



pennsylvania

DEPARTMENT OF AGRICULTURE
DIVISION OF RIDES AND AMUSEMENTS

Department of Agriculture
Division of Rides and Amusements

WALK THROUGH STUDY MATERIAL
for Pennsylvania Restricted Inspector Certification

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Pennsylvania Amusement Ride and Attraction Go Kart Inspector Study Guide Dear

Ride or Attraction Operator:

To prepare yourself for the Amusement Ride Inspector test, it will be helpful for you to become familiar with the following study guide. This study material has been compiled to help the applicant prepare for the Certified Amusement Ride Safety Inspector Test. This document does not include all information required to answer all the questions on the test. The information in this document covers the essential areas of Amusement Ride inspections and should be helpful in preparing to become a certified inspector as well as for the test.

Regulations - It is also essential that all inspectors are aware of the regulations and review them regularly. Be sure to review the regulations found at this link:

https://www.agriculture.pa.gov/consumer_protection/amusement%20rides/Documents/AMUSEMENT%20RIDE%20REGULATIONS%20-%207%20Pa%20Code%20Ch%20139.pdf

Seminar - You are required to attend an approved seminar at least once within each three-year certification period. Your required hours of training for Water Attraction certification is 16 hours. The seminar alone does not prepare you for the test. If you need to become certified and have not yet attended the required seminar, we may extend a one-time grace period until the next seminar so that you can comply immediately pending review of qualifications.

Test Application- An application to become a Pennsylvania Qualified Amusement Ride Inspector is at this link: [Certified Inspector Application](#) to schedule a test at an approved seminar or regionally.

The Amusement Ride Inspector test is administered by appointment throughout the year and during approved ride inspector safety seminars. If you wish to take the test, please contact Supervisor Joe Filoromo at 717-215-4316 or jfiloromo@pa.gov for any additional assistance.

The Department can and will change and up-date this material as necessary. The Department reserves the right to limit the number of times an unsuccessful person can attempt to pass the test to three (3).

The Department assesses a \$50.00 certification fee, payable the day of the test. Make checks payable to "Commonwealth of Pa". The Department cannot accept cash.

Questions should be submitted to jfiloromo@pa.gov or 717-215-4316.

Thank You,

Joseph G. Filoromo, Supervisor

Walk Through Attractions

Overview

Walk Through Attractions are a popular attraction at many different events and amusement facilities. These types of attractions can be enjoyable to patrons of all ages. Some can easily accommodate the handicapped as well.

These attractions can either be at a fixed location or they can be mobile to be erected and dismantled for use at many locations. Both types require some type of operator to be present and a daily inspection be completed. Mobile attractions will have more items to inspect compared to the Fixed location. Areas of the attraction that may need inspected more will be the trailer and support to the trailer. Pay attention to these areas as this can be an area that corrosion can be overlooked. Cracks can form in the welds, freeze damage from moisture in the tube structures over the winter and possibly unusual wear damage can pose a serious safety issue. These may not be an immediate safety hazard for the attraction during operation, however, inspection of the attraction should not stop at just the part of the attraction being used by patrons.

Some attractions will have different elements for the patron to interact with. The different elements require the inspector to be fluent in different aspects of equipment safety. Elements may be low toward the ground, near a patron's mid-section or overhead. The integrity of these elements is very important. Ones that are low can pose a trip hazard and others a little higher can strike patrons of different heights in the face or other parts of the body.

Sharp edges are one of the most common issues. These can be found anywhere from the entrance of the attraction to the exit. Plastic zip ties are used by everyone for all types of fastening. When zip ties are used and not snipped, the long tail left hanging can poke a patron's eye as they walk past. Zip ties that are snipped may have a sharp edge left that can easily cut a patron as they brush up against them. Pop rivets can also leave a sharp edge after being installed. After a rivet is installed, the shank is normally sheared off by the tool. This process can leave a sharp edge behind if the cutoff part of the shank still protrudes above the rivet. Some other areas for sharp edges could be from splintering wood, broken fence and other pointy objects. Pay attention to sharp edges around elements like slides. These types of elements put the patron in direct contact of the surface.

Emergency evacuation is another concern to be vigilant about. Often these types of attractions place the patron in a different sense of awareness. This can cause some confusion whether the perceived issue is part of the attraction or the need to evacuate to safety. Dead ends should not be greater than 75 feet from the most remote point to an exit. Other parts of the attraction may not be greater than 150 feet in an unsprinklered structure and 250 feet in a sprinklered structure. Exit doors need to open out and may not

Walk Through Attractions come in many varieties. Some of these types are Haunted Attractions, Fun Houses, Mazes, and Playports/Softplays. They have many similarities but they also each have their own inspection criteria. We will go over some important items for each type. Remember, there may be other types of Walk Through

Attractions that are not mentioned which will be like one of these.

Haunted Attractions

This type of Walk Through Attraction is possibly the most popular. This may be due to the amount of publicity and advertising there is by the industry. There may be more of the other types, but none have as much influence as the Haunted Attraction.

Most of these attractions are at fixed locations. The structural integrity of the building is something not to be overlooked. Sometimes an older building such as a barn may be used. The foundations may not be easily visible but need to be inspected. Crumbling stone can make the building overhead unstable and may even pose a trip hazard if the stone can fall into a walking path. Watch for foundations that may not hold water out when it rains. If water gets through, this can make the floor slippery at different times of operation. Water that gets through the foundation can be a sign of other problems. This could mean gutters and other types of drainage systems are not working properly. Left unchecked and maintained, this can pose a serious problem. A common thing to look for is 'washout' around the perimeter. 'Washout' can also occur around columns and posts used on the interior of a building. Pole buildings are used often instead of an old existing structure. Just because the building is newer does not mean a structural problem cannot occur.

