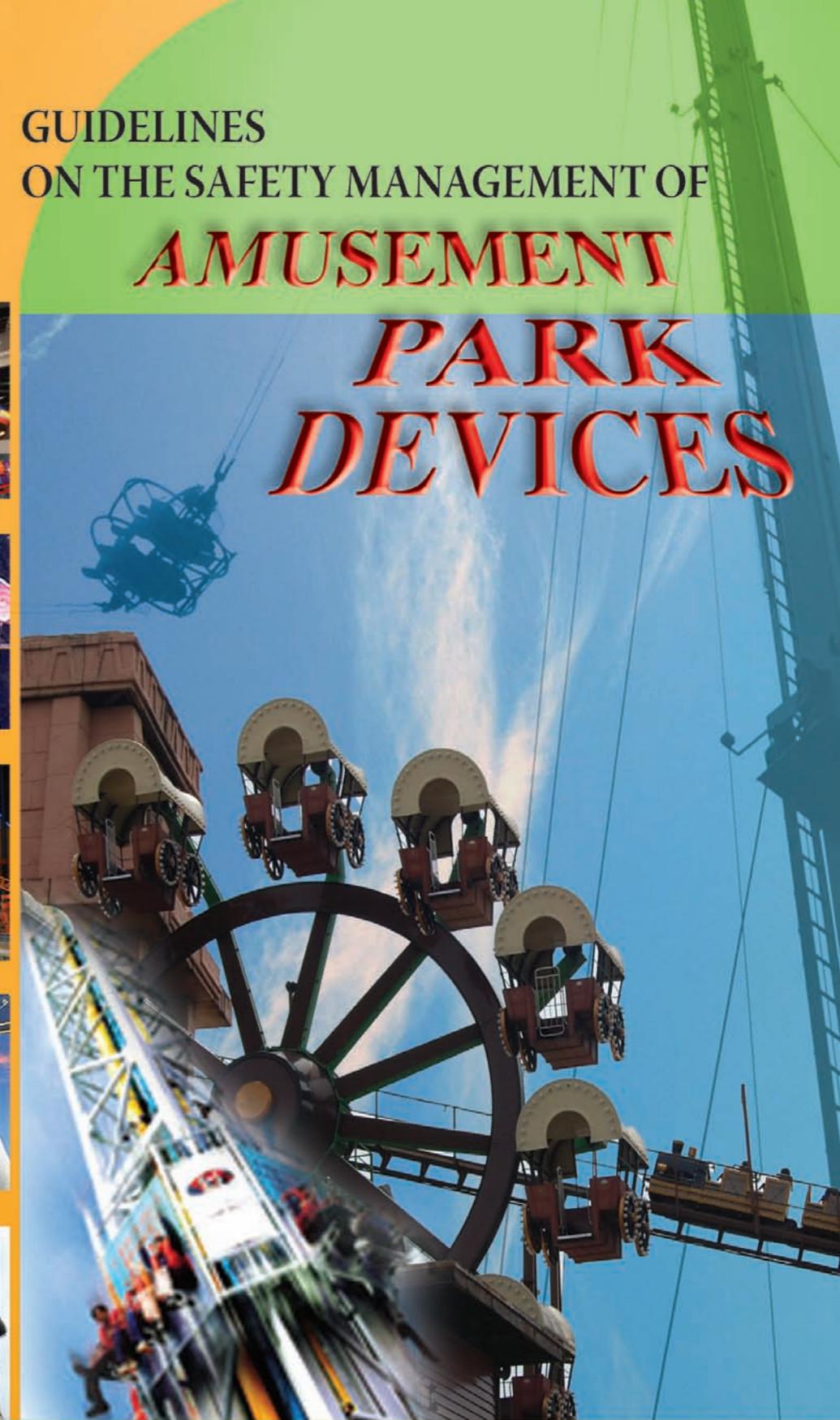




GUIDELINES
ON THE SAFETY MANAGEMENT OF

AMUSEMENT PARK DEVICES



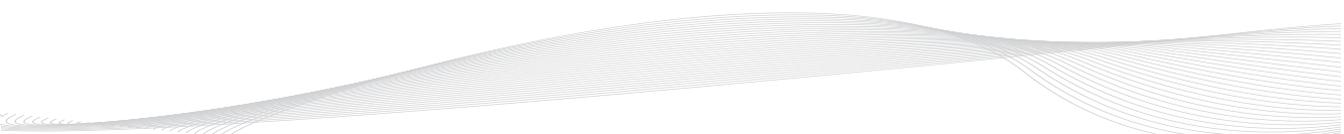
DEPARTMENT OF OCCUPATIONAL SAFETY AND HEALTH
MINISTRY OF HUMAN RESOURCES MALAYSIA

2008

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**DEPARTMENT OF OCCUPATIONAL SAFETY AND HEALTH
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The Guidelines have been endorsed by the department's Policy Review Committee chaired by the Director General of the Department of Occupational Safety and Health.



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1.0 INTRODUCTION

These guidelines aim to improve amusement park safety by ensuring that the equipment used is, as far as possible, properly designed, installed, maintained, modified and operated according to accepted international standards to eliminate accidents to riders, visitors and those working on amusement park devices. These guidelines are applicable to amusement parks and fairs located at either permanent or temporary sites.

Some aspects to be considered for improving the safety of amusement park devices are:

- i. Design - ensuring the structural integrity and the ride are safe when used as designed. Also taking into consideration how riders may use the ride.
- ii. Construction - ensuring that the ride is built according to the safe design.
- iii. Maintenance - ensuring that all rides receive proper maintenance.
- iv. Operation - ensuring that the operator operates the ride consistent with the design and maintenance requirements and the riders use the ride consistent with the designed safety requirements.

These guidelines will assist the owners and operators to comply with the Factories and Machinery Act 1967 (Act 139) and the Occupational Safety and Health Act 1994 (Act 514).

2.0 EXCLUSIONS

These guidelines do not cover non-mechanised playground equipment such as swings, coin-operated machines, seesaws, stationary spring mounted animal features, rider propelled merry-go-rounds, climbers, slides, swinging gates and physical fitness devices.

3.0 OBJECTIVE

The objective of these guidelines is to set safety standards for the design, construction, operation, maintenance, inspection, erection, dismantling, repair and use of amusement devices at amusement parks and fairs.



4.0 DEFINITIONS

4.1 *Accepted international standards*

These standards include ISO Standards, IEC Standards and other international standards having a similar standing, e.g. Commission Internationale de Eclairage (CIE) and any European Standards produced by the European Committee for Standardisation (CEN), European Committee for Technical Standardisation (CENELEC) and American Society for Mechanical Engineer (ASME).

4.2 *Amusement device*

Any contrivance or a combination of contrivances, or rides, equipment or plant which is designed or intended to entertain or amuse people and which can be installed repeatedly without loss of substance, whether temporarily or permanently, at fairs, amusement parks or other locations.

4.3 *Amusement park*

A tract or area used principally as a location for amusement devices and structures.

4.4 *Approved*

Approved by the Chief Inspector in writing.

4.5 *Approved inspection body*

Inspection body with the expertise, competency, quality management systems, procedures and facilities for inspection of amusement devices and registered with DOSH including inspecting authorities in the fourth schedule of Act 139.

4.6 *Attendant*

Any person appointed to work under the control or direction of an operator, to assist in the operation of an amusement device available for use by the public.



4.7 Authorised person

A person with the knowledge, experience and skill in the work to be performed on an amusement device and who has been given the responsibility to perform his duties by the owner or controller of an amusement device.

4.8 Controller

Any person or organisation having overall control of an amusement device. This may be an individual or corporate body owning an amusement device or the concessionaire or lessee who has been granted control of the device by the owner for a specified period.

4.9 Fair

An enterprise principally devoted to the exhibition of the products of agriculture or industry and at or in connection with which amusement devices and temporary structures are provided.

4.10 Log book

All the necessary information about daily examinations and checklist as prescribed in Appendix J.

4.11 Modified device

An amusement device of which the structure, drive system, method of erection, or other item affecting the safety of the amusement device has been changed, except for changes recommended by the ride manufacturer.

4.12 Operator

A person appointed by the controller who has been trained in the work to be performed on an amusement device and who has been given the responsibility to perform his duties by the controller of an amusement device.

4.13 Owner

The person for the present time receiving the rents or profits of the amusement devices in connection with which the word is used, whether on his own account or as an agent or trustee for any other person or who would so receive the same if the amusement devices are leased.



4.14 Passenger space

The area, seat, tub, chair, car, cage or other devices in which the customer sits, stands, walks or otherwise occupies while riding an amusement ride.

4.15 Permanent structure

A structure which is used, or intended to be used, as an amusement device that is erected to remain as a lasting part of the premises.

4.16 Properly maintained

Includes assembling, disassembling, transporting, operating, lubricating, greasing, oiling, testing and repairing of amusement devices in accordance with accepted international standards.

4.17 Ride

Any mechanical device which carries or conveys passengers along, around or over a fixed or restricted route or course for the purpose of giving the passengers amusement, pleasure, thrills or excitement.

4.18 Rider

A person participating in an amusement ride who does not require any formal training or previous experience to be able to participate in a safe manner.

4.19 Technical file

All the necessary information about the use and history of any amusement device, beginning with the design, calculation review and approval process by DOSH and an approved inspection body as prescribed in Appendix F.

4.20 Temporary structure

A structure which is used, or intended to be used, as an amusement device that is relocated from time to time with or without disassembly.



5.0 CLASSIFICATION OF AMUSEMENT DEVICES

Amusement devices are classified as follows:

5.1 Category I amusement devices

Amusement devices that require a certificate of fitness from DOSH as prescribed in the Factories and Machinery Act 1967 before being put in operation (refer to Appendix K for examples of Category I amusement devices).

5.2 Category II amusement devices

Amusement devices that do not require a certificate of fitness from DOSH. Inspection should be carried out by an approved inspection body before the device is put in operation (refer to Appendix L for examples of Category II amusement devices).

6.0 SUBMISSION FOR THE DESIGN APPROVAL, INSPECTION AND REGISTRATION OF AMUSEMENT DEVICES

6.1 General

The owner or controller or lessee of an amusement park shall obtain the design approval of a Category I amusement device from the Department of Occupational Safety and Health (DOSH) before the installation and operation of the amusement device.

