TECHNICAL REPORT

ISO/TR 25743

First edition
2010-04-01

Lifts (elevators) — Study of the use of lifts for evacuation during an emergency

Ascenseurs — Étude de l'utilisation des ascenseurs pour l'évacuation lors d'une situation d'urgence

Reference number
ISO/TR 25743:2010(E)

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TR 25743 was prepared by Technical Committee ISO/TC 178, *Lifts, escalators and moving walks*.

Introduction

This Technical Report has been prepared in response to a request for an investigation into the implications of the use of lifts[1)] (elevators) for the evacuation of persons during various types of building emergencies. There has been considerable debate over recent years with regards to the hazards and risk associated with using lifts for evacuation. There is clearly a need to determine what hazards and risks exist and what can be done to the building and lifts to minimize these risks if lifts were to be used.

The purpose of this Technical Report is to investigate the risks to persons using lifts to evacuate a building during an emergency.

Lift engineers and firefighters were involved in the production of this Technical Report. It is fully recognized that lift engineers are not experts in building design or fire engineering; therefore, this Technical Report does not attempt to resolve issues in these areas. It aims to make clear to those persons involved in building design and fire engineering the issues that need to be addressed. Not all of the issues set out in this Technical Report need to be addressed in all building designs.

There are many reasons why a building can need to be evacuated, such as a fire, explosion, chemical or biological attack, flooding, storm damage or earthquake. Not all of these are relevant to every building and other possible risks are so unlikely to occur that they can be disregarded. It is the responsibility of the building designer(s) to determine whether a particular risk is sufficiently great to require addressing.

If, for example, a small office block is being designed for a mid-town area, it is within the realms of possibility that it can be subjected to an explosion or chemical attack (as a result of terrorism). It is not, however, very likely to be the case unless there exists some particular reason to make it attractive or susceptible. In most cases, the risk of these events is probably so low as to make it unnecessary for them to be addressed.

If a building is intended to be the headquarters of the military, this increases the likelihood of it being subjected to some form of attack. It is, in that case, necessary to consider the effect of an explosion in or close to the building or a chemical agent being introduced into the building.

A building constructed in an area where earthquakes do not normally occur need not have provisions made for such an event.

If a building is intended to be located in the centre of a city to form a prestigious landmark, consideration of all the possible events that might occur can be essential.

It is the responsibility of the designer of the building to determine by risk assessment or other methods what events reasonably need to be addressed. Once this is done, the chart provided in Figure 1 can be used to see what needs to be considered, if lifts are to play a part in any evacuation strategy.

A lift or lifts can allow disabled persons to evacuate a building in relative ease, but if it is thought that lifts can play a role in general evacuation, it is possible for them to make a significant contribution to reducing the general evacuation time. This depends on the building size, number of lifts, etc.

This Technical Report does not concentrate on the evacuation of disabled persons, but instead highlights and addresses the hazards and risks to which all users can be exposed if lifts are used for evacuation.

Even if it is thought that lifts can play a part in a general evacuation, it could prove to be uneconomic. It is not suggested that lifts should replace stairs or that using lifts instead of stairs will increase evacuation times in many building designs.

1) Hereinafter, the term “lift” is used instead of the term “elevator”. In addition, the term “lift” is also used instead of the terms “lifts, escalators and moving walks”.

Lifts (elevators) — Study of the use of lifts for evacuation during an emergency

1 Scope

This Technical Report investigates and highlights the main risks associated with using lifts (elevators) for the evacuation of persons in various types of emergency.

The types of emergency under study arise from fire, flood, earthquake, explosion, biological or chemical attack, gas leakage, lightning or storm damage in the building being studied or a building adjacent to it.

The purpose of this Technical Report is to provide a process for making decisions relevant to the design of lifts and buildings, in order to determine if a given design can enable the lifts involved to be used with an acceptable level of safety.

It is not intended that all buildings be designed for all risks and, consequently, it is not intended that all lifts incorporate all features mentioned. It is the responsibility of the building designer to determine events that are likely to occur, given the building's importance, function, occupancy, status, location, use, size, etc.

It is not the responsibility of, nor is it possible for, lift manufacturers to determine whether or not a lift can be used safely as a means of evacuation in a given building. It is the responsibility of other parties to make this decision. The lift manufacturer can only advise on the capabilities of a particular lift design or the status of the lift at a particular point in time.