Mobile Haunted Attractions have their own structural issues. These attractions may use different forms of supports and blocking. These supports and blocking act as the foundation for the attraction. 'Washout' can occur around the supports and blocking as well. Rain and water runoff from other areas should be diverted away so washout does not occur. Never use cinder blocks for blocking. Cinder blocks are made with small stones and cement. They can have the tendency to crumble when positioned wrong and/or under load. Be sure to use solid wood that is not rotted.

Haunted Attractions use different elements to scare or excite the sensibility of patrons. Elements can be physical and/or visual. It's obvious that visual may be the characters and the visual layout of the facility and rooms. Other visual elements can be strobe lights and laser lighting. Flashing strobe lights can trigger a response in some patrons that may have an epileptic seizure or other response. Laser lighting by a visual effect or even by an actor, should not be directed directly at a patron's facial area. Physical elements can be strings and other items dangling in a dark room. It may be a hallway with an air pillow that the patron squeezes through.

Some Haunts have started using different extreme elements. One is having the patron giving consent to touching. This may add a new flare to the attraction. This may place your Actors in a position that can be troublesome. Even with consent, Actors need to exercise some type of boundaries. Another extreme element may be the use of smells and the actors must be vigilant to the guest's actions in these areas.

Actor training is extremely important. The Actor is the first line of defense if there is an issue that requires evacuation. It is important the actors do all the other stuff as no touching and no scaring around stairways too. For evacuations, actors need to be able to get the patron to realize the difference between the haunt and the need to evacuate. Evacuation routes should be kept clear of debris and trip hazards. These areas should be well lit and emergency lights at all emergency exits. During a fire,

smoke rises, and the cleanest air is near the floor, so It is a good practice to have Exit signs near the floor as well as up high. Illumination of Exit and/or directional signs should be of the luminescent, self-luminous or electro-luminous type.

Funhouses

Funhouse attractions are primarily portable or mobile attractions. These attractions come in various types of themes. Some of the themes may be a scary or haunt theme. Others may be a friendly or “fun” theme to attract younger children.

Since these attractions are mostly mobile, they will be on trailers and require some setup once on location. This type may also require a power source from a generator. Many of these will not have actors but will have an operator or several operators. The difference may be that the operator’s main job is to control the flow and oversee the attraction. The operator is not there to scare the patron. A common location for a Funhouse will be the local carnival or fair.

Extra attention may be needed for structural areas of the attraction. The support members are removed for travelling and then reinstalled upon setup. There may be wind braces for scenery items that fold into place. It is important to install all braces as required by the manufacturer. Pay close attention to the hinge points of the scenery and other items that fold into place. Over time, rust or corrosion can cause the metal to weaken and crack in critical areas.

There are different elements inside the attraction for the patrons to interact with. Ensure the connection points for the elements are in satisfactory condition. The elements should be checked for sharp edges and not cause any trip hazards.

Nets are often used to keep patrons from falling. Be sure to inspect netting for rips and tears. Don’t forget to check the nets around the height of the patron. It’s easy to inspect netting as you walk through and not notice items as they are at a different eye level than you. Also, be sure to check the connection points of netting all around. Some patron bridges have netting fastened at the bottom that may look connected but might be torn. Use your foot to push the net away from a bridge slightly to expose any bad spots. Gaps where one’s foot can slip through will allow a small child to fall through the net.

The setup location can play an important role in the safety of operation as well as setting up and tearing down. Attractions are required to be more than 15 feet from overhead wires. Be observant of power lines as these attractions are being erected. Scenery panels may sometimes fold out past the trailer until they get into their final position. The safety of the employee setting up the attraction is equally as important as the patron. A flat surface is preferred but sometimes this may not be possible. Take into consideration the grade when placing on location.

Playports/Softplays

Playports and Softplays are a unique type of Walk Through attraction. These attractions are mostly for younger patrons and sometimes allow adults to accompany

their child. The attractions can be multi levels with padded landings, tunnels, slides, bridges, nets and special elements.

Height requirement rules are important to follow. The layouts can be confusing and pose a challenge for operators to oversee. There may also be a maximum number of patrons that is equally important. Too many patrons puts extra stress on the structure and may also make it difficult for the operator to know who all is on the attraction.

Evacuation of Playports is important to keep in mind. Unforeseen circumstances can cause the need to evacuate. Knowing how many patrons are in the attraction can speed up the evacuation and ensure none are left inside. Evacuations can be the entire group or may just be one of the children crawling around. The operator for these attractions should be one that can crawl through to aid patrons that need assistance.

The padding on the landings and walkways can get torn or ripped from the constant foot traffic. The nets also need checked for rips, tears or holes. The nets around the entrance to tunnels and other elements may need additional attention. There may be padding around the poles and also around other items. The plastic ties that hold the padding in place can come loose. This can cause the padding to loosen and expose the hard metal structure.

Special elements are changing the dynamics of how patrons interact in the Playports. Some of the elements may only be for a certain age, height or age group. This can be tricky for the operator to control the attraction. Some attractions may be punching bags, ball pits, zip lines, swings, spinning objects, ropes, etc. It is important to inspect these attractions daily and is recommended the operator goes through before his or her shift. Hanging elements that come loose may leave a metal surface exposed where a child can hit their head on.