The application should be addressed to:

Director General
Department of Occupational Safety and Health, Malaysia
Levels 2, 3 & 4, Block D3, Parcel D
Federal Government Administrative Centre
62502 Putrajaya
Malaysia

Tel no: +603-88865000

Fax no: +603-88892349

6.2 Information and documentation to be submitted

The following information and documentation shall be submitted for the design approval:



6.2.1 Owner or controller or lessee (if different from owner)

- i. Name
- ii. Mailing address
- iii. Telephone number
- iv. Contact person/designation

6.2.2 Amusement device description

- i. Name of ride
- ii. Type and model
- iii. Manufacturer
- iv. Design code
- v. Identification/serial number
- vi. Place of installation (address)
- vii. Year built

6.2.3 Description of design, construction and operation

The design and utilisation of each amusement device shall be explained in detail. Details of the mechanical (as well as hydraulic, pneumatic, equipment, etc), electrical and electronic equipment including the control system shall be listed.

The description shall cover the following items:

- i. Details of the particular features of the amusement device and any alternative modes of installation which may exist;
- ii. Details of operating sequence and any restrictions regarding the circle of users which may exist;
- iii. Type of non-permanent structure and types of use of major design features, structural systems;
- iv. Main dimensions and any space beyond these dimensions required for movement;
- v. Boundary systems;
- vi. Functional and operating procedures;
- vii. Movement systems and drive types;
- viii. Speeds;
- ix. Acceleration rates;
- x. Any restrictions on types of riders;
- xi. Electrical systems; and
- xii. Hydraulic/pneumatic systems.



6.2.4 Safety equipment

A list of safety equipment which may be operational in normal use or exceptional cases (e.g. personal safety and restraint systems, emergency lighting and systems to ensure the safe completion of all movements in the event of failure of the drive system). The list shall include the purpose and functions of each item of equipment and details of possibilities of inspection.

6.2.5 Design and manufacturing drawings

Design and manufacturing drawings are required for all sub-assemblies and individual components. Drawings shall indicate the design specifications, all dimensions and cross section, details of materials, structural components, welding details, fasteners and connectors.

The drawings shall include:

i. General drawings

Show the plan view, elevations and sections of the non-permanent structure. The scale of these drawings shall be appropriate for the size of the structure. The clearance required for movement shall be indicated on the drawings. Where possible, the dimensions of all major sections shall be shown.

ii. Detailed drawings

Show the assembly, connections and relevance to safety which are not evident in the general drawings.

The required detailed drawings may include:

- a. Drawings of slewing, lifting and swivelling mechanisms, including bearings and supports, drives, control systems and movement ranges;
- b. Drawings of carriages, gondolas and similar devices showing all necessary views and sections, external dimensions and the internal dimensions of all components which are important for passengers, such as seats, back rests, grab devices, locking and safety systems.



- iii. Special drawings, if required
 - a. Elements of the drive mechanisms of amusement park devices which could expose passengers to the risk of falling or to other risks as a result of the sudden removal of centrifugal force or otherwise (for example in the event of the sudden blockage of a slewing gear).
 - b. Cylinders and pistons with support points.
 - c. Entry and exit routes, including stairways, with safety clearance required between stationary and moving parts.
 - d. Escape routes from tents and, if required, other structures.
- iv. Safety equipment
 - a. Mechanical safety equipment such as safety stops, personal safety and restraint systems, buffers, housings, barriers and railings.
 - b. Special facilities, e.g. layout plans of escape routes or emergency lighting.
- v. Underpinning and anchorage plans
 - a. The base block and anchorage plans shall indicate all support points, the areas and thickness of all underpinnings required, all anchorages and the magnitude and direction of the main vertical and horizontal forces acting on them. Provided that a sufficiently clear presentation is possible, it shall be sufficient to indicate the data required on the overall plan. In the case of tents, stages and grandstands with different installation variants, the anchorages required for each variant shall be indicated.
 - b. The installation position and size of decorations and ballast required for maintaining the structural stability of the structure shall also be indicated.
- vi. Hydraulic and pneumatic systems
 - a. If the mode of operation of hydraulic/pneumatic systems and the interaction of such systems with electrical equipment are not clearly shown by the diagram of such systems, a separate description shall be submitted.



- b. Diagrams of the hydraulic/pneumatic systems shall clearly indicate the structure of the control system, the equipment controlled and facilities for the connection of testing equipment.
- c. The designations of equipment in the diagrams of the hydraulic/pneumatic systems shall be consistent with those used on the equipment itself.

6.2.6 Design calculations

- i. Design calculations taking into account the loads and forces the structure is expected to be subjected to shall be submitted to demonstrate the stability of the non-permanent structure. These calculations shall include:
 - a. Calculations of load-bearing capacity (including stability);
 - b. Calculations of fatigue strength;
 - c. Calculations of safe positioning (with reference to lifting off, overturning and sliding); and
 - d. Calculation of fitness for purpose (deformation calculations).
- ii. Design calculations made using computer software shall clearly identify the list of inputs and outputs with explanatory notes.
- iii. Loads and forces

The following loads and forces shall be taken into consideration:

- a. Dead loads
- b. Imposed loads
- c. Driving and braking forces
- d. Wind loads
- e. Inertia forces
- f. Special loads



6.2.7 Hydraulic/pneumatic systems

Design calculation for any components subject to internal or external pressure which are also used as structural members shall be based on the worst possible combination of loads and forces.

6.2.8 Analysis

Stress and fatigue analysis of all essential and safety critical components shall comprise as a minimum analysis and calculation the following main items:

- i. Structural and mechanical parts;
- ii. Hydraulic and pneumatic parts;
- iii. Drive unit, bearings; and
- iv. Brakes and safety devices

6.2.9 Attachments

Attachments such as decorations, lamps, loudspeakers, flags and similar parts shall be securely attached to the structure; where necessary, appropriate calculations shall also be submitted.

6.2.10 Certificates

- i. Inspection certificates shall be submitted for all materials. The manufacturer shall certify that the materials stated in the design documents have actually been used.
- ii. The following certificates, issued by the manufacturer, shall be submitted for load-bearing ropes and chains:

- For ropes

Certificates concerning the type, design, dimensions and calculated rupture force.

- For chains

Certificates concerning the applicable standards or manufacturers' specifications, type, dimensions and minimum breaking force.



- iii. For standard of mechanical components and type-tested assemblies for which no design calculations are available, the applicant shall submit a certificate issued by the manufacturer.

6.2.11 Medical effects

The effects of acceleration on passengers shall be considered. If appropriate, expert opinions shall be commissioned to assess medical effects.

6.2.12 Manual

A copy of instructions for erection, dismantling, maintenance and operation.

6.2.13 Technical file

For used devices a copy of the extract of the contents of the technical file is required.

6.3 Notification for installation of Category I amusement devices

6.3.1 For the purposes of installation, the owner or controller or lessee shall notify the DOSH state office where the device will be installed with the following documents:

- i. Design approval letter;
- ii. Approved design drawings;
- iii. Layout plan indicating the location of the amusement device with respect to property lines or street, electrical transmission lines or other hazards which may interfere with safe operation;
- iv. Form JKJ 105;
- v. Organisation chart for owner or controller;
- vi. The report on any non-destructive test and load test;
- vii. Operation and Maintenance Manual (refer to appendix E); and
- viii. Confirmation letter from the manufacturer or nominated designated person or approved inspection body to certify that the device has been inspected and tested in accordance with the manufacturer's requirement/design code.



6.4 Documents to be submitted for Category II amusement devices

The owner or controller or lessee shall submit to the relevant DOSH state office the necessary documents as prescribed in clauses 6.2 to 6.2.13 for the purpose of review and inspection.

7.0 DESIGN OF AMUSEMENT DEVICE

7.1 Design codes

The design, construction, installation, inspection, operation and maintenance of amusement devices shall be in accordance with any accepted international standards. The design shall be reviewed by an approved inspection body.

7.2 Design basis

7.2.1 General

The design or analysis (or both) of an amusement device shall be carried out by the designer who shall be involved in all phases of manufacture, construction, testing and commissioning of new equipment, where his responsibility shall be to ensure a level of supervision of the work such that there is no negation of any basic premise or assumption underlying the design.

7.2.2 Analysis

Stress and fatigue analysis of all essential and safety components shall be available and shall comprise as a minimum analysis and calculation the following main items:

- i. Structural and mechanical parts;
- ii. Hydraulic and pneumatic parts;
- iii. Drive units/bearings; and
- iv. Brakes and safety devices

7.2.3 Fail-safe systems

- i. A fail-safe system should exist for all components of the amusement devices with details of limited fatigue life.



- ii. Any fail-safe system shall include a means to signal the primary fault (e.g. alarm, cessation of motion, process shutdown) or shall incorporate a positive procedural arrangement involving inspections directed to the timely discovery of the primary fault where secondary (load carrying) systems are involved, i.e. redundancy.

7.2.4 Control systems

7.2.4.1 Stop functions

7.2.4.1.1 General

When necessary (as decided by the risk assessment), the safety related control system shall provide the facility to allow operational stopping, safety stopping and emergency stopping of the amusement device. Stop functions shall have priority over related start functions. Stop functions shall be capable of being activated by either more than one system (redundancy) or a single system depending on the risk.

7.2.4.1.2 Operational stop functions

This function halts the ride for normal operational reasons, e.g. for loading and unloading.

7.2.4.1.3 Safety stop function

- i. This function is intended to avert actual or impending danger and may be activated either manually or automatically.
- ii. It shall stop the relevant parts of the amusement device so as to reduce the overall risk to an acceptable level as quickly as possible.
- iii. A safety stop function shall override operational stop functions but not emergency stop functions.
- iv. After a safety stop, a restart may not take place until the cause for the stop has been removed.
- v. The amusement device should reach standstill in the shortest time, commensurate with avoiding hazardous conditions with due regard to all safety requirements including:



- a. General integrity of the amusement device;
- b. Safe accommodation of passengers; and
- c. Deceleration.

7.2.4.1.4 Emergency stop function

- i. Where appropriate, provision shall be made, according to the risk assessment, for a manual emergency stop.
- ii. The amusement device should reach standstill in the shortest time, commensurate with avoiding hazardous conditions with regard to all safety requirements including:
 - a. General integrity of the amusement device;
 - b. Safe accommodation of passengers; and
 - c. Deceleration.
- iii. An emergency stop function shall override operational stop functions. After an emergency stop, a restart may not take place until the cause for the stop has been removed.

7.2.4.2 Safety related parameters

- i. Means shall be provided to ensure that the values of the safety related parameters stay within predetermined levels defined by the risk assessment.
- ii. Speed is an important safety critical parameter for amusement devices where acceleration and consequently forces are dependent on the speed of amusement ride elements. Therefore, speed control can prevent hazardous effects on structures and passengers.

