

**Oklahoma Department of Labor  
Safety Standards Division**

**Water Related Amusement Ride/Device Inspection Criteria**

Revision 6  
March 16, 2020

*The following inspection criteria are provided to augment the minimum requirements of the manufacture's guidelines for Water Type Amusement Rides/Devices. These criteria have been developed based on a review of manufacture's requirements, generally accepted engineering methods, ASTM F-24 (F 2376-17A), and the Oklahoma Amusement Ride Safety Law (40 O.S. - 460-469). These guidelines **Do Not** supersede any other guidelines/requirements of other local, state, federal governmental agencies. Each owner, manager or operator who provides for public use and operation Water Related Amusement Rides/Devices, for the purpose of providing amusement, thrills or excitement shall abide by these criteria.*

**“NOTE”: ALL WATER TYPE AMUSEMENT RIDES/DEVICES SHALL BE ERECTED OPERATED AND MAINTAINED IN ACCORDANCE WITH THE MANUFACTURE’S GUIDELINES UNLESS IT IS DETERMINED BY THE COMMISSIONER OF LABOR THAT THE MANUFACTURES’S GUIDELINES DO NOT PROVIDE FOR THE ADEQUATE PROTECTION OF THE GENERAL PUBLIC.**

## **Ride Design**

1. All Water Related Amusement Ride/Devices shall meet the requirements as outlined in the latest edition of the ASTM F-24 (F-2376-17A), Oklahoma Amusement Ride Safety Law, generally accepted engineering methods;
  - a. Pre-existing Water Related Amusement Ride/ Devices not meeting the ASTM F-24 (F-2376-17A) shall be required to provide documentation, showing they met the building codes in force, generally accepted engineering methods when constructed. An engineering certificate from a licensed professional engineer may be required.
  - b. All Bolts, nuts, fasteners use in Water Related Amusement Ride/Devices shall be a minimum of Grade 5 and in good condition.
  - c. All materials used shall be demonstrated as strong enough to support specified loads.
  - d. Components, maintained using the manufacturer's instructions shall not deteriorate over time in such a way that a hazard will develop.
  - e. Supports shall be constructed from durable materials such as wood, metal, concrete or engineered composites.
  - f. Metal structures/ supports shall be inherently corrosion resistant, or be finished in such a way to provide protection against deterioration. Metal structures shall be designed in accordance with current AISC, ASCE standards or equivalent standards
  - g. Wooden structures/supports shall be finished in such a way to provide protection against deterioration. Wooden structures shall be designed in accordance with USDA-72, ASCE standards or equivalent standards.
  - h. Plastic and Plastic Composite structures shall be designed in accordance with generally accepted engineering methods. Assessment shall be performed in a manner suitable for the specific material and structure.

## **Ride Design**

- I. Concrete structures/supports shall be designed in accordance with current ACI-318 or equivalent national standards.
- j. Fiberglass reinforced plastic or other composite materials used structurally shall have samples tested for strength with accelerated aging in accordance with Test Methods D 570, D 638 and D 790.
- k. Loads from normal operational conditions shall demonstrate a minimum of 5 to 1 factor of safety against rupture for fiberglass, reinforced plastic or other composite materials.
- l. Calculations for extraordinary operational conditions from user overload shall demonstrate a minimum of 2 to 1 factor of safety against rupture of fiberglass, reinforced plastic or other composite materials.
- m. All supports shall be constructed to accommodate regular inspection and maintenance for structural integrity, material deterioration or corrosion or a combination thereof.
- n. The manufacture shall determine the water flow rate and shall set a fixed range of acceptability for each installation at the time of commissioning.
- o. Flow meters, calibrated means of flow measurement or marker indicating proper operational water flow/level shall be provided for each ride/device.