There are other types of Walk Through attractions that are similar to one of the 3 mentioned above. As noted, they all have their own inspection items but are similar in many ways. Here are some common items to look for:

1. Emergency lighting present.
2. Emergency exits are identified and swing in the direction of Exit travel.
3. Emergency exit doors are readily opened from the inside and do not latch.
4. Door exit area is clear of debris and free of hazards.
5. Interior finishes and decorations should not be foamed plastics or other combustible material.
6. Fire retarder product applied to surfaces.
7. All hazardous electrical connections are covered and/or protected.
8. No slip, trip or fall hazards are present.
9. Props and furnishings are properly secured as to not fall onto patrons.
10. Railings for stairs, ramps and landings are the proper height and secure.

General Study Material

It is the intent of this study material to help the reader become a more valuable member of the amusement industry. It is anticipated that the reader intends to become a Certified Amusement Ride Inspector empowered to operate within the Commonwealth of Pennsylvania. Therefore, it is important for the reader to understand that the ability to become a Certified Ride Inspector rests on a combination of experience, mechanical aptitude, and testing ability. Because of the requirement for experience, **NOT ALL THE QUESTIONS ASKED IN THE CERIFICATION TEST ARE FOUND IN THIS STUDY MATERIAL.**

RESPONSIBILITY OF THE CERTIFIED RIDE INSPECTOR

It is **critical** to remember that the inspector who signs the inspection affidavit is the person **responsible** for the information found on that report.

Each inspector is responsible to provide a signed inspection affidavit for the inspection of **all** the rides he/she inspects.

Inspections conducted by a **team** of inspectors require that each team member submit an inspection affidavit for rides he/she inspected.

Multiple signers of an inspection affidavit will **void** the document; and require an appropriate inspection by an explanation to the Department of Agriculture.

HISTORY OF THE ACT

In 1984 the Pennsylvania Legislature enacted, and Governor Thornburg signed into law legislation “providing for the inspection of amusement rides and attractions; granting powers and imposing duties on the Department of Agriculture; creating the Amusement Ride Safety Advisory Board; and imposing civil and criminal penalties”. This (Act 1984-81) is known as “The Amusement Ride Inspection Act”.

This Act empowers the Department of Agriculture to develop and enforce regulations found in 7 Pa. Code, Chapter 139. It is the Act and the accompanying regulations that will dictate the actions of Certified Amusement Ride Inspectors.

GUIDELINES FOR RIDE INSPECITON

LOCATION AND INSTALLATION:

1. Free from Adjacent Hazards and Interferences:

All rides, walk through shows, and funhouses, should be located in such a manner that they do not physically interfere with other rides. Severe and even fatal accidents have occurred as a result of improperly placed rides.

Operating clearances should be carefully verified for each ride prior to passenger loading. Nearby utility poles, trees, buildings, and other structures may present interference to safe ride operation and their clearances should be verified. There shall be a six-foot clearance between rides. Particular attention should be paid to overhanging items such as lighting, power lines, telephone cables, overhead piping, guy wires, and anything which is apt to be a hazard to the safe operation of the ride. It should be noted that power lines may increase their sag under conditions of hot weather and heavy current draw (after the initial inspection). Be sure to take this possibility into account when inspections are made.

Rides and fencing should be so located that it is impossible for a person to reach over the fence and grab the hand of a passenger reaching out of a carrier.

2. In Level Position on Solid Ground or Pavement:

Portable rides are intended for installation on solid ground or pavement. They are designed in such a manner that no special foundations are required. Many of them are trailer mounted and have outrigger supports to provide stability and to resist wind forces. Some have hydraulic or mechanical jacks to assist in installation and leveling. Some will require blocking to produce a satisfactory installation.

Assuming that the soil or pavement is adequate to provide ride support, it is desirable that the ride be approximately level after all adjustments are made. This can usually be done by sighting the ride from several directions.

A small hand level can be used to arrive at a more accurate determination. In general, the taller the ride the more need for accurate leveling.

3. Properly Blocked and Jacked:

Every ride installation should be examined to determine that the blocking or jacks, which have been used, are doing their job and not presenting a hazard in themselves. Narrow blocking should be avoided since the blocking should spread the load over a larger area and not concentrate it. Excessively high blocking contributes to instability. Poorly placed blocking can contribute to instability and should not be permitted. Blocking should be placed at the points which the manufacturer has indicated as being proper. In the absence of specific information, the blocking should be placed under the obvious strong points of the main frame or outriggers of the ride. Blocking generally should not be placed at locations where the structure may be observed to move or bend on the blocking as the ride operates. The structure and blocking should be checked to assure that the structure is resting firmly on the blocking and that a suitable number of blocks have been used to properly support the ride structure.

If the ride is equipped with mechanical or hydraulic jacks, the inspection is simplified. The jacks should be examined to make sure that they are in good mechanical condition and being used properly. Check for missing parts such as the base plate on the end of the Jack screw or cylinder. If the original plate is missing and another plate or wood block has been substituted, make sure it is of adequate size to properly spread the load (as the original one did). It should be noted that hydraulic pressure can increase in the jack due to expansion when the jack is exposed to heat and direct sun rays. This increased pressure can cause the leveling jack to raise the ride off the locking rings or support and create an unstable condition. This condition can be avoided if the needle valves and hand pump valve are opened to relieve pressure on the leveling jacks after the ride is leveled and otherwise supported. Whether the ride has been blocked, jacked, or a combination of the two achieve level conditions, the important thing is to be sure that the ride is not only level, but also supported securely on the blocks or jacks.

