Guidance Note PM 57
from the
Health and Safety
Executive

Safe operation of passenger carrying amusement devices The Big Wheel

Plant and Machinery 57 (April 1986)

These Guidance Notes are published under five subject headings: Medical, Environmental Hygiene, Chemical Safety, Plant and Machinery and General.

INTRODUCTION

1 The Health and Safety Executive (HSE) published *The Code of Safe Practice at Fairs* in April 1984. It is the result of a joint initiative by HSE and the Associations* representing the fairground industry to improve safety standards at fairgrounds. The Code describes general principles and procedures required to safeguard operators, employees and members of the general public against injury from fairground amusement devices.

2 This Guidance Note describes various factors that can contribute to accidents on the Big Wheel, and the precautions that should be taken to avoid them. It is intended for operators, ride attendants and anyone else concerned with the safe operation of this ride.

3 The guidance is based on HSE reports on incidents, visits to fairgrounds by inspectors, and the considerable experience of fairground operators. The advice is not exhaustive, and should be read in conjunction with the Code. However, compliance with this Guidance Note or the adoption of other equally effective measures will reduce the risk of accidents on this ride.

SCOPE

4 The basic ride is known by different names such as the Ferris Wheel, Big Wheel, Big Eli, and Mini Big Wheel, which is a smaller scale ride for juveniles. These rides are available in both static and mobile versions.

5 Some of these ride names may be used for other rides of a different type. Other names may be used for this type of ride.

* The British Association of Leisure Parks, Piers and Attractions
The Showmen's Guild of Great Britain.
British Amusement Catering Trades Association.

DESCRIPTION

6 In its simplest form this ride consists of a single wheel mounted on a horizontal axle supported between two vertical towers as shown in figures 1-2. There are several different design variations, but all of these, apart from the very large static models installed at certain amusement parks in Europe and the USA, are of the same general configuration.

7 Some designs incorporate two or three wheels. The configuration of each wheel and its support towers is similar to that of the single wheel version, but additional structural beams and bracing are used to link adjacent support towers. The arrangement for transmitting power to the wheels is by a friction drive, wire rope or hydraulic system.

8 Each side of the traditional Big Wheel is a circular structure supported on spokes which radiate out from a central bearing hub. Each of these structures incorporates an arrangement of intermediate bracing members and/or wire ties between the hub and the periphery of the wheel. These two structures, the sides of the wheel, are mounted vertically in parallel on the horizontal axle which supports the wheel. They are connected together by cross members and diagonal wire ties. Passenger seats are mounted on the periphery of the wheel between adjacent pairs of spokes. The axle on which the wheel rotates is normally supported between a pair of towers, which are braced by steel tie members or tensioned guy ropes to give them lateral stability.