The following speeds shall be considered:

- a. Minimum operational speed

The minimum speed necessary to ensure, for a stated operational condition, the safe containment of passengers and the intended function and integrity of the amusement device.



b. Maximum operational speed

The maximum speed at which, for a stated operational condition, the safe containment of passengers and the intended function and integrity of the amusement device are ensured during repeated or sustained use.

c. Maximum achievable speed

The maximum value of speed achievable by an amusement device element, without any restriction of control.

iii. For a particular part of the ride cycle there may be different operating speeds. In particular, the following criteria shall apply to prevent the amusement device operating beyond the design parameters.

a. The control system shall control the speed between the minimum and maximum operational speeds for that part of the ride cycle;

b. Either the device fails to achieve a minimum operating speed after a predetermined time, or the speed falls below the minimum operational speed, after which the control system shall perform a safety stop;

c. If the speed of the device rises above the maximum operating speed, the control system shall perform a safety stop.

iv. The risk assessment shall evaluate the effects on the amusement device and passengers due to any achievable speeds. In general, if the maximum achievable speed is lower than or equal to the maximum operational speed, the control system does not require additional speed control circuits, but if the maximum achievable speed is greater than the maximum operational speed, additional means may be necessary to ensure that the maximum operational speed is not exceeded. Moreover, if the machine does not reach, or falls below, the minimum operational speed, additional means may be needed to ensure that the minimum operational speed is achieved or a safety stop is performed. The need for, and the integrity, of these means shall be determined by risk assessment.



7.2.4.3 Passenger restraint status

Where a control system is involved in the operating, interlocking or monitoring of passenger restraints, its function and integrity shall be determined in a risk assessment. The following items should be taken into account.

i. Positioning for starting

There shall be a confirmation of closure and locking before starting the ride cycle; this confirmation need not be automatic.

ii. Enabling of release

It shall not be possible to enable the release of the restraint devices unless it is safe to do so or unsafe not to do so.

iii. Alarms and warnings

Where an amusement device is used under the ultimate control of an operator, who must rely on audible alarms or visible indications as evidence that restraint devices are locked in the closed position, such alarms or indications need to be fail safe (hardware/software) if the risk assessment requires it.

v. Loss of power

Loss of power supply shall not:

- a. Allow the release of restraint devices unless such release will not endanger the passengers; or a suitable system of work is in use to ensure passenger safety;
- b. Prevent the intentional release of restraint devices when required to ensure the safety of the passengers or for operational purposes, e.g. manual release.

vi Monitoring of position

The need for the monitoring of the position of passenger restraint devices and their interlock latches should be determined by risk assessment.



7.2.4.4 Collision prevention by control systems

7.2.4.4.1 General

Where required by a risk assessment, a means of preventing unintentional collisions shall be provided.

7.2.4.4.2 Block-zone control system

- i. A block-zone control system consists of the partial or complete sub-division of the rail or channel into sections, called block-zones, each of which shall not be occupied by more than one passenger unit or train at any one time.
- ii. The number of block-zones into which the rail or channel is sub-divided shall be sufficient to prevent collisions.
- iii. In some devices dependent on the risk assessment, closer spacing of the passenger units may be allowed in one or more of the block-zones with safety being assured by other means. For example, speed may be restricted to allow passenger units to come into contact with one another at station areas or immediately before a lift in a log flume.
- iv. A block-zone control system shall be based, as a minimum in general, on the following elements:
 - a. Means of signalling the occupied status of a block-zone, e.g. occupancy sensors;
 - b. Means of signalling the clear status of a block-zone, e.g. clearance sensors;
 - c. Control logic;
 - d. Devices which can stop the passenger unit or train, e.g. stopping devices.
- v. The front section of each passenger unit or train, upon entering a block-zone, shall signal to the control logic the occupied status of the block-zone. Only if the next block-zone in the direction of travel is clear, will a passenger unit or train be allowed to leave the block-zone in which it is currently situated. When leaving the block-zone, the rear section of the passenger unit or train shall signal to the control logic the cleared status of the block-zone.



- vi. The control system shall perform a safety stop in case of any failure which could lead to an increase in the risk to passengers, e.g. the failure of one out of a set of redundant sensors or loss of power. On restoration of power including electrical, hydraulic or pneumatic power, if there is no automatic system to ensure the safe restart of block-zone operation, the system shall prevent the opening of brakes except under a manual system of work. If an automatic restart is provided, it shall be initiated manually.
- vii. The anti-collision function of the block-zone system shall not be de-activated at any time.

7.2.4.4.3. Requirements for the positioning of sensors and stopping devices

- i. Stopping devices should be located so that, after a stop, the passenger unit or train, in normal conditions, can be restarted safely.
- ii. In any block-zone, clearance sensors shall be so located that if the passenger unit or train stops for any reason as soon as it leaves the block-zone, the following unit or train shall be prevented from colliding with it even if it stops in the most unfavourable condition or position possible.
- iii. The occupancy and clearance sensors shall be so located that a block-zone has been indicated occupied before the previous block-zone is cleared.

7.2.4.4.4 Emergency brakes and anti roll back devices

Installation on which the rides are conveyed on the ascent ramp by means of chains, ropes, friction wheels or by self propulsion shall be provided on the ascent ramp with safety devices or with automatically acting brake to prevent running back.

7.3 Risk reduction by prevailing design and safety measures

7.3.1 General

In designing an amusement device, a designer is required to:



- i. identify hazards associated with the use of the device;
- ii. ensure that an assessment is made to determine the risks associated with such identified hazards; and
- iii. control such risks by implementing measures to either eliminate or minimise risks.

7.3.2 Hazard identification

Hazards may be identified at any stage during the set-up, operation and dismantling of amusement devices. A hazard is any activity, situation or substance that can cause harm.

7.3.3 Risk assessment

A systematic approach to assessing hazards which provides an objective measure of the hazards and allows hazards to be prioritised and compared.

7.3.4 Control of risk

Control of risk is the elimination or inactivation of a hazard in a manner such that the hazard does not pose a risk to people who have to enter an amusement area.

Note:

Refer to Appendices G and H for Hazard Identification, Risk Assessment and Risk Control Process. For details, please refer to the 'Guidelines for Hazard Identification, Risk Assessment and Risk Control' issued by DOSH.

8.0 TESTING

8.1 General

- i. Before being put into service, an amusement ride or device shall undergo the following tests, as appropriate to the device:
 - a. Load test;
 - b. Out-of-balance test;
 - c. Test to prove effectiveness of evacuation procedures, control devices, speed-limiting devices, brakes and other equipment provided for safe operation;



- d. Hydraulic system test;
 - e. Pneumatic system test; and
 - f. Electrical test.
- ii. Prior to the test, the designer or manufacturer shall prescribe a schedule on the method of testing and its acceptance criteria.
 - iii. All testing shall be conducted in the presence of the designer or authorised person nominated by the designer.
 - iv. For Category I amusement devices, testing required under para (i) (a), (b) and (c) shall be conducted in the presence of a DOSH officer.

8.2 Load test

The load test shall be carried out by operating the device at the nominal full speed and service condition, with each passenger carrying device loaded as recommended by the designer, but not exceeding 100% of the design load.

8.3 Out-of-balance test

- i. The device shall be considered satisfactory for use at the specified design load rating if it operates safely under test without any adverse effects on any of its parts.
- ii. Where the design of an amusement ride or device caters for a degree of out-of-balance loading, the designer shall specify the appropriate test to confirm the strength and stability of the device according to the design. The specified out-of-balance test shall be carried out, and its results documented, by the designer or other authorised person.
- iii. Where such permissible out-of-balance is a feature of the design, it shall be confirmed, as part of the test, that the limits for out-of-balance operation are appropriate, as specified in the operation and maintenance manual for the device.
- iv. Where specific data are not provided by the designer, or not specified in the operation and maintenance manual, an authorised person shall assess the ride or device and establish appropriate limits for out-of-balance loading. The device shall be tested under the conditions established and shall be considered to have passed the test, provided no adverse vibration, harmonic oscillation or movement relative to footings and



foundations is witnessed. Upon completion of such a test, the limits determined shall be noted in the operation and maintenance manual as limits for operation.

8.4 Hydraulic or pneumatic test

The following tests shall be conducted to establish the integrity of a hydraulic or pneumatic system and its components, in accordance with the specifications supplied by the manufacturer or designer:

- i. Operational tests to prove the correct operation of the system and all safety devices; and
- ii. Pressure tests to test each part of the system at the maximum working pressure sustained under all conditions of intended use.

8.5 Electrical test

Electrical test to assess compliance with any accepted international standards and requirements of relevant authority.

8.6 Certification

Testing at the completion of initial installation and commissioning shall be conducted in accordance with the schedule prescribed by the designer and in the presence of either the designer or the authorised person nominated by the designer. Upon completion of the test, the designer or nominated authorised person shall certify in writing that the device has been tested in accordance with the requirement of the manufacture/design code.

9.0 INSTALLATION, OPERATION AND MAINTENANCE

9.1 Scope

This section specifies requirements for the installation, operation, maintenance, inspection and fire safety measures for permanent and temporary amusement devices.

9.2 Standards documentation

The documentation which shall be available for every amusement ride is:

- i. Operation and maintenance manual; and
- ii. Technical file.



Note:

- i. The contents of the operation and maintenance manual are described in Appendix E.*
- ii. The contents of the technical file are described in Appendix F.*

9.3 Duties and responsibilities of personnel

9.3.1 Controller

i. Duties of controller

The controller supervises and directs:

- a. Erection and dismantling;
- b. Maintenance;
- c. Servicing;
- d. Repair; and
- e. Modification.

ii. Responsibilities

The controller of an amusement ride or device shall be responsible for ensuring that:

- a. Legislation pertaining to occupational safety and health is complied with;
- b. All manufacturer's instructions relating to the safe operation of the amusement device are followed;

Note:

Additional safety criteria as specified by the designer, manufacturer, importer, supplier, erector or (where implemented) any quality assurance scheme, must also be met.

- c. All operating staff receive sufficient training and instruction in the safe set-up operation and maintenance of the devices (including training in emergency procedures, operation of emergency controls and, where appropriate, retrieval/rescue of riders) for them to be considered authorised persons, and that they accept responsibility for the control of all activities of the device;



- d. Sufficient fencing, handrails, guards and temporary barriers are supplied and installed in accordance with the requirements of related legislation and accepted international standards;
- e. Each amusement ride is subjected to a hazard identification risk assessment and risk control process by an authorised person each time the device is set up;

Note:

Appendix G contains a flow chart for typical hazard identification, risk assessment and risk control process which may be applied to amusement devices.

- f. Riders receive sufficient instructions to be able to participate safely in an amusement ride without putting themselves or others at risk;

Note:

Appendix A contains guidance on instructions to riders relating to rider responsibility.