In all cases, the ride structure, and the blocks or jacks, should finally be examined when the ride is running. This is in order to be sure the support is proper, and nothing has been overlooked. On some rides, the rides frame tends to move relative to the blocking during the ride operation. For this reason, the ride should be examined periodically during its operation to assure it does not move off the blocking. Blocking shall have the same width, length, and height. (e.g. Four-Foot-high requires 4' X 4' base)

4. Properly Anchored, Braced and Guyed:

If a ride requires anchors, braces, or guy lines to produce a satisfactory installation, they should be properly installed before the ride is permitted to operate. Items such as the inflatable plastic pillows, (i.e., Moonwalk, etc.), need to be anchored securely in position as they tend to move around rather easily in operation. Stakes are commonly used in conjunction with lines from the pillow in a manner like staking a tent. In this situation, the installation should be examined to make sure that a sufficient number of stakes have been properly installed to secure the item in position. The stakes, particularly near the entrance, should not be installed in such a manner as to present a stumbling or tripping hazard. On hard pavements where it is difficult to drive stakes, concrete anchors (similar to boat anchors) or sandbags are sometimes used. These can be effective and should be permitted if they are of adequate weight and appear to satisfactorily restrain the pillow.

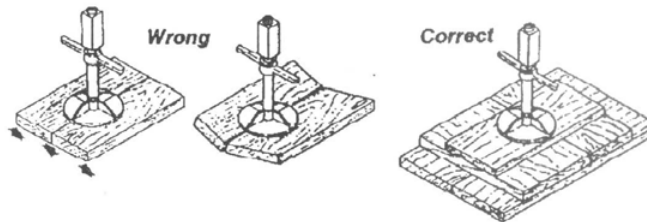
Leveling and blocking (portable models)

1. Inspect leveling and blocking at each set up and at the start of each day (rides erected in soft locations require more frequent inspection).

2. Inspect for proper cross blocking or crib blocking. Cross blocking distributes weight evenly.

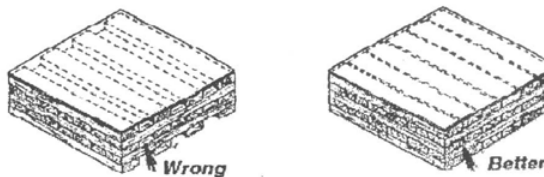
*Always cross block
Cross blocking distributes weight evenly.*

*Recommended blocking:
3 X 12 X 36" and 3 X 12 X 24"
unless otherwise noted.*



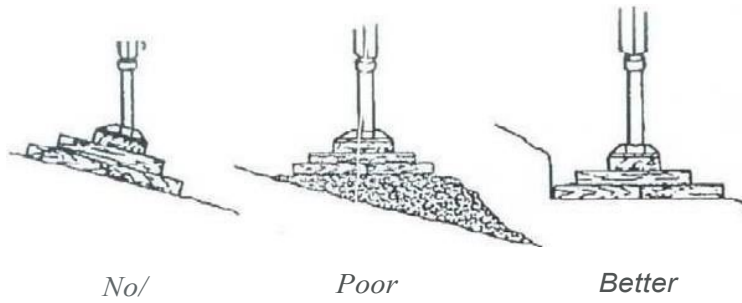
To avoid crushing under load "crib" blocking should be spaced no more than 1/4" for drainage.

*"Crib" blocking
Large voids can let blocking crush under load. 1/4" spaces allow adequate drainage.*



3. Inspect blocking for proper contact with ground

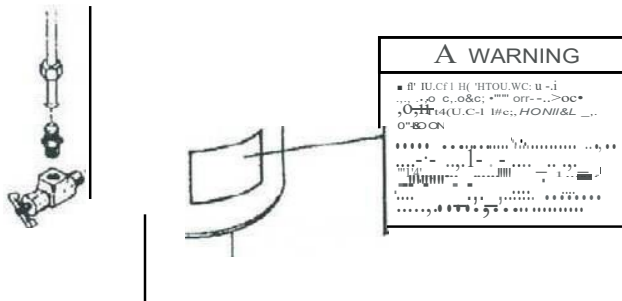
4. Level ground under blocking by digging where possible, instead of filling. Fill dirt will be soft and allow settling.



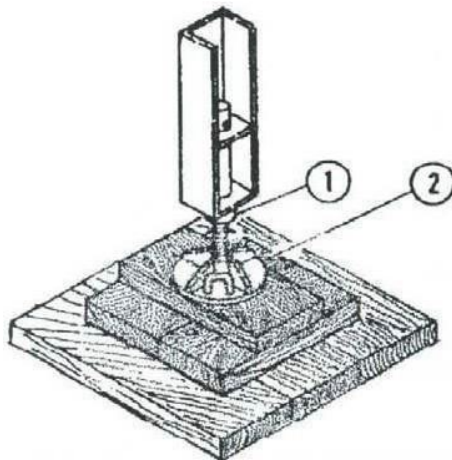
Block on a slope

Level the ground beneath blocking by digging with a shovel. Don't fill, the dirt will be soft allowing the rig to tilt

- Inspect hydraulic cylinders for leakage at every set-up. The cylinders are for leveling purposes only. They must be banded and their shut-off valves closed during operation. They must be fully retracted and their shut-off valves closed before transporting the rig.