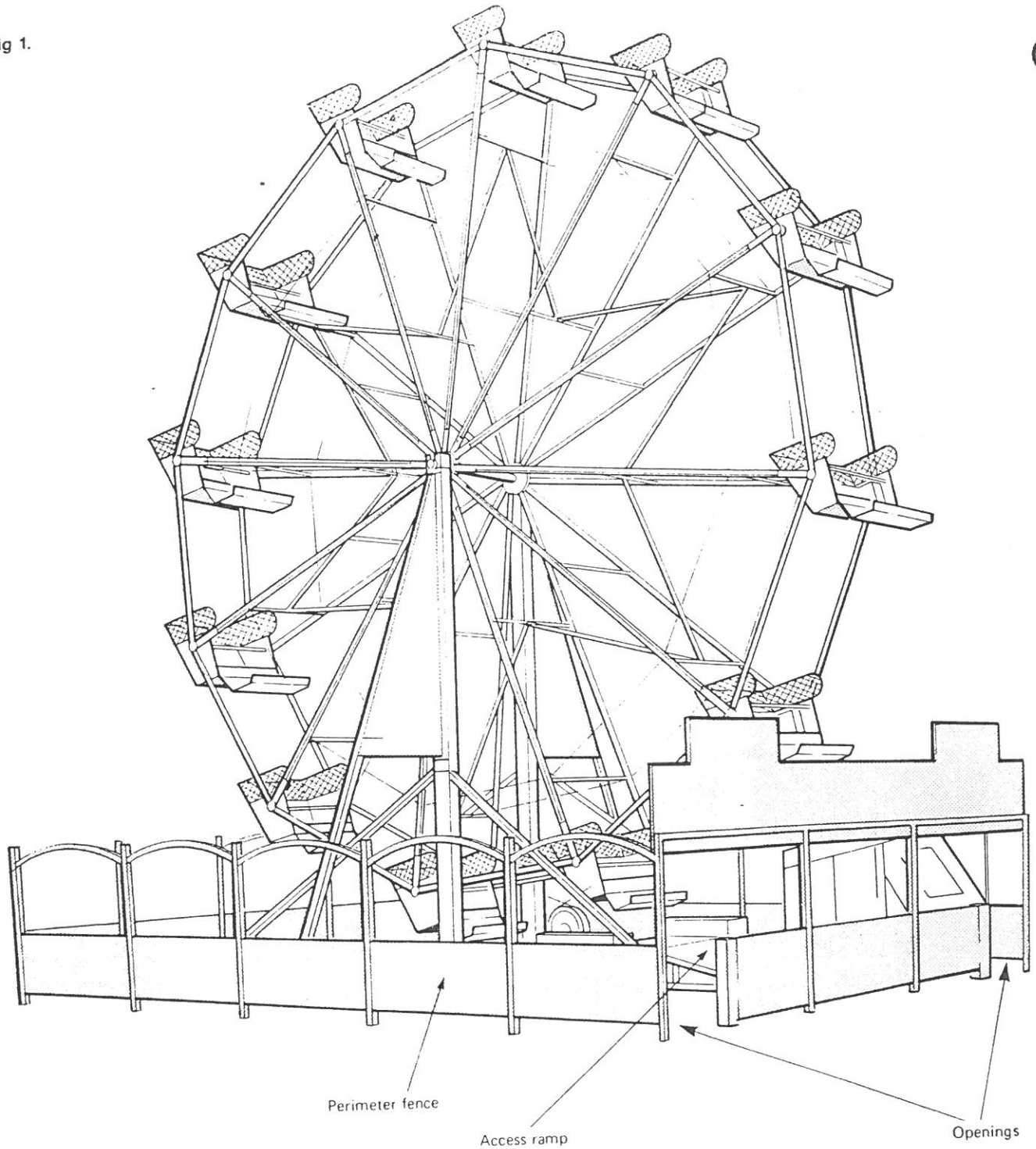
9 The wheel is driven by a cable which passes around the circumference of the wheel through guide blocks which are mounted alongside the passenger seat. The cable passes over an arrangement of drive pulleys at the base of one of the towers. These pulleys incorporate a rope tensioning device and are driven either by an electric motor or an internal combustion engine.

10 The wheel support towers and their associated bracing members are usually mounted on some form of chassis or ground beam.

11 The ride is enclosed within a perimeter fence, and various arrangements of ramps or steps are provided for access to the passenger loading area.

12 Variations on the traditional Big Wheel have recently been developed and these incorporate features which are not included in this description.

Fig 1.