- g. The level of noise to which operating staff and riders are exposed shall be below the specified legal limits;
 - h. A daily log of the activities of the device is kept;
 - i. A copy of the manufacturer's instructions is kept with the device at all times;
 - j. The records and documentation relating to the device (including records of testing of equipment and staff training) are fully maintained;
 - k. All maintenance, replacements, repairs, modifications and inspections are carried out in accordance with Clauses 9.10 and 9.11; and
 - l. A quality assurance scheme is implemented where necessary.
- iii. Delegation of controller's responsibilities

When, for any reason, the controller is not able to accept direct responsibility for the safety of a device, the controller shall appoint an authorised person as a supervisor. The supervisor shall accept the responsibilities of the controller in the controller's absence, including



those outlined in Clause 9.3.1 (ii), and the location of the supervisor shall be known by and accessible to the operating staff at all times while the device is operating.

9.3.2 Amusement ride operator

The duties of the amusement ride operator are:

- i. An amusement ride operator shall be in immediate control of every amusement ride at all times when it is available for use to members of the public. In addition, the minimum number of ride attendants needed to operate the device safely shall be on duty at all times the ride is operating;
- ii. The amusement ride operator shall immobilise the device and take all reasonable steps to prevent access to it by members of the public at times when the device is not intended for public use;
- iii. An amusement ride operator shall not be in charge of more than one ride at any one time, and shall be in control throughout the ride cycle of the device. When in use by the public; no person other than the amusement ride operator or a trainee under direct supervision shall handle or interfere with the operation of the device, except in an emergency;
- iv. An amusement ride operator in charge of an amusement ride and device shall not operate the device slower or faster than the speed range specified in the manufacturer's manual or at any lower maximum speed which has been set by the controller. Where there is a particular requirement to load passengers into the device in a particular pattern, the amusement ride operator in charge of the device shall ensure that this loading is correctly carried out;
- v. Where appropriate, the amusement ride operator of an amusement device shall be provided with effective means of communicating any necessary instructions to members of the public using the device;
- vi. The amusement ride operator shall ensure that guards provided for dangerous parts of the machinery, power units and transmission machinery are maintained in position whenever the device is in motion or in use;
- vii. The amusement ride operator shall take all reasonably practicable measures to prohibit members of the public from using the device when he considers them incapable of doing so safely; and



- viii. The amusement ride operator shall ensure as far as practicable that the ride attendant carries out his duties in a safe manner.

9.3.3 Ride attendant

Duties of ride attendant:

- i. Every ride attendant shall carry out his duties in accordance with instructions given to him and with due regard to the safety of members of the public and others working with him on the device;
- ii. A ride attendant whilst at work at an amusement device shall carry out his duties in a manner which puts neither himself nor any other person at risk because of his actions.

9.3.4 Training of personnel

The amusement ride operator shall receive suitable and sufficient training in the workings of the device to ensure that he has adequate knowledge of:

- i. The operation method of the amusement device itself and of any particular measures to be taken to ensure that the device is operated in a safe manner;
- ii. The duties that have to be carried out by the ride attendants working on the amusement device to ensure its safe operation;
- iii. Any specific measure that has to be adopted to ensure the safety of passengers where this is appropriate;
- iv. The steps required to ensure that appropriate action is taken in the event of an emergency arising at the device for which he is the amusement ride operator. The attendant appointed to work on any amusement device shall receive suitable and sufficient training in the workings of the device to ensure that he has adequate knowledge of:
 - a. The task he is required to perform on the amusement device;
 - b. The procedure for reporting any breakdown or defect which he notices; and
 - c. The measures or action which he is required to take in the event of an emergency arising on the device;



- v. The amusement ride operator and attendant shall be properly instructed on their duties relating to the use of containment or restraint equipment provided for the safety of riders.

9.4 Site layout, assembly and erection and electrical requirement

9.4.1 Choice of site

The ground chosen as the site should have a firm surface, be well drained and shall be capable of carrying safely, without excessive settlement, any loads likely to be imposed upon it. The following additional factors should also be considered in the choice of a site:

- i. The slope or unevenness of the ground;
- ii. Perimeter protection;
- iii. Availability of services, e.g. electricity, water, drainage and sewerage, and fire services;
- iv. Prevailing or possible wind speed;
- v. Access and egress for riders, emergency vehicles and equipment;
- vi. The proximity of surrounding buildings, natural objects and cultivated areas in relation to the potential for collision and the risk of the spread of fire;
- vii. The air space above the operating zone;
- viii. Known history of the site;
- ix. The proximity of other devices;
- x. The proximity of electrified conductors;
- xi. The possibility of uplift, caused by the action of the device itself or by the wind acting upon it, and the effect of such uplift upon the ground chosen for the site; and
- xii. The position of underground services or overhead cables which may present hazards during the erection or operation of the device.



9.4.1.1 Preparation of site

The site should be prepared and maintained so that it provides an even surface for those parts to which the public has access. Care should be taken to avoid creating hazards which may cause people to trip or stumble.

9.4.1.2 Condition of site

The condition of the site should be checked regularly to ensure that its load-bearing capabilities have not deteriorated. Settlement in the ground may cause instability, thus requiring repacking and re-levelling of a device.

9.4.1.3 Location and clearance

When establishing the positional relationship between amusement devices and between devices and fixed structures or objects, controllers shall apply the following principles:

- i. The proximity to other fixed or mobile structures or services shall be considered before building of the device;
- ii. A device shall be sited so that there is no dangerous uplift present, which may be caused by the action of wind forces on the device itself;
- iii. Arrangement so that the public has safe access to each device at entrance and exist points;
- iv. Sufficient clearance shall be provided between and above devices on main access routes to provide access for emergency service vehicles and access to fixed fire hydrants; and
- v. Sufficient clearance between adjacent amusement devices, buildings or other occupied areas so as to minimise the risk of fire spreading.

9.4.2 Set-up and operation near power lines

- i. Unless written permission has been obtained from the power supply authority and the required special procedures specified by that authority are followed, any part of an amusement device, whether permanently installed or mobile, shall not encroach on the limits set out below during set-up, installation or operation near power lines:



Power Line	Less than 600V	More than 600V
For distribution lines on poles	2.1 m	4.57 m
For transmission lines on towers unless designated otherwise by the electricity supply authority	4.57 m	

- ii. For installation or erection of an amusement ride or device at any site, the controller shall ensure that no underground cables, either permanent or temporary, can come into contact with spikes or pegs driven into the ground, and that any site preparation will not damage such cables.

9.4.3 Locations within buildings

Where a device is within a building having other functions, e.g. within a shopping complex or hall, specific attention shall be paid to the following to ensure compatibility of the emergency procedures for the device with those of the building or complex:

- i. Provision of emergency systems to effect disembarkation;
- ii. Special features required for operation under fire or emergency evacuation conditions, including provision of emergency lighting for evacuation paths and areas around the device, which operating staff may need to access to effect evacuation; and
- iii. Training of operators and proof of procedures to address emergency evacuation requirements.

9.4.4 Lighting

Adequate lighting shall be provided within, and for the approaches to, any device that operates in a building or at night.

9.5 Erection and dismantling

9.5.1 General

The assembly and dismantling of devices shall be carried out by or under the direct supervision of authorised persons and in accordance with the manufacturer's instructions.



9.5.2 Supervision and personnel

- i. The assembly and dismantling of amusement devices shall be carried out by or under the direct supervision of the controller or authorised person trained or experienced in such work.
- ii. Devices shall be correctly assembled or dismantled in accordance with the manufacturer's written instructions.

9.5.3 Lighting

Work should not be carried out where the lighting is insufficient to enable work to be performed safely.

9.5.4 Public safety

- i. No work in connection with the assembly or dismantling of amusement devices shall be carried out where such work may present a hazard to the public. Any zones of concern around a device during assembly or dismantling should be clearly delineated with appropriate signage posted.
- ii. The controller shall operate in full compliance with all laws, prescriptions and regulations issued by the relevant authorities.

9.5.5 Suitability of equipment and parts

The parts, tools, working platforms, scaffolding and lifting equipment should be suitable for the application, and should comply with all Malaysian laws and relevant standards.

9.5.6 Working methods

- i. A safe procedure of work shall be followed during operations.
- ii. Where there is any temporary state of weakness or instability in the device during assembly or dismantling, all practicable precautions shall be taken to prevent danger through the collapse of any part of the device.
- iii. If the structure is anchored by means of guy ropes and ground anchors, these must be fenced off or otherwise protected so that members of the public or operating personnel do not walk into them or trip over them.
- iv. Safe access during erection and dismantling operations shall be provided.



- v. Before the device is made operational, unauthorised access shall be prevented through openings in platforms and through any gaps within the device, which are required for access only when the device is not in motion or use. Such openings or gaps shall be provided with covers, securely fixed in position or with barriers and access doors, which are securely fastened.
- vi. Upon completion of assembly, all components crucial to the safety of the device, such as structural elements, connecting parts, securing parts, safety devices, the electrical system and brakes, shall be checked to ensure that they have been properly installed.
- vii. All structural members needed to ensure the stability and safety of a device should be used and correctly fitted. Where it is a design requirement, the whole assembly shall be securely anchored to ensure that it is stable.
- viii. During assembly, all components shall be carefully and closely examined for signs of wear, deformation or other damage.
- ix. Where excessive wear or damage is discovered, such components shall be replaced by components which meet the design specification before assembly and use. Temporary repairs using unsuitable components shall not be made.
- x. Where necessary, all components shall be properly lubricated before they are incorporated into the device.
- xi. Parts should be aligned and should not be bent, distorted, cut or otherwise damaged in order to force a fit.
- xii. Fastening and securing components of an appropriate type and size shall be used and correctly adjusted.
- xiii. Where rail tracks form part of the device, they should be properly laid and aligned so that units run safely and smoothly over them.

9.5.7 Ground packing and blocking

9.5.7.1 General

Amusement devices shall be set up to maintain stability under all conditions of operation. Where packing and blocking are used to achieve this, the following should be considered in their selection and deployment:



- a. Blocks should be of timber or reinforced concrete, and should be free of defects. They should be in square or rectangular sections and cut cleanly with parallel sides. Masonry blocks, bricks or similar materials should not be used for short-term set-ups;
- b. Shims (packing of less than 32 mm timber or 25 mm plywood) should be from steel or moisture resistant plywood or should be of high quality, dressed hardwood with thickness greater than 8 mm; and
- c. Brittle fibre composites should not be used in any packing;
- iv. No packing, block or stack should have a ground bearing area dimension less than that of the load point (float, jack or similar) to which it applies. Blocks in ground contact in any circumstance should provide an area not less than 200 mm x 200 mm;
- v. Packing stacks should be assembled from the minimum number of individual blocks, constructed in alternate layers of increasing dimension (from top down) so as to maintain stability. Bridged packing layers should be avoided. Shims installed to level and stabilise layers should be fixed by nailing as the layers are constructed; and
- vi. Before a device is put into operation, packing should be checked to ensure that it is securely fixed in position and does not permit differential settlement, which may be detrimental to the safe running and stability of the device.

