically if not properly handled. The critical information in these cases is where the center of gravity of the load will be in relation to the center of the platform. Ideally, we like to see the center of gravity of a load in the center of the platform. Fork truck counterbalance weights and oil filled transformers are just two examples of loads that present severe off center loads when their foot prints are nicely centered on the platforms. Powered conveyors with offset power drives can also create severe offset loads, especially with small size platforms. All of these situations can be handled, provided that they are considered during the selection process.

In order to utilize the maximum rated capacity of a turntable, the load must be evenly distributed over the surface of the platform. The center of gravity of the load should be placed directly over the center of the turntable platform. However, offset loading is allowed for loads that are less than the maximum rated capacity of a given turntable as explained below.

Standard Platforms: Allowable offset or loading can be calculated for turntables with standard (non-reinforced) platforms using the following (2) formulas:

To calculate the allowable load offset for an actual load, the following formula is used:

LOAD OFFSET = (PLATFORM LENGTH/2) x (1-(ACTUAL LOAD/RATED CAPACITY))

Offset can not exceed the roller radius published in the turntable specification tables *(Refer to drawing on pg.67 for illustration of roller radius).* Maximum load for a given offset can be calculated using the following formula:

ACTUAL LOAD = (RATED CAPACITY) x (1-(2 x (LOAD OFFSET/PLATFORM LENGTH)))

Reinforced Platforms: Allowable offset loading for heavy duty turntables with reinforced platforms can be calculated in a similar way using the following (2) formulas:

- *When actual weight is known:*
  LOAD OFFSET = (PLATFORM LENGTH/1.2) x (1-(ACTUAL LOAD/RATED CAPACITY))

- *When offset is known:*
  ACTUAL LOAD = (RATED CAPACITY) x (1-(1.2 x (LOAD OFFSET/PLATFORM LENGTH)))

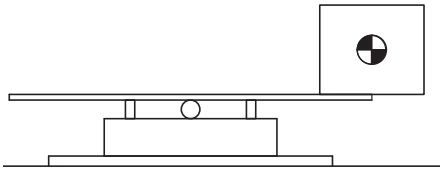
When using any of the (4) formulas above it is best to use inches for length and pounds for weight. Offset is measured from the center of the turntable platform to the center of gravity of the load. Rated capacity and available platform sizes can be found in the turntable specification tables. Consult the factory for offset loading cases that exceed the allowable offset or load calculated using the formulas.

Means Of Loading And Unloading: How loads are transitioned onto and off of the turntable can be the critical factor in choosing an appropriate lift design. These movements determine the “edge loading” and/or “impact” that the structure must sustain and they may contribute to off centered load conditions during the rotation. The most common ways in which loads are transitioned on and off turntables are as follows:

- **Rolled on/ Rolled off** – with a wheeled vehicle or cart
- **Slid on/ Slid off –** as in sheet feeding operations or conveyor operations
- **Placed on/ Picked off –** as in stacking operations or crane loading

Before we talk about these specific applications we need to discuss unit capacity ratings.

Edge Loading: "Edge loading" capacities of turntables are generally stated in this catalog as a "static" capacity. This is equivalent to a uniform stiff load teetering on the edge of a minimum size platform edge with no allowance for any impact.
This is illustrated in the drawing:



Static Edge Load

In real life this condition rarely exists and the "static" rating in the catalog must be modified with an appropriate multiplier for the various types of "dynamic" or moving loads that will actually be encountered.

What matters most with edge loading is what loads will pass over the edge of the turntable platform and potentially cause high platform stresses or tipping (standard duty models).
Edge load ratings for standard duty turntables that are published in the turntable specification table are based primarily on platform tipping criteria. Standard duty turntables are designed with a "free floating" platform in order to reduce rotational friction. The platform is retained at the central pivot point, but some vertical movement is possible. If edge loading exceeds published values, the platform may tip up slightly until it is restrained by the central pivot. Movement and shock caused by tipping increases turntable component wear and may cause damage to the turntable or load. Edge load ratings for heavy duty ring bearing turntables are determined by ring bearing capacity, platform stress levels, andplatform deflection. Exceeding edge load capacity in these models can result in platform damage or cause excessive deflection.

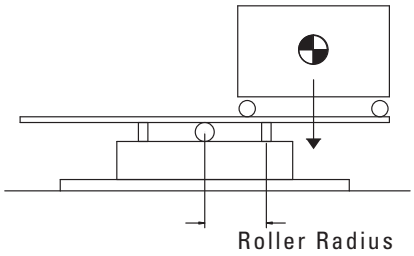
Derating For Oversize Platforms: The "static" edge load capacity of oversized platforms must be derated because the oversize platform overhang acts as a lever, increasing the forces incurred by the platform structure and supporting rollers for any given weight. Edge loading capacities are derated by the rule of thumb of 4% per inch for every inch that a platform is wider than minimum width and for every inch that it is longer than minimum length. For example, a TPH-605 has a minimum platform size of 60" X 60". If it were equipped with a 65" X 65" platform, the unit would have the edge load capacity reduced by (65" – 60") X 4% = 20%. There are many variables that go into the actual edge load capacities, but the 4% rule of thumb is a safe tool to use.