RISKS

13 Experience has shown that risk of injury arises from:-

(a) passengers falling from seats following release of the lap bar;

(b) passengers falling from cars when they have attempted to stand, rock the car or have been engaged in general horseplay, which has resulted in the car tipping or turning over completely;

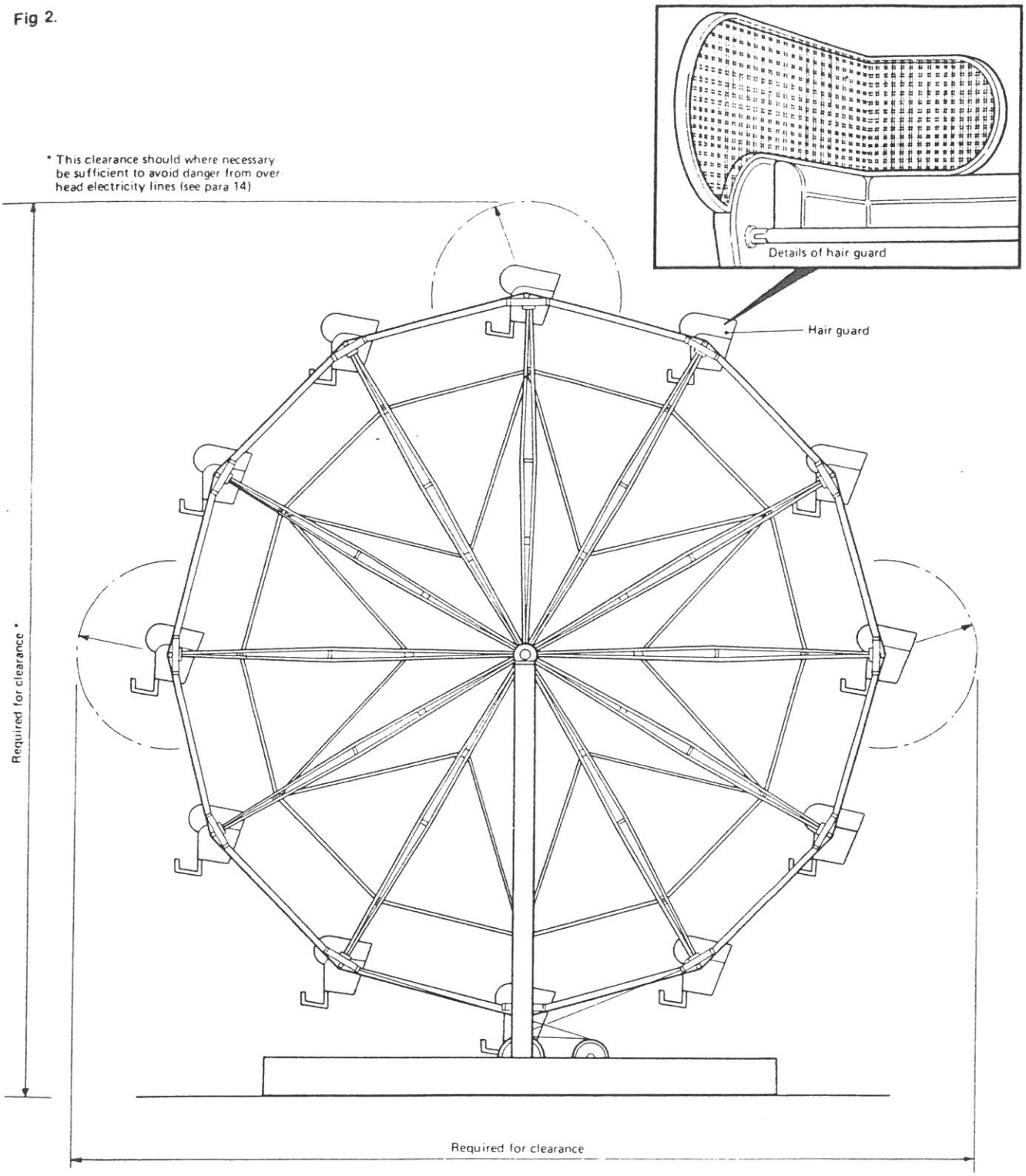
(c) passengers entangling hair or clothing (e.g. scarves) with seat support pins and their housing;

(d) breakage and fouling of the drive cable where this causes the wheel to stop suddenly and passengers to be thrown out of their seats, under the lap bar;

(e) failure of the wheel axle;

(f) structural failure resulting from operating the wheel in an out-of-true condition.