9.5.8 Control stations

- i. Control stations shall be situated where any interference by the public may be prevented. Wherever possible, control stations should be located to provide the operator of the device with an unrestricted view of all embarkation and disembarkation stations.
- ii. Where a device has remote areas or areas obscured from the view of the operator, means of observing and communicating with riders should be provided at the control station.

9.5.9 Access

Access doors and hatches and any gaps on or beneath devices, which are large enough to permit unauthorised access of a whole or part of a body, should be sealed or effectively guarded.

9.5.10 Fences, handrails, guards and temporary barriers



9.5.10.1 General

An amusement ride or device shall be provided with fences, handrails, guards and temporary barriers or other apparatus and controls as may be necessary to:

- i. Confine operating staff and riders within the boundaries of the device to safe areas;
- ii. Ensure the safety of persons in the vicinity of the device (e.g. spectators, passers-by and those queuing to use the device) other than riders using the device when it is in operation; and
- iii. Ensure the safety of operating staff.

and comply with the Factories and Machinery (Fencing of Machinery and Safety) Regulations 1970.

9.5.10.2 Fencing

Fencing, where provided, shall have sufficient strength and stability and shall:

- i. Delineate the zone of concern;
- ii. Be not less than 1 m in height above adjacent surfaces; and
- iii. Be constructed to effectively prevent any person from moving through it or under it, thus impeding unaided access to the zone of concern.

9.5.10.3 Guards

Guards, where provided, shall prevent a person reaching (with any part of the body) into the clearance space that applies to any vehicle of an amusement device. Guards, whether in combination with fences or other means, shall also prevent any person from reaching within 1 m of any moving part of the device with any part of the body.

9.5.10.4 Temporary barriers

Temporary barriers, where provided, shall be not less than 1 m in height, and shall remain stable when loaded by a horizontal force applied in any direction, to the uppermost edge. They shall be painted in a distinctive colour and shall carry signs marked 'NO ACCESS' in lettering not less than 75 mm in height and of a contrasting colour which are placed at appropriate intervals along their length.



9.5.11 Discharge of exhaust fumes

Engine exhaust fumes or noxious fumes from any source shall be discharged clear of any persons or equipment.

9.6 Care of equipment

9.6.1 Mechanical equipment

- i. It is necessary to take special care of safety critical components. They must be carefully checked before erection. They shall not have signs of tear, breakage or other damage.
- ii. Particulars and assembly units defined as having a specified operational life must be checked to verify their complete functional safety.
- iii. When cranes are used for the erection of heavy components, it is necessary to follow carefully the instructions of the manufacturer in order not to adopt unsuitable lifting methods which may cause damage and consequent danger during operation.
- iv. All mechanical precision fittings must be erected without abnormal stresses.
- v. All pins must be provided with safety locknuts and washers or with split pins, castellated nuts with split pins, etc. It is necessary to give close attention to bolted couplings. Tightening torques used must be suitable to the dimension of bolts and their class of sturdiness. There must be available torque wrenches for bolted couplings, which are important for the safety of the amusement device.

9.6.2 Hydraulic and pneumatic equipment

- i. Piping, hosing, relief valves, etc. shall not be damaged, weathered or flattened.
- ii. There shall not be leakages.

9.7 Electrical requirements

9.7.1 General

- i. All electrical equipment used in the assembly, erection and operation of an amusement device shall comply with the requirement of relevant authorities.



- ii. Installation work in relation to connection to the main electricity supply must be carried out by an authorised person.
- iii. Electrical light fittings must be positioned in such a way that the risk of fire is minimised.

9.7.2 Switchboards and switch panels

All switchboards and switch panels shall be mounted in key-lockable enclosures located in a position not readily accessible to unauthorised persons.

9.7.3 Specific requirements for all electrical installations

All electrical installations shall comply with the following requirements:

- i. Exposed lamps shall not be installed within arm's reach of any position accessible to the public;
- ii. An electric cable passing under an amusement device or within 900 mm of any moving part thereof shall be adequately protected;
- iii. No damaged or faulty cable, appliance, switch or electrical fitting shall be permitted or retained as part of any electrical installation;
- iv. Where an amusement device is connected by means of a flexible cord and plug to a voltage supply:
 - a. Any suspended wiring shall be of stranded cables and shall not be within arm's reach of the ground or floor level; and
 - b. Any electrical wiring that is on the ground and vulnerable to damage shall be mechanically protected.

9.7.4 Emergency lighting

- i. Emergency lighting shall be used to illuminate exit signs deployed, except where natural light during power failure would be adequate. Such emergency lighting shall be inspected and maintained.
- ii. Where the nature of the construction prevents the use of internally illuminated exit signs (e.g. light fabric walls), painted signs illuminated by general and emergency lighting may be used. In addition, the following requirements shall apply:



- a. Where the emergency power is not generated by a self-contained power source within the device, an emergency generator or central battery system shall be used;
- b. The emergency lighting and exit sign system shall be tested on a regular basis. For mobile amusement devices, this testing shall take place each time the device is set up, and prior to daily operation.

9.7.5 Lightning protection

If lightning protection is supplied with the amusement device, it shall be deployed each time the device is erected.

9.7.6 Grounding of devices

All amusement rides or devices which are electrically powered shall be effectively grounded.

9.7.7 Special safety devices/ emergency equipment

Special safety devices and special emergency equipment which are listed in the manufacturer's manual shall be subject to special care at all relevant times.

9.8 Trial operation and check

9.8.1 After erection and before putting into use

- i. After erection, a check shall be carried out in accordance with the checklist of the manufacturer.
- ii. After assembly, it shall be ensured that the device is stable and firmly in position.
- iii. The operator and/or the controller shall conduct one or more trial runs without the public according to the instructions of the manufacturer, simulating, where possible, emergency situations to verify that the safety equipment and emergency equipment are in proper working order.

9.8.2 Daily check and trial run

- i. Each amusement device shall be checked daily or at more frequent intervals where necessary each day before it is made available for use by the public.



- ii. The check shall be carried out by the controller or authorised person on his behalf. The authorised person carrying out the check shall be sufficiently trained or experienced in the check routines that have to be carried out.
- iii. Daily checks shall concentrate on the proper functioning of those parts of the device which, should they fail, could result in personal injury.
- iv. The device shall not be made available to the public until any adjustments or repairs judged to be necessary as a result of this inspection have been satisfactorily completed.
- v. The components to be checked shall be recorded in a daily checklist which forms part of the log book as prescribed in Appendix J.

9.8.3 Inspection of safety and emergency devices

The manufacturer's written instructions shall be followed.

9.9 Operation

9.9.1 Start up daily

Before an amusement device is made available to the public, the amusement ride operator shall make a complete trial run including, if possible, emergency test controls.

9.9.2 Loading and unloading of passengers

- i. Every passenger carrying amusement device shall be loaded in a manner which ensures that all passengers are accommodated and carried safely.
- ii. Where there is a particular requirement to load passengers into a partly filled car or device in a particular pattern, the amusement ride operator in charge of the device shall ensure that this loading is correctly carried out.
- iii. The ride attendant and operator shall ensure that each passenger is appropriately positioned and that any restraint equipment is effectively fastened in position before either starting the ride cycle, or giving any signal or form of indication that the ride cycle may be started.



- iv. Passengers shall be excluded from using any part of a device where the equipment for containment or restraint is defective.
- v. The ride cycle shall not be started until it has been established that no persons in the vicinity are in positions of danger due to the motion of the device.
- vi. The loading area must be free during the operating cycle.
- vii. The controller of an amusement device shall regularly review the efficiency and adequacy of safety arrangements in the light of experience or changing circumstances, and where appropriate, modify or improve the arrangements in use. He must not modify safety devices or the safety procedure without consulting the manufacturer or designer.
- viii. Where there is a possibility that the passengers on an amusement device may become stranded away from the disembarkation point, instructions shall be prepared which detail the arrangements for conveying them safely and without undue delay to the safe place, preferably in the unit in which they are travelling. In the case of a dark ride, the instructions shall detail arrangements for conveying passengers to the exit. The arrangements shall be suitable for all persons allowed to use the device, and should be known and understood by the ride operator and the ride attendant working on the device.
- ix. Areas on or near devices where it is not safe for persons to stand shall either be fenced off or be clearly indicated and so far as practicable, members of the public prevented from encroaching upon them.

9.9.3 During operation cycle

All passenger carrying amusement devices, when available for use by the public, shall at all times be in the immediate charge of a ride operator who is capable of working the device competently in a safe manner with due care for passenger safety.

9.9.4 Supervision of the public

Where it is foreseeable that particular passengers or riders by virtue of their physical characteristics may be at risk on certain passenger carrying amusement devices because of the nature of the ride, they shall be identified and excluded, so far as practicable, unless sufficient additional protection can be given to them.



9.9.5 Instruction to the public

- i. Legible notices or signs shall be prominently displayed, clearly and simply stating any limitations as to who has to be excluded from being carried on the device.
- ii. The information on such signs should include the following:
 - a. Minimum age of users;
 - b. Minimum or maximum allowable height/weight of riders;
 - c. Carrying of bulky items (sticks, umbrellas, etc.) is prohibited;
 - d. Maintaining of the intended passenger position (i.e. no leaning out, stretching out arms or legs nor standing up during operation);
 - e. Any other specific advice on the safe operation of the device;
 - f. Advice for passengers who are ill, under medication or under the influence of alcohol or drugs;
 - g. Other restrictions such as persons who have heart diseases or are pregnant, etc.
- iii. Ride attendants and operators shall, so far as they can reasonably do so, ensure that such exclusions are enforced.
- iv. Other kinds of visual or audible signals must be available particularly for emergency situations. They must be kept in working order and tested before the amusement device operates.

9.9.6 Out of operation

The main switch and all other switches shall be switched off and the starting key shall be removed. Unauthorised access to the operator cabin shall be avoided by keeping it securely locked.

9.9.7 Environmental limitation

The owner should cease the operation of all amusement devices whenever there is a severe change in environmental condition such as lightning, strong wind or earthquake except to release or discharge riders. The owner should follow the restriction stipulated in the manufacturer's manual.