6. Check the lock ring, on all screw jacks for tightness.



1. Screw Jack
2. Lock ring

Bracing of a demountable nature is often used both on the ride structure and to support scenery panels. This bracing should be checked to verify it is present, installed at the proper locations, and adequately secured. A thorough visual examination of the ride will usually enable one to spot missing braces. Clues to look to for are holes not filled with bolts or pins. These may be intended as attachment points for braces. **In case of doubt, refer to the manufacturer's manual for definite information.**

Some rides, particularly high structures, use guy wires or cables to prevent collapse from wind loads or to tie various parts of the ride structure together more or less rigidly. Guy wires and wind braces, where necessary, should be properly placed, properly adjusted, and in good condition in order to accomplish their job. Connection points of all guy wires should be examined to be sure they are of good quality. If the connection is made to a stake in the ground, be sure that the stake is suitable anchored in the ground (or pavement) so it does not yield and allow the guy wire to develop excessive slack. Guy wires, many times, occur in pairs and when properly adjusted, will have nearly equal tension in both wires of the pair. If the wires are not properly adjusted, excessive movement of the ride may occur. The manufacturer's manual is a good reference to determine the number, placement and adjustment of the guy wires or cables.

5. Stairs and Walkways in safe and Secure Condition:

Walkways should be solid and free of projections which might cause stumbling. Extremely smooth metal or wood surfaces can result from normal traffic wear. These can be conducive to falls and can be quite dangerous, particularly when wet. When these conditions are encountered, corrections should be made before operation is permitted. Handrails should be present on stairs and ramps. Walkways may or may not need handrails depending on the physical layout. The judgement and discretion of the inspector will be required in some cases to assess the degree of hazard involved and the correction to be made. Bear in mind that public safety is paramount. On rides where the public enters or exits above grade, the stairs, ramps, and walkways should be checked to be sure they are in good condition.

6. Proper Fencing and Railings

All rides must be adequately fenced to provide protection to spectators and riders. Fences should be located to provide a safe distance from the outmost point of swings or aerial rides.

Breaks in fencing be limited to those necessary to allow proper entrance and exit by passengers. Slides, or their walkways, should be protected by guards to restrain the person sliding from falling over the side. Power units should be shielded from the public. In some cases, this will require fencing. Depending upon the construction of the power unit, however, some units can be shielded by barricades or screen panels at the openings of the trailer containing the power unit. **The inspector should use his judgement to determine that a proper result is being obtained.**

7. Fire Extinguishers- Number, Size & Locations:

The Inspector should verify that a properly charged fire extinguisher is present on every site and that the operator knows its location. All extinguishers should meet the standards of state and local fire officials.

8. Free of Unguarded Pinch Points:

Rides and shows should be carefully examined for areas where a person might be struck by, caught in, caught between, or otherwise exposed to moving parts or hazards. Be alert to the possibility that children and even adults sometimes do unexpected things and thereby risk their own safety.

STRUCTURAL INTEGRITY:

9. Assembled in Correct Manner:

A ride, when completely assembled, should be examined to determine if it has been put together properly. Previous experience and the manufacturer's manual will be of value in making this determination. Gross mis-assembled will be rather obvious by comparing the assembled ride with photos or drawings in the manual.

Some mis-assembly will be less obvious, such as a member being bolted to the wrong place or attached to the wrong side of another member.

Sometimes this can be determined by an examination of photos or sketches and sometimes it "**Just doesn't look right**". Any sign or clue of improper assembly should be reason not to allow the ride to operate until the correctness of the assembly has been determined. In case of doubt, contact the inspection office. The essence of correct assembly is the use of proper components in the right places. Be alert to areas which have been modified from the manufactured configuration. Mechanical items which you know or suspect to be different from the original item should be checked to determine if they appear adequate for the job. They should also be looked at from the standpoint of their effect upon the characteristic of the ride such as speed, control, braking, etc. If the substituted item has deteriorated the quality and safety of the ride, then its use should not be permitted.

10. Free of Cracks and Excessive Wear:

Most manufacturer's service manuals and bulletins will indicate the areas where heavy stresses occur and where cracks are prone to develop. The bulletins usually pinpoint specific areas where problems have been found and indicate the corrective action necessary. In some cases, modification kits are required to correct the problem. In other cases, instructions are given for making repairs on the existing members. It should be remembered information is not exhaustive and cracks or other problems may develop in areas for which there is no information available. If the repair is to be made by welding, it should be done by a welder skilled in this type of repair. If cracks are welded cracks structural members which show evidence of abuse, extensive welding, or widespread cracking should be recommended for further repair. Poor quality welds can many times be detected by their appearance. In case of doubt, do not permit a ride with evidence of poor welding to operate until satisfactory correction has been made. In some cases, the manufacturer will indicate that a particular member is not to be repaired by welding. Any cases of this nature should be cause not to allow the ride to operate no matter how good the weld may appear to be. **Insist that**

the repair be made in accordance with the manufacturer's specifications.

Cracked paint may or may not indicate a cracked area. It is a good clue, however, and all such locations should be examined carefully. The areas around bolt and pin holes should be examined for cracks. Pins and bolts in critical areas should also be checked for evidence of cracks, particularly in the threaded portions, around cotter or pin holes and under the head. In case of doubt, have the bolt or pin replaced before operation.

During the examinations of the structure for cracks, the inspector should look for loosened bolts or rivets and badly worn or elongated holes. Pinned connections or other joints that have developed excessive wear should be recommended for repairs in accordance with manufacturer's specifications.

11. Properly Pinned with Correct Grade of Bolts:

Ride manufacturers use bolts throughout their products. Many in locations where failure could be catastrophic with injury or death resulting. Inspectors and others, concerned with ride safety, need to familiarize themselves with the various types and grades of bolts used by the ride industry. Identification of bolts that are in place on a structure should be of particular concern to inspectors and ride maintenance personnel. Rides built by European manufacturers will contain graded metric bolts. The inspector should check for loose bolts and verify that common bolts have not been substituted for graded bolts. Particular attention should be given to the main ride structure, sweep connections, tub and car attachments, and nay connection where bolt failure could be catastrophic.