Fig 2.



SITING AND LOCATION (Paragraphs 110-115 of the Code)

14 Before the Big Wheel is erected the site should be checked for overhead electricity lines. The ride should never be erected near overhead power lines which may be a risk to passengers or anyone involved in erecting or dismantling. Operators should not assume that a gap between the structure of the ride and high voltage overhead power lines is always a sufficient precautionary measure to prevent risk, since electricity at high voltage can arc across substantial air gaps. Operators should seek advice from the regional electricity board on this matter.

15 The owner of the land and/or the electricity board should also be consulted where it is necessary for equipment to be staked into the ground, with the risk of striking underground cables.

ASSEMBLY AND DISMANTLING (Paragraphs 134-155 of the Code)

16 All assembly and dismantling operations should be directly supervised by a person trained or

experienced in such work. Safe systems of work should be employed during these operations.

17 All load bearing joints should be correctly assembled using the fixings supplied by the manufacturer. Where it is necessary to replace lost or worn fixings, parts should be obtained from the manufacturer. Alternatively, advice on suitable equivalents should be obtained either from the manufacturer or from the person who is appointed to carry out periodic thorough examinations of the machine. The importance of using fixings of the correct design and quality cannot be over-emphasised.

18 Ropes used to guy the structure or to provide structural ties should be of adequate strength and the rope ends should be properly terminated.

19 Packing used to support any load bearing part of the structure should be carefully assembled and should be positioned exactly in accordance with the manufacturer's instructions, where these are available. Packing assemblies should be made from solid timber or other suitable materials. They should be capable of withstanding the compression loads involved and should have a base area which gives adequate load spreading support for the ground conditions on any particular site. Wooden pallets and bottle crates should not be used.

20 It is important that the ride is properly levelled and that the towers, which support the wheel axle are plumbed to ensure that they are truly vertical and parallel to each other. If they are not, the axle will not be square with the base of the wheel and the drive cable will not track properly in its peripheral guide blocks. A rope which does not track properly may become disengaged or snag, causing structural damage and injury to passengers.

21 For the same reason, it is important that the wheel is square to its axle and that the sides of the wheel are true.

22 Care should be taken in the fitting and tensioning of the drive cable. The cable should not be twisted and any twists introduced during coiling of the cable for storage should be removed before the cable is rigged. Once the cable has been installed, the tensioning device should be used to eliminate slack. The cable should be adjusted so that it is just tight enough to operate the wheel without undue slippage. If the cable is too tight it will be damaged. On the other hand, if it is too slack it may jump off the woodrims or sheaves and snag, causing the wheel to come to a sudden stop, possibly injuring passengers and/or causing structural damage.

23 A perimeter fence should be erected around the ride. This should be positioned so that members of the public outside the perimeter fence cannot reach over and touch moving parts of the ride.

24 Passengers should not be carried on the ride unless the operator is satisfied that the ride has been properly assembled and is safe for use.

SAFE OPERATION (Paragraphs 41-70 of the Code)

25 The system of work and standards of supervision play an important part in the safe functioning of the ride.

26 The operator should appoint a sufficient number of ride attendants to ensure that the ride and members of the public waiting to use it can be properly and safely managed.

27 When the ride is in use the operator should ensure that passengers waiting to use the ride are not admitted to the ramp and loading platform during the ride cycle.

28 While carrying passengers, the ride should not be operated at a speed greater than the maximum operational speed specified in the log book.

29 Operators should give clear advice about how passengers should behave during the ride. Where necessary they should warn passengers who expose themselves to risk, and, in particular, they should instruct all passengers not to stand in their seats, rock the cars or interfere with the locking mechanism of the lap bars (see paragraph 36).