Increasing Edge Load Capacity: If the edge load capacity for a chosen model is not sufficient, a different turntable model must be selected. In many cases selecting a higher capacity model will result in a higher allowable edge loading. This is because the higher capacity models generally have more support rollers and larger support roller diameter, both of which increase edge load capacity. Consult the factory if higher edge load capacities than those published are required.

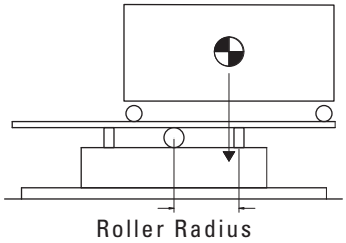
Rolling Axle Loads: In some applications loads may be rolled onto platforms using carts or pallet jacks and thus make axle loads a concern.

Axle loads may be expressed in static edge load terms by simply adding 50% for impact and dynamic forces. For example, a two axle cart loaded to a 2,000# total weight would have a 1,000# axle load. To calculate the static load equivalent, we would simply add 50%, so we would have a 1,500# static load. If the static load rating of the turntable configuration you have chosen does not meet the calculated requirement, you must choose one that does.

Caution is advised when rolling on a load and using these simple axle load conversions. Rolling a very short cart rolling onto a platform with a long overhang can present a situation where the entire cart is on the overhang and potentially exceed the edge load capacity. In this situation, please give the distance between axles to our sales people so that they can check with our engineers about what can be done to accommodate the load. Typically, a unit with larger support roller diameter must be chosen so that the center of gravity of the entire cart will be within the roller support circle before the second axle reaches the platform.
See figures on top of next page.



Improper Loading



Proper Loading

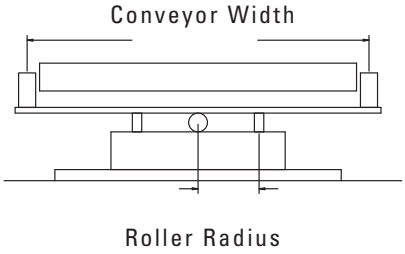
Mounting Conveyors: Conveyors are sometimes used as a method of transitioning loads onto and off of turntable platforms. Care must be taken when using conveyors in order to assure a reliable application. Important details for the conveyor itself are quantity, size, mounting location, weight, and center of gravity. Important details regarding loading are load size, load weight, and load transfer dynamics. These terms are defined and discussed below.

Conveyor quantity is the total number of conveyors to be mounted on the turntable platform. Usually one or two conveyors are used. Conveyor size consists of width (rail to rail) and length. The conveyor should never extend beyond the edge of the turntable platform. Mounting location is the placement of the conveyor on the platform. It is important to know the location of the conveyor rails relative to the outline of the turntable platform. Conveyors should usually be placed symmetrically on the platform. In some cases loads with uneven weight distribution may require uneven placement of the conveyor. Consult the factory for this special case. The weight of the conveyor is considered to be “dead weight” and is included in the total load of the turntable. If the conveyor has a large weight concentrated on one side (i.e., drive motor) this should be noted. Load size is important because it effects the amount of offset loading on the turntable platform as the load is transitioned onto the platform. A load with a large footprint (a large pallet for example) will typically place less offset loading on the platform than one with a small footprint as the load is rolled onto the platform. The weight of the load is also important as it has a direct effect on the magnitude of offset loading. Load transfer dynamics refers to the mechanics of how a load is rolled onto the platform. Important details to consider are rolling velocity and the method of stopping the load. Conveyor applications that have horizontal impact against stops are of particular concern because of potential increased wear or damage to the turntable components. If the application involves heavy loads and/or high load velocity and stops consult the factory. When you consult with the factory, be sure you have the weight of the moving object and the speed of movement.

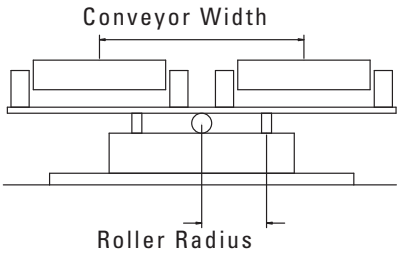
Because conveyors typically transfer load to the turntable platform in a concentrated manner through the conveyor mounting rails, the capacity of the turntable must be derated in many cases. The following formula is to be used to calculate the allowable load for conveyor applications:

ALLOWABLE LOAD = RATED CAPACITY x (ROLLER RADIUS/CONVEYOR WIDTH)

When using the formula it is best to use inches for length and pounds for weight. In the case where one conveyor is used, conveyor width is defined to be the distance between the roller support rails. If two conveyors are used, conveyor width is defined to be the distance between the centers of the conveyors as they are to be mounted on the turntable platform. See figures on top of next page. Roller radius varies by turntable model and can be found in the turntable specification table.