12. Properly Pinned Secured with Retainers:

As an aid to rapid assembly and disassembly, many ride connections are made with pull pins rather than bolts. The type of pin used is designed to be used with a spring pin ("R" pin or other type) as a retainer to prevent the pull pin from working out as the ride operates. These pins have strength qualities similar to graded bolts. The inspector should make sure that any pins which have developed cracks should be replaced. Spring retaining pins, ("R" pins), which have spread to the point that they are no longer held securely in position, should also be replaced.

13. Properly Aligned Including Sheaves and Cables:

A ride should be inspected for alignment of major parts such as uprights, wheels, bearings, sheaves, guides, couplings, cables, gearing, shafting and

other mechanical parts or assemblies. Most out of line conditions can be determined by visual inspection. In case of doubt, contact the inspection office.

14. Cables, Chains, Belts and Gearing in Safe Condition:

All wire rope, whether used for support or drive cables or for any other purpose, must be thoroughly examined. Wire rope found to be damaged is to be repaired or replaced with new rope of proper design and capacity, in accordance with the ride manufacturer's specifications. Any of the following conditions is cause for rope replacement or repair:

- A. In running ropes, six randomly distributed wires in one rope lay, or three broken wires in one strand in one rope lay. A rope lay is the length along the rope in which one strand makes a complete revolution around the rope.
- B. In pendants or standing ropes (ropes bearing the entire load and subjected to constant pressure and surge shocks), evidence of more than one broken wire in one rope lay.
- C. Heat damage including welding, brazing and soldering to the rope itself.
- D. Improper use of Clamps and Excessive Splicing:

All mechanical devices that brake, control, or come in contact with wire rope, such as rollers, drums and sheaves must be examined for broken chips, undue roughness, uneven or extreme wear.

Chains, belts, gearing and other drive components should be checked to make sure that they are in satisfactory operating condition and show evidence of proper lubrication.

Support chains such as those used to support chair seats on swings should be examined to make sure they are in good condition and are attached safely. Extreme wear, cracked or broken links or attachments, call for immediate replacement. It is recommended that chain be welded link and of proper capacity; and any components shall be of compatible material. Check with Manufacturer for proper type of chain.

LOCK-OUT / TAG-OUT

Whenever it becomes necessary to work on belting or any piece of machinery, employees shall assure themselves that a proper tag is attached to the pump, governor, valve throttle, switch, or other device used to set the machine into motion.

The equipment shall be de-energized and locked out. Each employee should be assigned one 6 hole "scissors-type" lock-out assembly, two personal padlocks (for which only the employee will have keys) and two plastic "Danger-do Not Operate" tags to be used in conjunction with the padlocks and lock-out device.

These lock-out tools must be carried by the employee to the job site at all times, and be properly installed before any work is performed on electrical or mechanical equipment whenever there is the possibility of electrical shock, or of the possibility of machinery being set in motion while work is being performed.

Each person working on the job must install a padlock and tag identified and employees name on the lock-out device before beginning to work and should remove the personalized lock and tag when leaving the job site.

If the machinery does not have a safety switch or does not have a switch that can be locked off, notify the electrical department prior to beginning work.

The electrical crew will remove fuses or disconnect wires in order to make the job safe to perform the work.

Red tagging where fuses are removed or wires disconnected must be done by the electrician and only the electrician can restore power by making the necessary connections.

Locking a push-button station stop button "off" shall not be considered as safety locked off, because a problem with the wiring or someone tampering with the motor starter could energize the equipment.

In a case where a circuit breaker is the only disconnecting means, in lieu of disconnecting wires, a "Do Not Operate" tag may be securely attached to the turned off breaker and a guard posted to assure that no one turns the circuit on.

No one may, at any time remove any other persons locking device, or start up any equipment while anyone else has it locked out.

LOCK-OUT PROCEDURES:

To assure the safety of maintenance working on or about any large piece of equipment such as an amusement ride/attraction or device, lock-out procedures should be developed and implemented.

The following is an example of a typical maintenance lock-out procedure.

(Example:)

Lock-out procedure Ride/Attraction:

The main key switch of the control power must be locked in the off position and the key removed to avoid any accidental start-up of the device while personnel are working on it.

A red tag must be affixed to the emergency stop button before any maintenance work can be carried out on the ride or attraction.

Maintenance:

Employees working about moving machinery or live equipment and circuits shall proceed with great care when performing their work, considering carefully each act and doing nothing which may endanger themselves or others.

Employees shall be careful to place themselves in a safe and secure position and to avoid slipping, stumbling or moving backward into moving machinery or live parts, or into openings.

Note:

It is recommended that all power and operating machinery be locked off prior to any work being started, however where live electrical circuits and operating machinery is necessary to perform required work, a minimum of two (2) qualified persons should be required in these locations maintaining radio, or telephone communications to the ride/attraction control operator.

IDENTIFICATION OF FASTENER GRADES

Virtually every mechanical assembly used by industry, transportation and construction is literally held together with fasteners.

Few of us realize how important the quality of these fasteners is in assuring that the equipment we depend on daily is safe and reliable.

Before a mechanic can select the correct grade of fastener for the application and determine the proper installation torque, he must know the strength of each grade and be able to tell one from the other. This becomes vitally important when a mechanic removes an OEM specified bolt from a connection to perform regular maintenance. The mechanic must identify the grade of fastener removed and replace that bolt with the SAME grade.

Failure to do so could result in an accident because of a lesser grade bolt used in the connection. This may cause expensive property damage and/or sever personal injury. Extensive liability suits could result.