9.10 Maintenance, replacement, repair and modifications

9.10.1 General

- i. All replacements, repairs and modifications of amusement rides and devices, including discrete systems and components within them, shall be carried out by authorised persons and shall be:
 - a. In accordance with the designer or manufacturer's instructions;
 - b. Fully documented; and
 - c. Recorded in the technical file with the device or recorded and kept elsewhere for future purposes.
- ii. In the absence of instructions from the designer or manufacturer, those authorised persons involved in the maintenance, replacement, repair and inspection of amusement rides and devices should be able to demonstrate knowledge of the original intentions of the designer or manufacturer.
- iii. Preventive maintenance programmes and inspection routines shall be implemented for the moving and load-bearing components and structural members of an amusement device, to maintain mechanical and structural integrity and to identify areas of excessive rust, wear, fatigue or any other condition which could lead to the failure of such components and structural members and compromise the safety of passengers and operating staff.
- iv. Following major maintenance and repair, and at random intervals on other occasions, a hazard identification and risk assessment procedure should be completed to ensure new hazards are not present, and residual risks identified by the designer or manufacturer are not increased.

9.10.2 Maintenance

All maintenance work on an amusement device shall be carried out by or under the direct supervision of persons trained or experienced in the maintenance procedures appropriate to that device and in accordance with the designer or manufacturer's instructions.

9.10.3 Servicing

- i. The servicing intervals recommended by the manufacturer shall not be exceeded unless any extension in the period has been discussed and agreed with the manufacturer.



- ii. The frequencies at which servicing shall be carried out shall be in compliance with the manufacturer's recommendations.
- iii. Servicing recommendations shall deal with all components that have to be checked, tested, lubricated, adjusted or replaced at specified intervals.

Where necessary, these recommendations shall cover:

- a. Diagrams of the mechanical, electrical, hydraulic and pneumatic systems, and of the safety and security systems;
 - b. Instructions concerning the action to be taken in checking, testing, lubricating, adjusting or replacing, as well as for the dismantling and assembly of components;
 - c. Specifications of the required condition of the parts in question, and the permitted deviations;
 - d. Specifications of the components, materials and lubricants to be used; and
 - e. The intervals at which the various checks and servicing work shall be carried out.
- iv. The ride controller shall ensure that replacement parts fitted during servicing operations are of the correct specification. If it becomes necessary to use replacement parts which are different from those specified by the manufacturer, the ride controller shall treat these changes as a modification.

9.10.4 Modification

- i. Any modification to:
 - a. Design specification;
 - b. Structures;
 - c. Safety device components;
 - d. Emergency equipment; and
 - e. Performances



- iv. Upon completion, the repair work shall be tested to demonstrate that the component will perform in the same manner as the original component;
- v. The material used for any repair shall be equal to or superior in specification to the original material so that it will not give rise to any unwanted effect likely to reduce the overall performance of the component; and
- vi. Upon completion of the repair work, the device shall be tested and certified by an approved inspection body before being put into use.

9.10.6 Replacement

9.10.6.1 General

In the event of failure of any structural, moving, braking or load-bearing component of an amusement device, that component shall be replaced by a compatible component of equal or greater strength. Any replacement shall be recorded in the technical file.

9.10.6.2 Hydraulic and pneumatic system components

- i. Replacements for any of the components in hydraulic and pneumatic systems:
 - a. Shall be compatible with existing parts;
 - b. Shall be equal to or superior in specification to the original parts;
 - c. Shall not change the operating parameters of the device; and
 - d. Shall not adversely affect the performance and safe operation of the device.
- ii. Where the failure of any hose may affect the safety of riders or operating staff, it shall be replaced as part of a preventive maintenance programme, implemented in accordance with either the hose or device manufacturer's instructions.



9.11 Inspection

9.11.1 General inspection

- i. Every amusement device in use, together with all its ancillary parts, shall be thoroughly inspected at appropriate intervals.
- ii. Any inspection procedure and schedule specified by the designer or manufacturer shall be implemented and recorded in the technical file.
- iii. In the case of temporary amusement devices, thorough inspection should be carried out by the authorised person before being put into use at each installation.

9.11.2 Visual inspection

- i. All amusement devices require a visual examination as part of the thorough examination.
- ii. Any visual inspection may require supplementing with non-destructive testing (NDT) at the discretion of the approved inspection body. The ride structure should be observed for deformities, i.e. buckled, bent or dented members, loose or missing parts, cracks.
- iii. Structural members should be examined for deterioration, such as rusting of steel, rotting of wood/plywood, degradation of textile membranes.
- iv. Passenger restraint devices should be closely examined for wear, correct adjustment, correct operation and anchorage.
- v. Critical welds, bolts, pins, joints, should be closely examined for evidence of crack or excessive wear.
- vi. Visual inspection of weld joints is particularly relevant where welds are being examined for the first time after modification or repair.
- vii. Electrical and electronic installations should be examined for any modifications or deterioration.



9.11.3 Initial inspection

- i. Amusement devices shall be subjected to an initial inspection after installation. For Category I amusement devices, the inspection shall be carried out by DOSH.
- ii. The installation of an amusement device shall be in accordance with the approved design documents;
- iii. Upon inspection of a Category I amusement device and payment of the prescribed fee, the inspector shall, where he is satisfied that such device complies with the provisions of the Act and the regulations relating thereto, issue the appropriate certificate of fitness.
- iv. The period of validity of all certificates of fitness in respect of Category I amusement devices shall be fifteen calendar months from the date of inspection.

9.11.4 Regular inspection

Every ride shall be subjected to a detailed inspection procedure, which takes into consideration all the manufacturer's instructions. It shall have NDT and an inspection programme that monitors the integrity of critical components as identified by the designer or manufacturer.

9.11.5 Record keeping

All devices must have records kept of any tests, maintenance, inspections, commissioning or alteration of devices relevant to controlling risks arising from the devices.

- i. The controller shall maintain, for as long as the ride is in operation, and make available to DOSH for review during any audit or inspection, all of the following records including, but not limited to:
 - a. Employee training records;
 - b. Maintenance, repair and inspection records for each amusement ride;
 - c. Records of accidents associated with amusement rides due to failure, malfunction, use or operation of the ride, resulting in any injury or fatality;
 - d. Records of incidents associated with amusement rides due to failure, malfunction, use or operation of the ride, resulting in no injury;



- ii. The information on accidents and incidents recorded pursuant to Occupational Safety and Health (NADOOPOD) Regulations 2004; and
- iii. Each accident/incident shall be classified according to the following categories based on the reliable reported or observed information:
 - a. “On ride accident/incident” – occurrence of accident/incident while the rider was riding the amusement ride which was in operation;
 - b. “Loading and unloading accident/incident” – occurrence of accident/incident while the rider was within the area designated for loading and unloading of the amusement ride;
 - c. “Queue line accident/incident” – occurrence of accident/incident while the rider was in line for the amusement ride;
 - d. “Other” – occurrence of accident/incident in a location other than described in (i) (a) through (iii) (c) above.

9.11.6 Log book

The controller of amusement devices shall provide a log book for each device. The controller shall ensure an up-to-date log book is kept and maintained for as long as the ride is in operation, and make it available to the DOSH inspector for review during any audit or inspection. The contents of the log book are as prescribed in Appendix J.

The purpose of the log book is as follows:

- i. To ensure that the ride is inspected by an authorised person before it is used;
- ii. To record the particulars of erection or installation;
- iii. To record the particulars of dismantling and storage;
- iv. To record the particulars of maintenance and periodic inspection;
- v. To record the particulars of repairs, modifications, servicing, damages or accidents; and
- vi. To serve as a permanent record for reference and guidance when necessary.

9.11.7 Certificate of fitness

- i. The owner of amusement devices shall hold a valid certificate of fitness so long as such devices remain in service.



- ii. The validity period of every certificate of fitness is fifteen (15) months from the date of inspection.
- iii. The certificate of fitness is void if the device is dismantled and relocated.

9.11.8 Transfer of ownership

- i. The validity of a current certificate of fitness shall be void in respect of any device which is sold or hired out.
- ii. A change of ownership shall be recorded in the technical file.

9.11.9 Ride identification (name plate)

Each amusement device shall be provided with a marking plate showing the following information:

- i. Name and address of manufacturer;
- ii. Type/model number;
- iii. Manufacturer's serial number;
- iv. Year of manufacture;
- v. Safe working load/number of persons.

10. MISCELLANEOUS

10.1 Fire fighting

All amusement parks shall be equipped with adequate fire fighting devices. Fire extinguishers shall be set up in places where they are readily visible and easily accessible. They must be able to be held/handled without difficulty and be kept ready for use at all times. They are to be inspected to confirm the expiry dates.



REFERENCES

- i. Factories and Machinery Act 1967**
- ii. European Standard (CEN/TC 152 WG)**
- iii. Australian Standard (AS 3533.1 – 1997)
(Amusement Rides and Devices), Part 1: Design and Construction**
- iv. Australian Standard (AS 3533.2 – 1997)
(Amusement Rides and Devices), Part 2: Operation and Maintenance**
- v. ASTM Standards on Amusement Rides and Devices**
- vi. Code of Practice for Design and Construction
(Temporary Structures – DIN 4112)**
- vii. VdTUV Code of Practice – Principles for Inspection and Testing on
Non-Permanent Structures (Manual Handling Systems 1507)**
- viii. Code of Practice – Fairgrounds and Amusement Parks (HS (G) 81 – Health
and Safety Executive (HSE))**
- ix. A Code of Safe Practice at Fairs: Technical Annex – Health and Safety
Executive (HSE)**



GENERAL INFORMATION FOR RIDERS

The controller of an amusement ride or device should:

- a. Display adequate information on the possible effects the use of a ride or device may have on riders; and
- b. Instruct the operator of a device on the importance of carrying out, at all times, any oral instructions to riders as may be necessary for their safe participation in the device.

TYPICAL INFORMATION

The following information (or variations thereof for specific rides or devices) for riders should be considered for display at appropriate locations:

- a. There are inherent risks in the participation in or on an amusement ride or device. Riders, by their participation, accept the inherent risks of which a prudent person is or should be aware. Riders should consider this participation an exercise in good judgment and act in a responsible manner while using the facility.
- b. Riders have a duty not to participate in or on any amusement ride or device when under the influence of alcohol or drugs.
- c. Riders have a duty to act with good judgment and consideration, both for themselves and others, and to refrain from behaviour which could affect their safety, the safety of other riders or the safety of the device itself.
- d. Riders have a duty to obey all reasonable written, and particularly oral, instructions and warnings given by the controller or operator of any ride or device, without objection.
- e. Riders have a duty to use, as instructed, all safety equipment provided when participating in any ride or device. Riders choosing to supply their own safety equipment do so at their own risk and accept full responsibility for any failure or non-performance of such equipment.
- f. Riders of amusement rides or devices have a duty to prove that their action did not contribute to any incident in which they may have been involved.