Single Conveyor



Double Conveyor

Calculated allowable load includes the weight of the conveyors. When the load is being transferred onto the platform it is important that the offset loading of the platform is not so high as to cause excessive deflection or tipping of the platform. A good rule of thumb to follow is that at the point where the full load has transferred onto the turntable platform, the center of gravity of the load should be at or inside the turntable support roller radius. The following formula can be used:

LOAD LENGTH > PLATFORM LENGTH – (2 x ROLLER RADIUS)

Consult the factory for cases where the above condition is not met.

SlidingLoads: In some cases loads may be slid onto a turntable platform.

Typically, loads are slid on the platform in increments. When sliding loads onto the platform it is important to consider impact, friction, and load center. Impact loading in a sliding application can occur when loads are slid into a stop on the turntable, and can cause excess wear or damage to the turntable drive or structure. As with conveyor applications with stops, load speed and weight are important details to consider. Consult the factory if heavy loads are to be impacting stops at higher speeds. Frictional forces caused by sliding on incremental loads typically are not high enough to create any problems. However, if high frictional forces are expected because of materials with a high coefficient of friction (rubber for example) and the load is to powered onto the turntable, consult the factory to prevent problems. It is important to follow the guidelines for offset loading (see previous section) when sliding on loads or whenever the load is rotated during the loading process.

Placed Or Stacked Loads: Loads may be placed or stacked on the turntable platform manually, with a fork lift, or vertically with a crane.

Manually stacking the load on the platform usually does not create any problems provided the boxes are evenly distributed on the platform and the center of gravity of the total load remains within the roller support circle. This type of operation imposes negligible impact and minimal edge loading.

Fork lifts may be used to place loads on turntables provided certain precautions are taken. The most important concern is avoiding impact shock loading. It is possible to generate high horizontal and rotational shock loads on the platform and structure due to the mass and velocity of the fork lift and load. This is particularly true if load positioning guides or stops are attached to the platform. A careless fork truck operator can cause significant damage to the turntable drive and structure by “ramming” loads into position against guides or stops rather than carefully placing them. Consult the factory whenever loading is by fork truck and stops or guides are to be used to position the load on the platform.

Vertical loading with a crane or other overhead device creates the possibility of high impact to the turntable. With a maximum capacity load, a lowering speed of 17 ft. per minute (fpm) will produce acceptable impact loads on a turntable. Speeds in excess of 17 fpm may create damage to the platform, support rollers, or structural members. Most industrial cranes are limited to speeds of 17 fpm or less, but applications with vacuum assist lifts, vertical conveyors or free fall applications, may produce harmful impacts. Obviously, the slower the rate of vertical impact the better.

Platform Size: The platform sizes must fall within the maximum and minimum sizes shown in the catalog. Note that if something is affixed to our platform like a conveyor or other device, it must also fall within the maximum size constraints listed for our platform, as the attached device in fact becomes the platform. Consult the factory for platform sizes outside the ranges listed in the catalog.

Speed Requirements: Usually the standard rotational speed and acceleration rates offered with each turntable model is satisfactory for most applications, but occasionally faster speeds are required. Standard acceleration and deceleration times are set at the factory at about 3 seconds for standard speed turntables and about 1 second for the high speed heavy duty turntables. In some cases it is possible to increase turntable speeds or decrease acceleration times, but compromises will have to be made. For example, increasing the maximum speed of the turntable increases the required torque of the drive motor and drive train of the turntable, and this would require a derating of the turntable capacity. In some limited cases it may be possible to increase the horsepower of the turntable drive to meet the increased torque demands of higher speed operation, but this may increase the costs significantly. Similarly, a reduction in the acceleration time would require a derating of the turntable capacity or an increase of the horsepower of the drive. Consult the factory with any speed or acceleration requirements that are outside standard parameters.

Duty Cycle Considerations: Primary considerations regarding the duty cycle of turntables are related to motor and motor drive heating. Standard turntable motors and drives are rated for continuous duty. This means that a turntable is capable of accelerating the rated load up to full speed and then maintaining this speed. However, many positioning applications require that a load be accelerated and decelerated many times within a short period of time. This can create motor and drive heating problems if it is done continuously with heavy loads, so the following guidelines should be followed. For standard speed turntables up to (5) start and stop cycles are permitted per minute. For high speed heavy duty turntables up to (15) start and stop cycles are permitted per minute. If the required cycle rate is near to or exceeds these guidelines, it is best to consult the factory to assure that problems do not occur. When calling, be prepared to provide the following information: description of process, degrees of rotation, times for rotation, load weight and size, and platform size.

Special Features & Accessories: These items are generally divided into two categories, standard options which are included in the catalog and price lists and those unusual items that must be priced by the factory.

Items that require factory consultation include:

- Special environments such as freezers, proximity to high heat, or damp locations.
- Special finishes such as stainless steel, polyurethane paints, epoxy paints.
- Any requirements that do not fit within any of our standard groups of equipment.
- Powered turntables: proximity sensors, precision control.

Items shown in our catalog and price lists: (see accessory sections)

- Push buttons, footswitches, and other control options.
- Oversize platforms and platforms with bevel toe guards.
- Non-powered turntables: detents, locking pins, hard stops.
- Powered turntables: limit switch stops.