The philosophy adopted in this Technical Report can be applied to any building, be it large, small, new or existing. In practice, its application to existing building designs can prove to be difficult and uneconomic in many instances.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
building management system
BMS
system capable of making intelligent decisions based on information sent to it

2.2
building management
persons or organization responsible for ensuring the day-to-day safe, efficient running of the building and for ensuring that the building is safely evacuated in line with the evacuation strategy in an emergency

2.3
emergency command centre
room, area or location within or outside the building, where those responsible for evacuation receive information, issue instructions and manage events as they unfold

2.4
fire compartment
fire separated area
area within a building bounded by walls, floor and ceiling, constructed from fire-resistant material, such as to provide resistance to fire for a defined period

2.5
hazardous area
floor or area in the lift well where, due to heat, smoke, gas, etc., the environment is considered dangerous to persons

2.6
required evacuation time
time measured from start of the lift evacuation service to completion of the evacuation of a floor or number of floors

2.7
safe area
floor of the building where it is known that heat, smoke, etc. are not present and where it is safe for people to exit a lift car

3 Abbreviated terms

B	building-related
BL	building- and lift-related
BMS	building management system
L	lift-related
TSR	technical solution required
TSRB	building technical solution required
TSRL	lift technical solution required
TSRBL	building and lift technical solution required
ETA	estimated time of arrival

4 Use of the decision chart

4.1 General

The chart in Figure 1 should be used to study a particular building design. Where reference is made to adjacent buildings, the intention is to consider the effects of incidents in the adjacent buildings on the building design under study.

Steps 1 to 8 of the chart contain various numbered boxes. The numbers do not run in any particular sequence and are provided for reference only. Certain boxes contain a series of upper case letters and a number, e.g. TSR16B. These are inserted at points where some form of design provision needs to be made. TSR stands for “technical solution required”. The number is the reference of the technical solution and the last letter gives an indication of who needs to address it. “B” is used to indicate that the issue is building-related. “L” is used when the issue is lift-related and “BL” where both are involved and a joint solution is required.

Possible technical solutions have been identified for lift-related issues and these have been further studied using the ISO 14798 risk methodology. Where a building solution is required, this has been left to those responsible for building design, although some pointers are given to assist in the thought process.

An explanation of each TSR is given in Annex A and a summary of the points is given in Annex B.

4.2 Example of use of the decision chart

In the decision chart, Figure 1 a), box 1, states: Emergency detection system or building management detects problem in building A or an adjacent building B — TSR00B.

This TSR assumes that either some system has detected an emergency or the building management has detected it. In the case of building management, it is likely that they are observing an event or have had the situation reported to them.

TSR00B indicates that a technical solution is required to detect emergencies and B indicates this is not a lift issue, but a building issue, to be solved by the building designer. The solution in low-risk buildings can be a building management procedure to deal with the situation or a simple detection system. In high-risk buildings it can be a very sophisticated detection system. It is the responsibility of the building designer to determine the level of sophistication required to address the given building risk. There is no need for building A to have a system which is also monitoring building B. Building B would have its own system and in the event of a fire, staff in building A are likely to see the adjacent building being evacuated or to see the fire.

Box 178 asks “Is the emergency a fire in building A?” and references TSR41B. Building A refers to the building design being studied, but this building can be put at risk by events in an adjacent building. In the decision chart, an adjacent building is referred to as Building B.

TSR41B indicates that this is an issue to be addressed by building design. Some means should be provided to enable building management to tell if the emergency is a fire in their building.

If it is assumed that the emergency is not a fire in the building being studied (building A), then one moves to box 174: Is it some other emergency in building A? — TSR16B.

If the answer to this is yes, box 12 is next. This explains that an explosion, terrorist attack, gas, biological attack, water, structural failure, lightning strike or storm has occurred in the building and that it is possible for it to affect the building structure.

These emergencies are deliberately selected because their outcome covers almost all possible emergencies. Other emergencies, while not mentioned by name, are addressed. For example, a lorry crashing into a building can, in the worst-case scenario, result in damage to the building structure and possible structural failure.

After box 12, comes box 28b (TSR11B). TSR11B indicates that this is another building design issue. It is the responsibility of the designer to decide if the building is of sufficient importance to make detecting events that affect the building structure essential. If no provision is made to monitor the structure, this decision cannot be made by persons other than those observing the structure.

If the event is assumed to be an earthquake then box 31 is relevant; it states: Building management or instruments detect(s) problem and, if over magnitude X, BMS instructs lifts to shut down at defined parking locations away from potential danger area. If event over Y, shut lift down immediately — TSR14BL.

TRS14BL indicates that there are both lift and building issues to be addressed. It is the responsibility of the building designer to determine how and where to monitor the structure.