30 Operators should not rely solely on notices to convey such advice or warnings, since passengers may not read or understand them. A suitable public address system is perhaps the most effective way of communicating instructions and warnings to passengers.

31 Where applicable in windy conditions, the foot well should be closed on cars when no passengers are being carried, so as to prevent the car from overturning.

32 When the ride is not in use, positive measures should be taken to immobilise it.

33 The perimeter fence should be erected in such a way that it will withstand people leaning on it or being pushed against it. There should be no more than two openings in the fence to allow for the entry and exit of passengers. The size of these openings should not exceed that which is necessary for safe entry and exit from the enclosure. These openings should be supervised and provided with suitable means for preventing inadvertent entry (e.g. a gate, turnstiles or offset and raised platform).

34 Adequate lighting should be provided at the openings in the perimeter fence and the routes from them to the passenger loading area.

SAFE ACCOMMODATION OF PASSENGERS (Paragraphs 31-40 of the Code)

35 Each car should be constructed in such a way that passengers cannot be inadvertently thrown or fall from it. The configuration of any restraint arrangement and the relationship between the restraint, the car seat and the foot rest should be such that it is not

possible for passengers to stand in the car, or slip under the lap bar if the ride is brought to a sudden stop.

36 The closing gate of any seat restraint arrangement should be provided with adequate locking devices (e.g. positive catch) which are fully closed by the ride attendants before the ride is set in motion. The locks should be constructed or positioned so that they cannot be readily opened by passengers in the car (e.g. by means of double feature catches, suitably shrouded catches, or catches so positioned that only the ride attendant or operator can open them). All locking devices should be regularly tested to check that they operate properly, but arrangements should ensure that they do not fail in such a way as to create danger (e.g. opening on the failure of a spring).

37 Where there is a risk of hair, scarves or other loose clothing becoming entangled with the car support pins and their housings or drive cables, each car should be fitted with suitable guards to remove the risk.

TRAINING OF OPERATORS AND RIDE ATTENDANTS (Paragraphs 71 and 72 of the Code)

38 Each operator should receive suitable and sufficient training in the safe operation of the ride. This training should include adequate instruction on:-

(a) method of operating the ride;

(b) maximum safe load of the ride;

(c) maximum speed at which the ride can be operated while carrying passengers;

(d) systems of work that should be followed to ensure the safety of attendants;

(e) systems of work that should be followed to ensure the safety of passengers and other members of the public;

(f) training needs of attendants;

(g) safe methods of assembly and dismantling;

(h) how to make a daily inspection. Where available, advice from manufacturers of this ride should be incorporated into this instruction.

39 Operators should be aware of the requirements set out in paragraphs 20-23 of the Code relating to daily inspections, the intervals at which thorough examination and testing should be carried out and the reasoning behind such procedures.

40 Each attendant should receive suitable and sufficient training for the type of work he is expected to do. Training should include adequate instruction on:-

(a) control of the loading platforms;

(b) safe loading and unloading of passengers;

(c) safe systems of work which he should adopt and how he should avoid risks;

(d) procedure for reporting defects or breakdowns;

(e) procedures that should be followed in the event of an emergency.

MAINTENANCE (Paragraphs 24-30 of the Code)

41 All parts should be properly maintained and particular attention should be paid to ensuring that:-

(a) cars, their support frames and pivot pins are maintained in a safe condition;

(b) car seats are secure and maintained in a safe condition;

(c) damage liable to cause weakness in the structure or mountings of the car and put passengers at risk is repaired immediately;

(d) where damage produces sharp projections, which may injure passengers or ride attendants, the ride is taken out of use until repairs have been made;

(e) passenger restraint arrangements are properly maintained and effective;

(f) packing used to support the ride is properly maintained and effective.

42 Ramps or steps and platforms, which provide access to the loading area, should be properly maintained and structurally sound. They should, so far as is reasonably practicable, be kept free from mud and other substances on which people may slip.