Owners or controllers of amusement rides or devices should display such information on appropriate signage at the point of sale where the contract for the use of such devices is completed.



GENERAL GUIDELINES FOR OPERATOR SELECTION AND INSTRUCTION

GENERAL

The following is a guide for controllers of amusement rides and devices on the selection and training requirements of operators:

- a. Select suitable personnel as operators who are at least 18 years of age and are able to be trained to understand the use and function of the ride or device under their control.
- b. Ensure attendants (some of whom may be under 18 years of age) fully understand their duties and are able to perform such duties as instructed by the operator.
- c. Instruct each operator fully in the proper use and function of the device to be operated, including the following:
 - i. Controls and procedures for normal and emergency operation;
 - ii. Manufacturer's recommended maximum speed and load;
 - iii. Manufacturer's recommended ride time and frequency of repeat rides;
 - iv. Any foreseeable misuse of the device as determined by the manufacturer or controller, or by special conditions such as weather, location or crowds;
 - v. Fire fighting and other emergency procedures.
- d. Ensure each operator carries out the following daily routine:
 - i. Inspect the device in accordance with a prepared checklist before commencement of operation each day.

Note: The checklist should be prepared by senior operations staff and should include a section requiring confirmation that all outstanding repairs, servicing and maintenance have been completed.

- ii. Determine, as far as possible, that no portion of the device is damaged or unsafe, or is liable to deteriorate to an unsafe condition.
 - iii. Ensure that the device is not operated unless the checking procedures are completed.
 - iv. Report any operating problem to a supervisor or controller.
- e. Instruct the operator and attendant not to allow riders who appear to be ill or under the influence of drugs or alcohol to participate in the device.



- f. Instruct the operator not to permit riders with loose clothing or unrestrained long hair to participate in the device where the potential for entanglement exists.
- g. Instruct the operator and attendants not to allow smoking on the ride or device.
- h. Instruct the operator and attendants on the correct method of securing riders in or on the device, and to ensure that the device is loaded in a balanced manner.
- i. Instruct the operator not to allow riders who cannot be properly secured owing to physical size, or with a disability which may affect their ability to withstand the forces generated by the movement of the device, to participate in the device.
- j. Instruct the operator to stop the device if any rider is observed tampering with any restraint or behaving in such a manner as to endanger himself or others.
- k. Instruct the operator not to start the device while people other than riders and the necessary attendants are within the operating zone.
- l. Instruct the operator to remain in control of the device during the entire cycle, and not allow any person other than another operator to assume control, except where the device is intended for direct rider control.
- m. Instruct the operator that no safety device is to be altered or removed for service or replacement purposes without prior approval from the controller.
- n. Instruct the operator in all emergency procedures and other procedures for breakdown, power failure, rider illness or any other event, which could affect the safety of the device or riders.
- o. Inform the operator of the danger presented by loose items carried or worn by riders and instruct him to inform riders on how to secure or deposit such personal items before participating in the device.
- p. Instruct the operator on maintaining an operating zone clear of all people other than attendants (where required) while the device is operating.
- q. Should the operator also be part of the erection crew, ensure that he is competent in such matters.
- r. Instruct the operator on procedures for incident or accident reporting and completion of logs.

TRAINING PROGRAMME

A formal training programme should be established and followed to include reference to all of the above requirements. Operators should be required to sign a document clearly indicating their participation in such training and subsequent acceptance of responsibility of operation.



SAFETY GUIDELINES FOR OPERATORS

The following is a guide for operators of amusement rides and devices to ensure that safe practices are implemented and followed during operation:

- i. Do not operate the device when feeling ill or under the influence of drugs or alcohol.
- ii. Riders who appear to be under the influence of alcohol or drugs or who are visibly ill should not be allowed on the device.
- iii. Assist riders on and off the device when necessary. Be careful when assisting riders with disabilities, and assist only with their express permission.
- iv. If the device is being misused in any way by riders, shut it down until the condition is corrected. Do not allow seats to be rocked or riders to stand up.
- v. Smoking by riders should not be permitted.
- vi. Be cautious and ready for the unexpected, especially where children are involved. Young children should be accompanied by responsible adults.
- vii. Riders waiting to participate should be kept out of the operating zone.
- viii. Ensure that entrances and exits are closed off before operation commences.
- ix. Ensure that the device is loaded in a balanced manner.
- x. Ensure any restrictions (e.g. height or size of riders) for the participation in a device are observed.
- xi. Be alert when the device is operating and be prepared for an emergency stop.
- xii. Never, under any circumstances, walk away from the device while it is operating, regardless of whether it is carrying riders or not.
- xiv. Do not board or mount a device while it is in motion.
- xvi. Take note of the nearest location of a fire extinguisher and check its condition.
- xvii. Report any fault or malfunction immediately to your supervisor or the controller.
- xvi. Do not operate the device in unsafe weather conditions, i.e. high winds.
- xvii. Be familiar with first aid procedures.
- xviii. Take pride in operating safely and always follow operating procedures, particularly where some restrictions may apply.



APPENDIX D

SUGGESTED TRAINING, QUALIFICATIONS AND EXPERIENCE FOR AUTHORISED PERSON

This appendix contains guidance on the minimum training, qualifications and experience that a person may be expected to possess when undertaking the various roles, responsibilities and tasks referred to in these guidelines.

Role/responsibility/task	Training/qualifications/experience
<p>Designer or other individual (whether or not nominated by the designer) responsible for undertaking work for which the designer would normally be responsible</p>	<p>This person should possess formal qualifications in engineering and sufficient experience to fully comprehend the concept of the amusement device, its probable mode and environment of operation, and the provisions relative to its maintenance.</p>
<p>Assembly, set-up, operation, dismantling and transport of amusement rides and devices (and supervision thereof)</p>	<p>Persons involved in such operations should have sufficient experience and knowledge of the device to enable such operations to be carried out safely and in accordance with the manufacturer’s instructions.</p>
<p>Specification of the load-bearing capacity of sites and the materials and methods used in packing blocking systems for mobile amusement devices that become permanent or temporary</p>	<p>The person providing such information should have an engineering or scientific background (preferably backed by formal engineering qualifications) and experience in the behaviour of the device under all conditions of operation.</p>
<p>Maintenance, replacement and repair of amusement devices or components thereof</p>	<p>Persons undertaking maintenance, replacement repair of amusement devices or repair of amusement devices or components thereof should, where necessary, be fully qualified by trade. Where formal trade qualifications are not required (e.g. for routine tasks), such persons should be fully trained in the requirements of the task to be performed.</p>



Role/responsibility/task	Training/qualifications/experience
Non-destructive testing (NDT) and evaluation of NDT results	A person conducting non-destructive testing and evaluating the results of any NDT programme should be recognised by the relevant industry body or regulatory authority.
Testing (to failure) of components	Any person carrying out sample testing (to failure) of components should have formal technical certification in the type of testing to be undertaken.
Hazard identification and risk assessment	Any person conducting hazard identification and risk assessment on an amusement device (or any part or component thereof) should have a thorough knowledge of the operation of the device, and of the general history of such a device. This person should be able to complete such hazard identification and risk assessment to the satisfaction of the relevant regulatory authority.
Inspection (general)	Any person inspecting an amusement device should possess formal engineering qualifications and experience similar to those of the designer of the device and should be in a position to make engineering judgments regarding the severity of faults determined through such inspections, intervals for inspection and appropriate repairs.
Refuelling operations	A person carrying out refuelling operations should be fully trained in the use of all equipment involved, and in the procedures for carrying out refuelling operations in a safe manner. The person should also be fully trained in the use of the fire fighting equipment appropriate to the fuel being used, and in the emergency procedure to be implemented in the case of fire, spillage or other unplanned hazardous events.
Alterations of an amusement device to eliminate or minimise a risk	The person providing advice on the implications of any alterations, where such alterations change the fundamental design or operating parameters of the device, should possess formal engineering qualifications and sufficient experience in the device to provide a comprehensive analysis of any change in performance which the alterations may bring about.



CONTENTS OF MANUAL

The manufacturer shall provide comprehensive instructions to the user including for assembly, operation and maintenance of the amusement ride and device. Special advice on qualifications of personnel too shall be given. These instructions shall be written in the language of the user. The manual shall at least provide the following stated instructions.

i. Assembly and dismantling instructions

These instructions shall comprise:

- specifications of the special equipment, tools, material or parts used for safe erection or dismantling of the amusement device;
- advice on foundation preparation (if permanently fixed);
- sequence of erection to maintain stability;
- jacking and packing procedures to facilitate levelling, out of level tolerances, advice on suitable packing and its limitations, load spread and any necessary ballast;
- correct methods for connecting electrical systems to the power supply and methods for interconnecting sub-assemblies if appropriate;
- torque settings for screws or bolts critical to the safety of the structure;
- schedules of tests and inspection to ensure correct functioning;
- earthing for lightning protection;
- plan of device, showing recommended packing points and details of maximum loads that will be applied at these points. Any foundation preparations should also be shown in the plan.

ii. Operating instructions

These instructions shall comprise:

- detailed explanation of the controls and their functions;
- recommended passenger access and egress procedures; and any limitations necessary to prevent static overload of the device;
- the prescribed limiting conditions stating any limitations for passengers (if any), the limits of speed of operation, cycle time and maximum number of passengers to be carried;
- any limitations as to permissible part loading or asymmetric loading of the device;
- details of the passenger restraint system and guidance on its use;



- emergency evacuation procedures including evacuation following a power source failure;
- any environmental limitations, e.g. conditions of wind, rain, during which the ride should not be operated.

iii. Maintenance instructions

These instructions shall comprise:

- those components which require regular lubrication, the types of suitable lubricant and the frequency of lubrication;
- those components which require regular replacement and the period between replacements;
- those components which require regular inspection, the recommended frequency of inspection and the method of inspection, e.g. visual, NDT;
- any specific tests to be carried out;
- recommendations for electrical testing which should include the testing of insulation resistance, conductor continuity, protective conductor continuity and proving the effectiveness of residual current circuit breakers where fitted;
- methods for proving the effectiveness of any interlocking circuits or controls;
- recommendations regarding electrical maintenance;
- safe isolation procedures.

iv. Special information

These instructions shall comprise:

- advice, that parts shall not be replaced without ensuring conformity to the original specification;
- any special requirement for the preparation of the device including the method to be adopted for examination;
- the maintenance, service or repair permissible by the user or qualified personnel and the necessary details.

v. Drawings and diagrams

These items shall comprise:

- an outline drawing of the device showing the principal dimensions when erected and recommended clearance distances for the device when in motion.