Four nationally recognized technical groups of engineers define fastener standards and specifications. These organizations are the Society of Automotive Engineers (SAE), the American Society for Testing and Materials (ASTM), the International Standards Organization (ISO), and the Industrial Fastener Institute (IFI). They have established a method of identifying various grades of fasteners. They also established the minimum strength requirements, chemical analysis of steel to be used and, where called for, the degree of heat treatment that is permissible for each grade. The following chart shows the head markings in use, and the material and mechanical requirements for each SAE grade.

Besides the standard grad markings on the heads of the fasteners, as indicated in the Head Marking Chart, most fasteners manufactured in North America have a manufacturer's identification logo placed somewhere on the product.

A listing of these logos is found in the IFI-122 publication issued by the Industrial Fasteners Institute, Cleveland, Ohio. The purpose is for identity and traceability. These fasteners MUST meet the indicated SAE specifications. If, for instance, there are just three radial lines on the head, indicating it to be Grade 5, with other markings, then the bolt is imported. This is very important because U.S. laws do not apply in foreign countries. We are not to say that imported fasteners without a manufacturer I.D. do not meet SAE specifications...they just don't HAVE to meet them; and there is no incoming inspection made of imported fasteners by the brokerage firms that import and distribute them.

The Bowman Distribution Engineering Department has tested imported bolts marked with Grad 8 radial lines that did not meet Grade 5 specifications; yet others out of the same box, identical in appearance, would meet the required specifications. The point is, with imported bolts, you must know WHAT you are buying.

Imported fasteners are purchased by brokers who buy from many different sources. In the case of a liability claim, if there isn't a manufacturer's I.D., there is absolutely NO WAY to trace the manufacturer of the bolt.

The chart in this book lists the different SAE and Metric grades of fasteners.

With the trend of downsizing in the automotive industry and the increasing use of metrics, original equipment manufacturers could not rely upon the strength of the Property Class 8.8. Instead, they have automatically upgraded themselves with an increase in strength by specifying the 9.8 Property Class.

Although some Grade 6 fasteners (formally discontinued by SAE in 1964), or those marked with only four radial lines, may have tensile strengths which are close to or compare to those of the Grade 8, NEVER substitute a Grade 6 for the Grade 8. They will not meet the SAE Grade 8 steel chemistry requirements. Where an SAE Grade 8 cap screw is specified, or designated as OEM, ALWAYS make replacements with the SAME grade to prevent liability claims. Consult your service manuals or factory representative for verification.

Glossary of Terms

ASTM American Society for Testing Materials
(Chemical & Physical Specifications)

ANSI American National Standards Institute (Dimensional Specifications)

SAE Society of Automotive Engineers
Specification of Grade 5 and Grade 8 Hardware

ASME American Society of Mechanical Engineers

ISO International Organization for Standards

FQA Fastener Quality Act (Public Law 101-592) To be enacted May 27, 1998

BASIC FASTENERS

Product Identification	Industry Standard	Material	Nominal Product Description	Tensile Strength	Rockwell Hardness	Material Reference For Marking Nut
	SAE J429 Grade 1	1010-1020 Low Carbon Steel	1/4 thru 1 1/2	60,000	670-6100	
	SAE J429 Grade 2	1010-1020 Low Carbon Steel	1/4 thru 3/4 5/8 thru 1 1/2	74,000 60,000	600-6100 670-6100	
	ISO 1501 Property Class 5.8 & 5.11	Low to Medium Carbon Steel	M5 thru M24	75.400 (520MPa)	662-695	
	A. TMA-449 TY J429 Grade 5	Low to Medium Carbon Steel heat treated	M4 thru 1/2	120,000	C26-04	
			D, 1/2 thru 1 1/2	105,000	C19-C30	
	ISO 1501 Property Class 6.8 & 8.8	Medium Carbon Steel	M4 thru M16	116,000 (800MPa)	C20-CW	
			M17 thru M30	120,350 (830MPa)	C23-CM	
	A9 TMA19B-7	4140 Chromium Molybdenum Alloy Steel	Thru and Studs 2 V2 thru 6	125,000	-	
	SAE J429 Grade 8	Austenitic Stainless Steel	V4 thru 3/4	150,000	C33	
			7/16 thru 5/8			
	ASTM A574 Grade 4	Specialty Alloy Steel	1/4 thru 1 1/2	1150,000	C33-C39	
	SAE J429 Grade 8	Low Carbon Steel	1/4 thru 1	150,000	CW-C39	
	ISO 1501 Property Class 10.9 & 12.9	Medium Carbon Steel	M6 thru M16	150,800 (1010MPa)	C42	
	Kanloy	Proprietary Alloy Steel	V4 thru 1	180,000-200,000	C56-C42	

BASIC FASTENERS

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Inspection

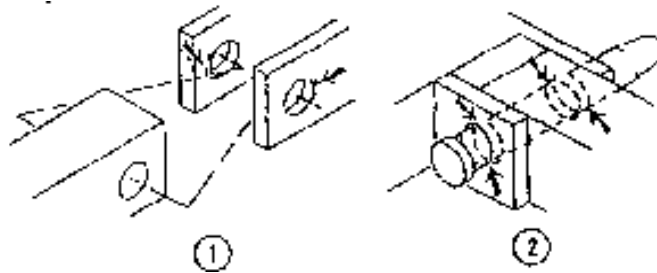
Joint Inspection

Some joints will appear to wear rapidly on new rides. This is usually a result of the holes not aligning in the mating parts. When this condition occurs, it results in “point contact”. A joint with this condition will generally wear rapidly until the load is distributed evenly over the fastener and the parts.