## **Water Related Amusement Rides/Devices**

### **General**

1. All rides/devices shall be designed and constructed so that the forces on riders, allow the rider to use the ride/device in accordance with the rules and instructions under normal operating conditions;
  - a. Surfaces in reach by attendants and riders shall be made in such a way as to reduce the potential for injury.
  - b. Fencing, guardrails and handrails shall be installed in accordance with Section of ASTM F-24 (F 2291).
  - c. If a ride/device includes a starting platform and the platform is more than 21" above surrounding terrain, the platform shall provide at least 36" distance between the ride/device entry and the top of stairs or ramp. Sufficient space shall be provided on the platform for attendant work space, safety signage and any communication devices needed for operation. Except where a stair or ramp or slide entry joins it, the platform shall be surrounded on all sides by a guardrail.
  - d. The surface of steps, access ramp and deck shall be slip-resistant and self-draining. Steps shall have yellow or contrasting stripe on the edge of steps indicating a grade change.
  - e. Ride/device entry sections should interface with the platform guardrail so that a 4" sphere cannot pass between the ride/device entry component and the adjacent guardrail component.
  - f. Ride/device sidewalls and bottoms shall be a smooth surface to minimize skin abrasions.
  - g. The ride/devices epoxy or paint shall not be bubbling or peeling within the ride/device.
  - h. Ride/device, vehicles, mats or tubes shall be properly stored and maintained. Vehicles, mats or tubes shall be stored in a designated area out of the guest traffic area.
  - i. The water flow valves shall be secured from interference or adjustment by unauthorized personal.
  - j. When life jackets are provided for any patron, the life jackets shall be U.S. Coast Guard approved, correctly sized and in good condition.

### **Open Slides**

1. Open Slides less than 18ft are exempt from inspection.

### **Open Flume**

1. Flume cross-section shape shall be configured to contain the rider(s), vehicle, mat and/or tube under all reasonable operating conditions. Total depth of section and shape of cross-section of a flume may be created in a single piece or more than one piece.
2. Open water slide flumes shall be kept clear of obstacles within the water slide clearance envelope. Flume riser sections may be added to block access to anything encroaching the area.
3. Water slides shall have additional sidewall height provided by a flume riser on the outside part of all horizontal curves to contain the rider. This flume riser shall be concave facing the center of the cross-section. The flume riser may be an integral or separate part of the main flume component.

### **Open Flume**

4. Flume Riser Transition-Flume riser parts shall be transitioned from sections without flume risers to sections with flume risers with a maximum angle of 45 degrees from the horizontal.
5. Other Additions-Where a cover, a tube entrance or flume riser is fitted other than at the beginning of the slide, the sides of the slide shall have a smooth transition from horizontal to vertical. Maximum angle of transition shall be 45 degrees. The inside height of the entrance to the cover or flume riser shall be at least 48".
6. Body slides with curved bottom flume sections such that the cross-section of the bottom and sides shall have a minimum inside width of 30", minimum sidewall height of 15" and the top 1" of curved sidewalls shall be within 10 degrees of vertical.
7. Tube slides with a flat bottom flume sections shall have, minimum width of 48" inside sidewalls, minimum sidewall height of 24" and sidewalls that are straight may diverge from vertical a maximum of 2" measured at 24" from bottom.
8. Tube slides with a curved bottom flume sections such that the cross-section of the bottom and the sides are a continuously curving surface shall have, minimum inside width of 52" minimum sidewall height of 26" and the top 1" of curved sidewalls shall be within 10 degrees of vertical.
9. Mat Slides that are straight in plan shall have, minimum width of 22" inside sidewalls, minimum sidewall height of 16", the top, sidewalls that are straight may diverge from vertical a maximum of 6" measured at 16" from bottom and the 1" of curved sidewalls shall be within 10 degrees of vertical.
10. Where more than one flume runs in parallel straight-line path (in plan), the outermost sections shall have sidewalls a minimum of 24" in height, where the flume path runs adjacent, there shall be a dividing barrier a minimum of 8" high between the lanes, each lane shall be a minimum of 22" inside width.
11. Water slides such as specialty slides that cannot be classified above shall conform to ASTM F-24 (F 2376-06 section 8.4)

### **Closed Flume**

1. The total shape of cross-section of a flume may be created in two or more pieces.
2. Body slides with curved bottom flumes shall have a minimum inside dimension of 30".
3. Tube slides with flat bottom closed flume sections shall have a minimum inside dimension of 48".
4. Tube slides with a curved bottom closed flume sections shall have a minimum inside dimension of 52".

### **Run Out Lanes**

1. Run out sections shall be designed to contain, decelerate and stop riders safely and allow them to exit the slide safely.
2. A weir or other device shall regulate the water level in the run out to the correct level given correct flow rate for the ride/device.
3. To facilitate proper deceleration, a marker shall be provided to indicate the operational water level in the run out, which the slide attendant/life guard may verify prior to allowing the next rider entry to the slide.