TECHNICAL FILE

General

The record associated with the amusement device must include the design documents which provide detailed information with respect to operating data, method of construction, instruction relating to operation and maintenance, repairs and modifications as well as examinations by independent inspection bodies. The record shall be available as a bound document on each erection site as proof to the DOSH inspector. All approval and examination reports shall be included by appropriate entries.

i. Content

The record shall comprise at least the following documents:

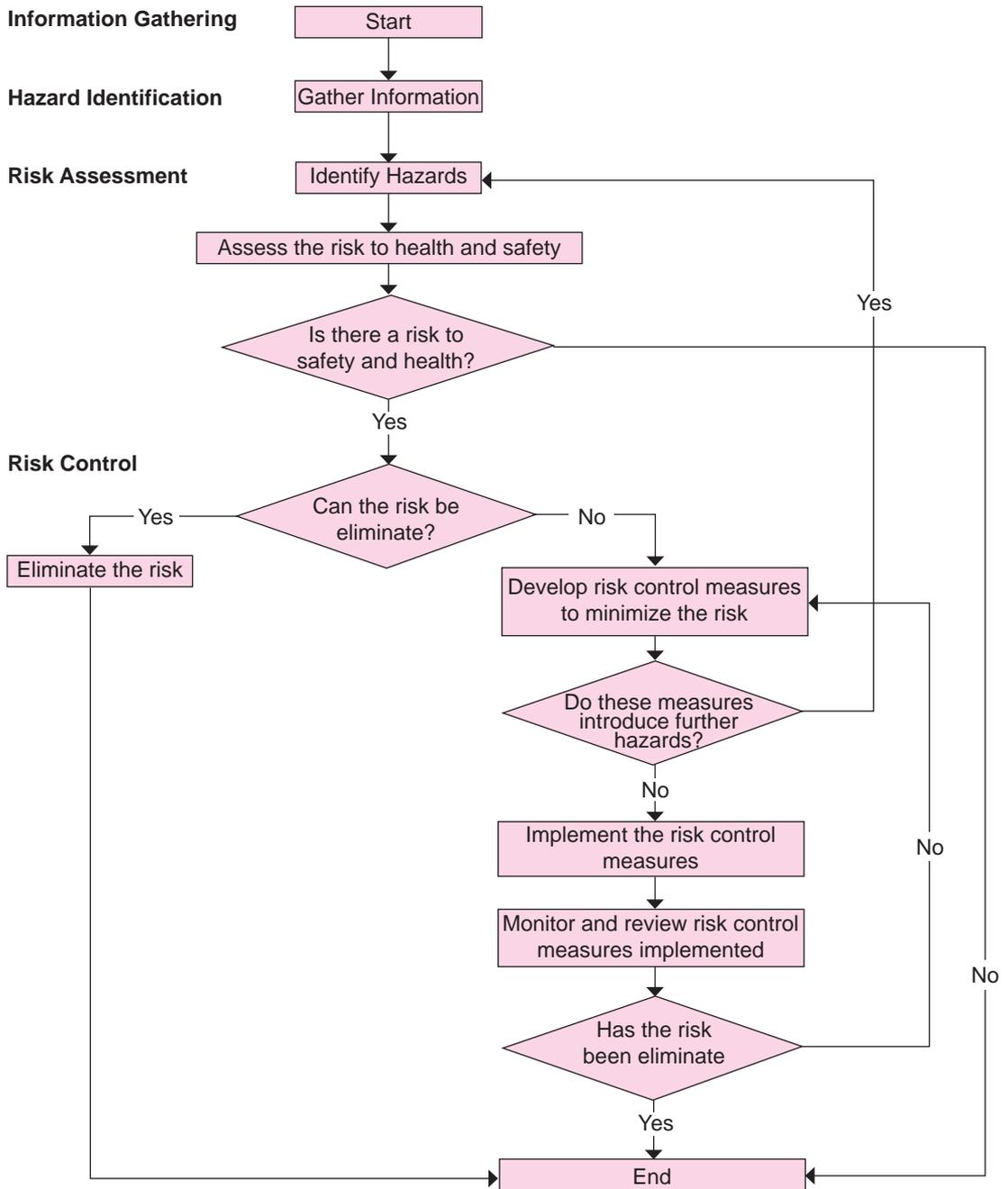
- Design approval letter (DOSH);
- Design and operation descriptions, which may be part of the stress calculations;
- Approved design drawings (clear presentation of the entire facility);
- Approved detailed drawings (accurate illustrations of the structural components and their connections);
- Stress analysis including fatigue analysis;
- Examination and approval reports as well as reports on any other inspections;
- Instructions written in the language of the user and manufacturer covering erection and dismantling, maintenance, list of all parts requiring periodic replacement;
- Basic circuit diagrams for electric, hydraulic or pneumatic components or equipment; and
- Layout drawings of the escape routes and their dimensions with calculated verification for enclosures with more than 400 occupants. Special instructions in case of fire.

ii. Conditions for use

When approval is granted, the technical file shall explicitly state:

- the speed limit;
- whether the utilisation by children must be prohibited;
- whether children may use the amusement device only when accompanied by adults;
- a height or age limit, if any;
- groups of persons to be excluded such as:
 - pregnant women;
 - persons with heart diseases;
 - persons with pacemakers;
 - persons with degraded health conditions;
 - persons with physical handicaps such that their safe accommodation cannot be sufficiently guaranteed by the restraint devices;
- the reference wind velocity specified for the device.

FLOW CHART FOR HAZARD IDENTIFICATION, RISK ASSESSMENT AND RISK CONTROL PROCESS





HAZARD PREVENTION

Preventive and Control Measures

Hazards and risks to workers' safety and health should be identified and assessed on an ongoing basis. Preventive and protective measures should be implemented in the following order of priority:

- a. Eliminate the hazard/risk;
- b. Substitute with less dangerous sources of risk;
- c. Control the hazard/risk at its source through the use of engineering controls or organisational measures;
- d. Minimise the hazard/risk through the design of safe work systems, which include administrative control measures; and
- e. Where residual hazards/risks cannot be controlled by collective measures, the employer should provide appropriate personal protective equipment, including clothing, at no cost, and should implement measures to ensure its use and maintenance.

Hazard prevention and control procedures or arrangements should be established and should:

- a. Be adapted to the hazard and risk encountered by the organisation;
- b. Be reviewed and modified if necessary on a regular basis;
- c. Comply with national laws and regulations, and reflect good practice; and
- d. Consider the current state of knowledge, including information or reports from organisations, such as occupational safety and health services, and other services as appropriate.



APPENDIX I

EMERGENCY PREVENTION, PREPAREDNESS AND RESPONSE

Emergency prevention, preparedness and response arrangements should be established and maintained. These arrangements should identify the potential for accidents and emergency situations, and address the prevention of occupational safety and health risks associated with them. The arrangements should be made according to the size and nature of activity of the organisation. They should:

- a. Ensure that the necessary information, internal communication and coordination are provided to protect all people in the event of an emergency at the worksite;
- b. Provide information to and communicate with the relevant competent authorities, and the neighbourhood and emergency response services;
- c. Address first aid and medical assistance, fire fighting and evacuation of all people at the amusement devices; and
- d. Provide relevant information and training to all members of the organisation at all levels including regular exercises in emergency prevention, preparedness and response procedures.

Emergency prevention, preparedness and response arrangements should be established in cooperation with external emergency services and other bodies where applicable.



DETAILS OF THE LOG BOOK

FRONT PAGE

Name and postal address of the owner of amusement devices
Name and postal address of the maintenance firm (if other than the above)
Location of the amusement devices
Certificate of registration no (if any)
Name of authorised person
Date of installation

CONTENTS

i. General:

Condition of pre-test
Maintenance and periodic inspection
Dismantling and storage
Short note on servicing and replacement
Short note on modification (if any)
Short note on damages (if any)
Short note on running repairs (if any)
Short note on all accidents involving the amusement device (if any)

ii. The daily checklist recommended by the manufacturer/authorised person must include:

Name of the operator
Date and time of authorised person's examination
Condition of weather
Condition of lighting
Condition of safety features
Condition of structure
Condition of fencing/guarding
Condition of surroundings, signage, alarm system and instructions
Condition of the controller's space
Condition of mechanical device/ride
Condition of wire rope (if any)
Authorised person's remark and signature

LIST OF CATEGORY I AMUSEMENT DEVICE



Spinning Star



Sky Flyer



Space Shot



Corkscrew



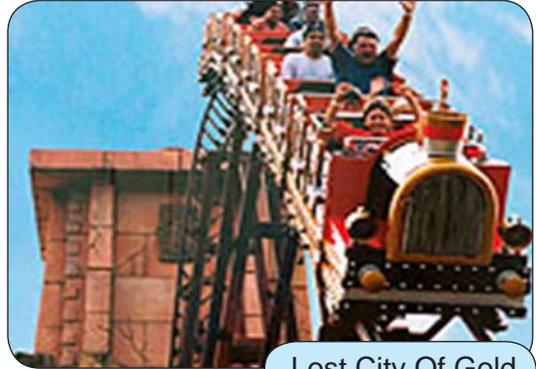
Flying Carousel



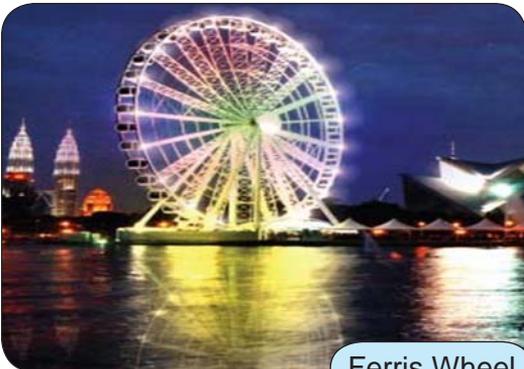
Swinging Ship



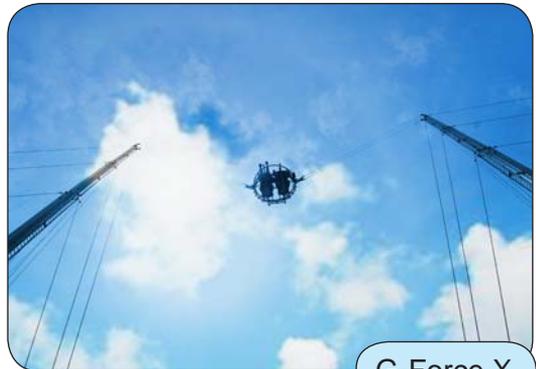
Rio Float



Lost City Of Gold



Ferris Wheel



G-Force X



Vulture



Super Loop

LIST OF CATEGORY II AMUSEMENT DEVICE



Tea Cup



Bumper Car



Merry Go Round



Busy Bugs



Mini Train



Mini Swing Ship



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