Once a means is provided, it is the responsibility of the designer to also decide how sophisticated the lift reaction should be to this event. If the lift system can only be sent one signal from the monitoring system to indicate that an event has taken place, the lift is only able to make one response. This can be to stop the lift in flight which means that there is a high probability of passengers being trapped. If a monitoring system is able to indicate to the lift the magnitude of the event, then other reactions are possible "at a magnitude X, take lift to a floor and wait", "at a magnitude Y, stop lifts" and so on.

The lift maker needs to make the lift respond in the desired manner, but it is the responsibility of the building designer to determine for the building what amount of structural movement is an issue requiring a reaction from the lift system.

Box 33 says: Check equipment displacement, make slow speed check run, guide alignment, etc. — TSR15L.

TSR15L indicates that these are tasks to be managed by the lift designer. Unless some reasonable degree of self-monitoring is provided on the lift, it is dangerous to allow it to continue to operate when the building has undergone a large shock.

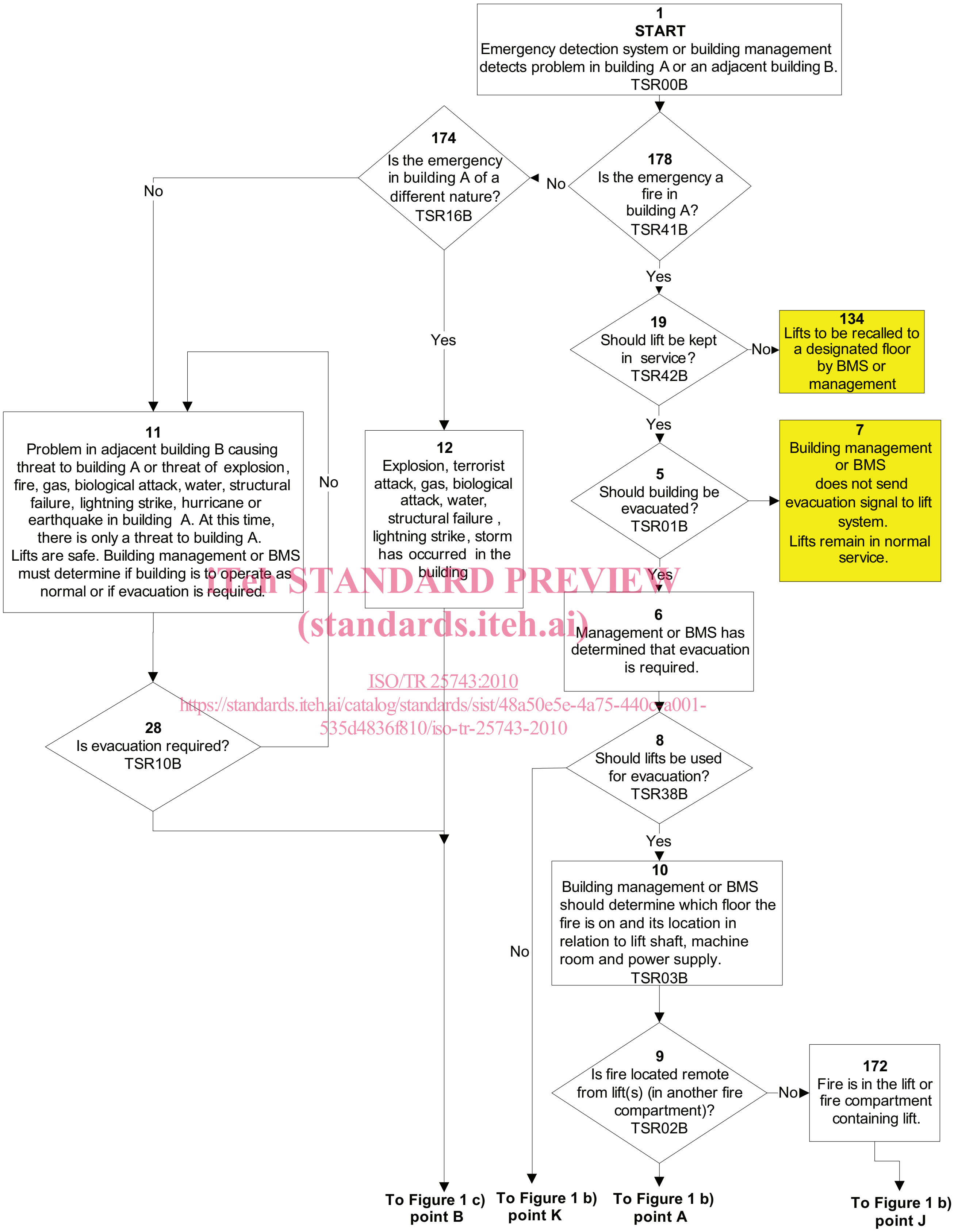
The lift system should determine if it is safe to move the lift. If it is assumed that these self-checks have concluded that the lift should not be operated in the normal manner, then box 147 says: Recover car to closest floor or raise alarm for trapped passengers. Signals and voice information for passengers trapped in lift car. Notify BMS and management — TSR07L.