### **Landing Pools**

1. Landing pools shall allow riders to decelerate and stop safely, allowing them to exit the water slide safely without encountering an obstruction.
2. The exit path for riders shall not cross with the landing zone of other slides. The designated pool exit shall be such as to force riders to move forward and away from the paths of riders in other flumes.
3. Water slides entering a landing pool shall have a landing pool of sufficient length to decelerate and stop riders and minimize the potential for contact with the pool wall or stationary objects, i.e. stairs, ladders, railings, in the landing pool. Water slides classified as speed slides, i.e. rider velocity over 25' per second will require additional pool length.
4. Pool depth in the landing zone for water slides for riders over 48" tall shall have a minimum pool depth of 3'.
5. Flume geometry at pool entry shall be straight viewed in plan for the last 8' of the water slide entering the pool.
6. Landing pools for water slides with a fall distance greater than 6" shall have an increase in pool depth from the 3' minimum according to the manufacture's recommendation to minimize potential impact with pool bottom.

### **Landing Pools**

7. If the water supply for the slide(s) is drawn directly from landing pools or other areas accessible to the public, the suction line shall be divided into at least two lines, where connected to the pool, such that one person cannot block more than one suction line. The fittings and pipe detail shall be designed so that the full volume of water for the slide may be drawn through the remaining fitting at a velocity not to exceed 1" per second, assuming one suction line is fully blocked.

### **Body Slide Landing Pools**

1. Body slides entering a landing pool shall have a minimum distance between the inside of the widest part of the flume riding surface and the closest pool wall of 5". The place of measurement in the pool shall be at any point from water level to 3" below water level and 6" in front of the flume termination. The lateral pool wall shall be parallel to or diverge from the axis of the slide.
2. Body Slides entering a common landing pool shall be arranged so riders do not come in contact with each other when exiting the flumes of adjacent slides simultaneously.

### **Tube Slide Landing Pools**

1. Tube slides entering a landing pool shall have a minimum distance between the inside of the widest part of the flume riding surface and the closest pool wall of 4.5". The place of measurement in the pool shall be at any point from water level to 3" below water level and 6" in front of flume termination. The pool wall shall be parallel to or diverge from the axis of the slide.
2. Tube slides entering a common landing pool shall be arranged to minimize the opportunity for contact with other riders when exiting the flumes of adjacent slides simultaneously.

### **Openings and Apertures in Flume Surfaces**

1. Openings may be provided in flume surfaces for introduction of water drains, special effects, light and other similar purposes. All edges in openings within reach of riders shall be smooth with a minimum radius of 1/8". Openings shall not present an entrapment risk.
2. Openings at the slide start for the main water supply do not require guards or grating unless the rider stands, sits, walks or slides over the face of the opening during normal slide operation or if the configuration of the opening is such that a rider moving in the usual direction of travel would not become entrapped. Grating when used shall have a maximum width of slot or hole diameter of 1/2".

### **Seams and Joints**

1. The surface of the sliding section shall form a smooth secure and continuous surface. If adjacent edges of lateral joints are not perfectly tangent, the upstream edge shall be set above the downstream edge on the riding surface a maximum of 3/16" to ensure the rider will not hit the edge of a lateral joint.
2. Longitudinal joints on the riding surface shall be made tangent.
3. Edges of lateral joints on body slides may have a radius of up to 3/16", edges of longitudinal joints in closed flumes may have a radius of up to 1/4", edges of longitudinal joints in open flume risers may have a radius of up to 3/8", edges of lateral joints on mat or tube slides may have a radius of up to 1/2".

### **Acceleration**

1. Rider(s) in seated or prone (lying face down) positions shall not experience greater than 2 Gs acceleration from gravity and centrifugal acceleration vectors added together. This limit may be increased to 3 Gs if the duration is less than 1 second. Rider(s) in a supine (laying face up) positions shall not experience greater than 3 Gs acceleration from gravity and centripetal vectors added together.

### **Mats, Tubes, Vehicles**

1. Mats, tubes, vehicles shall be used if specified by the manufacture of the ride/device.
2. Alternative mats, tubes, vehicles shall not be used unless prior approval is given in writing from the manufacture of the ride/device.