If in doubt about the condition of a bolt, pin or hole on a new ride consult the manufacturer and replace as required.

1. Inspect stationary joints for “egg-shaped” wear and loose pines

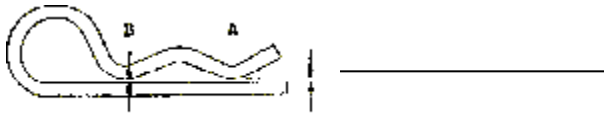
1. Stationary joint wear
2. Stationary joint-misaligned holes resulting in point contact



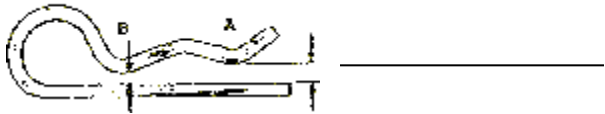
1. Severe corrosion
 - a. Rust appearing to stem from interior of cable.
 - b. Cable appears clean but previous corrosion is evident from pitted condition in wires.
2. Inspect moving joints for wear and lubrication.
3. Inspect welded structural joints for cracking or fatiguing.
4. Inspect bolted structural joints for cracking, fatiguing and proper bolt tightness.
5. Inspect pine and keepers on all pin joints for wear and proper installation.
6. Inspect all pins for proper manufacturer identification marks.

Cable Inspection

Replace cables if any of the following conditions exist. If more than one cable is used, cables must be replaced as a set.



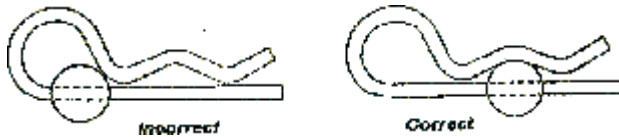
Acceptable hair pins
 Dimension "A" equal's
 dimension "B" in a relaxed
 position



Unacceptable hair pins
 Dimension "A" is greater than
 dimension "B" in a relaxed
 position

**NEVER ATTEMPT TO BEND A HAIR PIN BACK INTO SHAPE
 REPLACE IT WITH A NEW PART.**

The correct installation of a hairpin is shown. Incorrectly installed hairpins are more likely to fall, and will distort after only a few users.



Recognize and recommend the safety procedures specified in ASTM Standards F770 Operation Procedures for Amusement Rides and Devices and F853 Maintenance Procedures for Amusement Rides and Devices.

FIRE SAFETY & FIRE EXTINGUISHERS

Fires have played a part in the amusement industry for many years. In the early 1900's fire destroyed many amusement piers and parks. In the mid-eighties, a devastating fire in New Jersey claimed the lives of 7 teenage park visitors while they were walking through a Haunted House type attraction made up of a series of trailers. Amusement ride regulations were implemented by a number of states, including Pennsylvania, following the fire in New Jersey.

Fire Safety and Fire Extinguishers play a part in the inspections, operations and maintenance of every fixed site and mobile amusement operation. Areas of concern in the amusement industry include such things as Walk through Attractions, Gas Powered Rides, Generators, Stock Trailers and Warehouses, electrical Equipment, Dark Rides, Flammable and Combustible Liquid Storage, as well many other attractions, amusement rides and devices to numerous to mention.

The National Fire Protection Association (NFPA) has classified four general types of fires, based on the combustible materials involved and the type of extinguisher needed to put them out. The four fire classifications are A,B,C and D. Each classification has a special symbol and color identification

General Classes of Fires

- Class A: This type of fire is the most common. The combustible materials are things such as wood, cloth, paper, rubber and plastics. The common extinguisher agent is water, but dry chemicals are also effective.
- Class B: Flammable liquids, gases and greases create class B fires. Extinguishers to use are foam, carbon dioxide and dry chemical.
- Class C: These fires are electrical fires and non-conducting agent must be used. Carbon dioxide and dry chemical extinguishers are to be used.
- Class D: Combustible metals fires such as magnesium, titanium and sodium.
- Class E: These fires require specialized techniques to extinguish them.

Types of Fire Extinguishers

Here is a list of fire extinguishers most commonly found in an amusement operation:

- Water
- Carbon Dioxide
- Dry Chemical
- Multipurpose Dry Chemical

Multipurpose fire extinguishers (ABC) will handle all A, B, and C fires. All fire extinguishers are labeled with either ABC, or A, or B or C, so be sure to read the labels.

How to Use a Fire Extinguisher

Even though extinguishers come in several shapes and sizes, they all operate in a similar manner. Here's an easy acronym for fire extinguisher use:

P A S S - Pull, Aim, Squeeze, Sweep

- | | |
|----------------|---|
| PULL | the pin at the top of the extinguisher that keeps the handle from being accidentally pressed. |
| AIM | the nozzle toward the base of the fire |
| SQUEEZE | stand approximately 8 feet away from the fire and squeeze the handle to discharge the extinguisher. If you release the handle, the discharge will stop. |
| SWEEP | the nozzle back and forth at the base of the fire. After the fire appears to be out, watch it carefully since it may re-ignite! |

Suggested Areas to Check during Fire Safety Inspections

- Trash and litter, no unnecessary accumulation
- Housekeeping, rides and work areas neat and clean
- Fire extinguishers, well-marked, correct types, charged and ready to go
- Hazardous Materials, stored in designated areas
- Exits, well-marked and unobstructed
- Wiring, good connections, good grounds, insulation intact
- Smoking, only in designated areas, signs posted
- Flammable materials, being handle with care, sign posted where applicable

**Please note, this is not an all-inclusive list. Inspectors are encouraged to develop their own list of inspection points.