After checks are made, box 143 asks: Can lift be used safely?

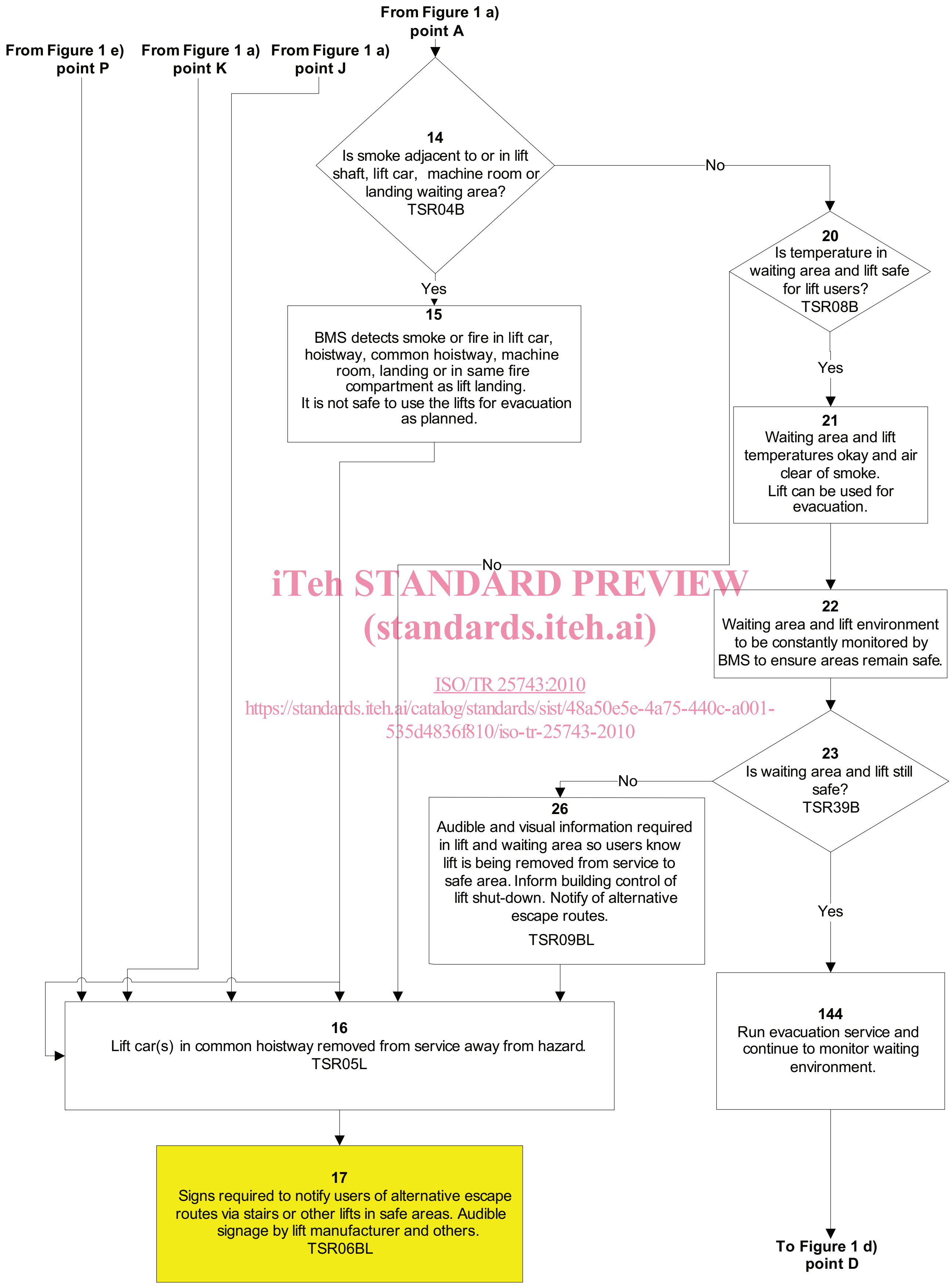
This clearly indicates the design requirements for the lift maker in terms of signal, etc. and response of the lift.

When using the chart, it is important to always work through the particular scenario from the beginning of the chart. If this is not done, it is likely to become misleading and lead to wrong conclusions.

Annex A provides additional information for each (TSR).



a) Decision step 1



b) Decision step 2