EXAMINATION AND INSPECTION (Paragraphs 1-23 of the Code)

43 Each ride should be thoroughly examined at least once every 14 months by an appointed person as required by the Code. This examination should, where practicable, be carried out before the season starts, but in any case within three months of its starting. The thorough examination should include the following:-

(a) all packing materials;

(b) the condition of all guy ropes and tie ropes, and their terminations;

(c) the structure of the cars and their support frame and pins;

(d) the passenger restraint arrangements;

(e) the wheel support axle and its bearings;

(f) the axle support towers, their mounting points and the ride foundation plate or chassis;

(g) the wheel hubs, locking rings, spokes and cross members, and their fixings;

(h) the provision of adequate guarding for the drive sheaves and cable, and the associated transmission machinery;

(i) the condition of the woodrims;

(j) the condition of the drive cables;

(k) the condition and adjustment of the clutch and braking mechanisms;

(l) the turnstile systems and the stability of the base.

44 As and when directed by the properly appointed person and as recommended by the manufacturer, an appropriate non-destructive testing technique should be applied to the wheel support axle and car support frame and pins.

DESIGN AND MANUFACTURE

45 When a relevant British Standard specification or equivalent recognised standard is available, devices should be constructed or modified to that standard.

FURTHER INFORMATION

This Guidance Note is produced by the Health and Safety Executive. Further advice on this or any other publications produced by the Executive is obtainable from St Hugh's House, Stanley Precinct, Bootle, Merseyside L20 3QY, or from Area Offices of the HSE.

List of HSE Area Offices

Area Offices normally operate between 8.30-17.00 Monday to Friday. The police have names and telephone numbers of local HSE staff who may be contacte in the event of an emergency outside office hours

Area		*Address*	*Telephone number*
1	South West	Inter City House, Mitchell Lane, Victoria Street, Bristol BS1 6AN	0272 290681
2	South	Priestley House, Priestley Road, Basingstoke RG24 9NW	0256 473181
3	South East	3 East Grinstead House, London Road, East Grinstead, West Sussex RH19 1RR	0342 26922
4	London North	Maritime House, 1 Linton Road, Barking, Essex 1G11 8HF	01-594 5522
5	London South	1 Long Lane, London SE1 4PG	01-407 8911
6	East Anglia	39 Baddow Road, Chelmsford, Essex CM2 0HL	0245 84661
7	Northern Home Counties	14 Cardiff Road, Luton, Beds LU1 1PP	0582 34121
8	East Midlands	Belgrave House, 1 Greyfriars, Northampton NN1 2BS	0604 21233
9	West Midlands	McLaren Bldg, 2 Masshouse Circus, Queensway, Birmingham B4 7NP	021-236 5080
10	Wales	Brunel House, 2 Fitzalan Road, Cardiff CF2 1SH	0222 497777
11	Marches	The Marches House, Midway, Newcastle-under-Lyme, Staffs ST5 1DT	0782 610181
12	North Midlands	Birkbeck House, Trinity Square, Nottingham NG1 4AU	0602 40712
13	South Yorkshire and Humberside	Sovereign House, 40 Silver Street, Sheffield S1 2ES	0742 739081
14	W & N Yorks	8 St Pauls Street, Leeds LS1 2LE	0532 446191
15	Greater Manchester	Quay House, Quay Street, Manchester	061-831 7111
16	Merseyside	The Triad, Stanley Road, Bootle L20 3PG	051-922 7211
17	North West	Victoria House, Ormskirk Road, Preston, PR1 1HH	0772 59321
18	North East	Arden House, Regent Centre, Gosforth, Newcastle-upon-Tyne, NE3 3JM	091-284 8448
19	Scotland East	Belford House, 59 Belford Road, Edinburgh EH4 3UE	031-225 1313
20	Scotland West	314 St Vincent Street, Glasgow G3 8XG	041-204 2646

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