### **Mats, Tubes, Vehicles**

- 3 Mats, tubes, vehicles shall be maintained in operating condition, including but not limited to the all handles or other holding devices and conditions of surfaces in contact with the slide surface. Mats, tubes, vehicles shall be removed from service when components are missing or damaged
- 4 Tubes and vehicles shall be constructed to have a cushioning effect for riders who come into contact with another tube, vehicle during normal operation of the ride/device.
- 5 Mats, tubes, vehicles shall float when used in a landing pool.

### **Lazy/Slow Rivers**

1. The entry and exit location shall minimize the potential for rider impact with rails, stairwells and ramps.
2. Tunnels, bridges, waterfalls and other features shall have adequate clearance to minimize risk of riders having a collision.
3. Rides/devices flowing faster than 5 miles per hour shall have special provisions for rider entry and exit to provide convenience and to assure safety.
4. A physical barrier shall be in place to prevent riders entering at points other than the designated entry point.
5. The sidewall surfaces shall be smooth to minimize skin abrasions.
6. Bumps or low spots shall not be present on the sidewalls or bottom surface.
7. Underwater jets shall be recessed, such that pipes are not protruding up out of the bottom and/or sidewalls.
8. Grates over water suction pipes shall be properly secured.

### **Depth Markings**

1. The depth of water shall be plainly marked at or above the water surface on the vertical wall of a pool and on the edge of the deck or walk next to the pool, at the maximum and minimum points, at the points of break between the deep and shallow points, at the points of break between deep and shallow portions and at intermediate 1" increments of depth in the shallow end up to the break point and at 2" increments of depth from the break point to the deep end wall, spaced at not more than 25' intervals measured peripherally and at 2" increments of depth (with at least 3 markers per pool) throughout the length of no-diving pools with uniform bottom slope.
2. Depth marker shall be in numerals of 4" minimum height and a color contrasting with the background. Where depth markings cannot be placed on the vertical walls above the water level, other means shall be used, said markings to be plainly visible to patrons in the pool area.

### **Safety Ledges**

1. Safety ledges are acceptable for pools where full-time lifeguards are on duty, provided the ledges are located not less than 4' nor more than 5' below the water surfaces. The corners shall be rounded.
2. Ledges shall be painted or constructed with a material of contrasting color to be easily visible. Ledge surfaces shall have slip -resistant textures.
3. Off-sets or protrusions from the pool wall resulting from design or construction variations shall fall within the area defined by an 11 degree line from plumb and a plumb line starting at the junction of the pool wall and water surface.

### **Ladders and Stairs**

1. A minimum of 1 ladder shall be provided for each 75' of perimeter and not less than 2 ladders shall be provided at any pool. Where stairs are provided in a pool 1 ladder may be deleted for each set of stairs provided. A side handrail extending up and above and returning to the horizontal surface of the pool deck curve or coping shall be provided at each side of the ladder.
2. All stairs entering a pool shall be recessed. An exception to this will permit the construction of steps extending completely across the shallow end of the pool, which will be construed as not projecting into the pool proper.
3. Steps leading into a pool shall have a minimum tread length of 24", a minimum tread width of 12" and a maximum

rise or height of 10". Intermediate treads and risers shall be uniform in width and in height, respectively. The front edge (intersection of the tread and riser) of all steps shall have colored stripes contrasting with the interior color of the pool. These stripes shall be a minimum of 2" in width on the tread and on the riser and shall extend the full length of the steps. Step treads shall be slip resistant.

### **Filter/Pump Rooms**

1. All filter/pump rooms shall be locked to prevent unauthorized entry.
2. Adequate signage shall be posted at entrances to warn unauthorized persons of the potential hazards.
3. Filter/pump room operators shall wear shoes when entering/working in the filter/pump room.
4. All valves shall be marked with numbers or labels for easy identification.
5. A chart or schematic drawing that identifies the numbered/labeled valves and pipelines shall be located in the filter/pump room.
6. Valve handles used in main operation shall be located within 2' to 7' above the floor and accessible.
7. Standard pipe marker flow arrows shall be posted on main pipelines.
8. Adequate ventilation shall be provided by mechanical devices and/or vent outlets or windows.
9. Operation instructions and emergency procedures shall be displayed.
10. Electrical outlets shall be U.L. watertight, snap-close lids.
11. Light fixtures shall be shielded to protect from direct hose spray or line rapture.
12. The floor shall be slip and corrosive resistant.
13. If suction intakes or screens are serviced at locations remote from the filter/pump room water pumps, outside disconnects shall be provided at each service location.

### **Water Quality/Clarity**

1. All water quality/clarity shall be maintained at all times, as per the requirements of the Oklahoma State, County or Local Health Department having jurisdiction.
2. A 6" disc of contrasting color placed on the pool bottom shall be visible in natural and/or artificial light.

### **Life Guards**

1. There shall be adequate life guard staffing at all times to maintain the 10/20 rule at all rides/devices.
2. All life guards shall be provided with a means, i.e. whistle/horn to direct rider(s)/patrons.
3. All life guards shall be easily recognizable from rider(s)/patrons, i.e. shirt, hat, tag, uniform.
4. All life guards shall have the appropriate level of current certification from a nationally recognized authority, i.e. Red Cross, YMCA, NASCO, Ellis & Associates for the ride/device assigned.
5. All life guards shall be equipped with the appropriate rescue equipment, i.e. rescue tube, reach pole, ring buoy for the ride/device assigned.

### **Grounds**

1. Surfaces intended for patron's activity shall be moderate in slope and elevation changes sections.
2. The deck surface can be drained.
3. All walkways, including horizontal sections of coping or overflows, shall have a slip-resistant surface.

### **Safety Signage**

1. Safety Signage shall be prominently at each ride/devices entrance and/or other appropriate area and shall include but not limited to the following:
  - a. Proper riding position.
  - b. Expected rider conduct.
  - c. Dispatch procedures.
  - d. Exiting procedures.
  - e. Obey slide operator/life guard.
  - f. Ride/device characteristics, i.e. speed of ride/device, water depth of landing zone.
  - g. Riders being free of medical conditions, i.e. including but not limited to, pregnancy, heart, back, muscular-skeletal conditions.
  - h. Maximum/minimum height and weight allowed for the ride/device, a measuring device shall be in place at

- each ride/device so operators may check for proper height.
- I. Any swimming or physical ability requirement for the ride/device.
    - i. Rider Responsibility signage shall be posted at the entrance to each ride/device and ticket area as required by the Oklahoma Amusement Ride Safety law.

### **Operations**

1. The owner/operator shall have written operating procedures for each individual ride/device.
2. A communication system between the general staff, lifeguards, management shall be in place.
3. All staff shall be easily recognizable from patrons, i.e. shirt, hat, tag, uniform.
4. The owner/operator shall document in writing that all rides/devices have been inspected daily prior to being put in operation, a written log shall be maintained indicating any repairs made to a ride/device, these records shall be kept on-site at all times.
5. The owner/operator shall provide a sufficient number of staff to insure safe operations at all times.
6. The owner/operator shall have written emergency action plan in place to cover, accident/incidents, foul weather, guest illness, all staff shall be trained in this plan.
7. Full manufacture's manuals, i.e., operation procedure, maintenance/ repair procedure shall be maintained on- site at all times for each ride/device, copies shall be provided to the Oklahoma Department when requested.
8. The owner/operator shall document in writing that all staff, i.e. operators, lifeguards, management, have received the proper training in operation of the ride/device in which assigned, this documentation shall be signed by individual conducting the training and the individual receiving the training, these records shall be kept on-site at all times.
9. Accidents/Incidents in fatalities or requiring to be transported shall be reported to the Oklahoma Department of Labor, in strict compliance with the reporting procedures outlined in the Oklahoma Amusement Ride Safety Law.
10. Accidents/Incident requiring in-house first only, should be recorded and kept On file.

**“Note” In addition to the above guidelines all owner/operators shall be familiar with and abide by the requirements of the Oklahoma Amusement Ride Safety Law.**

**In the ASTM and our own Water Park Guidelines, several codes and test methods are mentioned, below is the specific codes and where they came from.**

USDA-72, Wood Handbook - Wood as used in engineering.

ASCE, American Society of Engineering, there are many standards, not sure which one ASTM is referencing, this site has a fee to download anything, cost unknown.

AISC, American Institute of Steel Construction.

ACI-318, American Concrete Institute: Building.

Test Methods D 570, D 638 and D 790 are all ASTM Standard.

D 570 - Standard Test Method for Water Absorption of Plastics

D 638 - Standard Test Method for Tensile Properties of Plastic

D 790 - Standard Testing Methods for Flexural Properties of Un-reinforced Plastics, Reinforced Plastics and electrical Insulating Methods.