FIRES IN AND AROUND LIFTS.

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ABSTRACT.

In the buildings of today and in the future we need to expand our understanding of the effects fire can have on safety, and in particular how we protect life and property from the effects of fire. This paper will highlight many of the issues to be addressed during the design, construction and maintenance of a modern building and its lifts. The lift landing entrance will be covered in detail along with other items such as shaft walls, ventilation of shafts, sprinkler locations, fire and smoke lobbies many of which are covered by Lift Codes or Building Regulations.

CONTENT.

1 TOP OF SHAFT VENTS.

The requirements for top of lift shaft vents vary considerably,(see Fig;1-2).Where it has been made a requirement, it usually asks for a vent area of 5-10% of lift shaft area. From a fire control point of view there have been two schools of thought. Firstly the vent allows the smoke buildup in the shaft to dissipate to atmosphere. Secondly it is argued that the stack effect in the shaft of high rise building draws the smoke into the shaft. Some consideration is being given to deleting the vent requirement in Australia as the experts consider it to be detrimental to the fire control within a building. Other aspects about vents that although not fire oriented need to be addressed by the lift designer are, noises produced in an enclosed shaft; the differential pressures on landing doors which in turn can affect their operation.

Top of shaft vents on the low rise bank have also been dealt with in two ways; (a) vented into the high rise shaft, and (b) vented to outside air at the side of building. In some cases fire authorities have required the low rise vents to be vented up its own flue to the top of building.

2 SPRINKLERS IN LIFT SHAFT.

Now that many lift shafts are fire rated construction, particularly in high rise buildings, it is preferred that the sprinkler system (see Fig;1-3) in the top of lift shaft be of the alarm type (sometimes called dry head) to avoid water damage in an area that has very little fuel but electrical equipment that is required to return the lift to the main floor on fire recall. Water damage can also take the lift out of service when required for fire crew use.

The use of fire control sprinklers may be required in shafts used for vehicle lifts.

3 SHAFT PRESSURISATION.

There have been cases where the shafts have been pressurised to keep the smoke out during a fire situation. If this pressurisation is only switched on during a fire it can affect the operation of power doors closing. This in turn can prevent a car being recalled to main floor. The problem is not always solved by maintaining the pressurisation all the time. The ease of door operation requires the minimum differential pressure from the landing side and the shaft side. Other equipment such as air conditioning, and building lobby doors can also change the differential pressure. What effect does the pump action of fast lifts have on spread of fire or movement of smoke in the lift shaft, and how does the changes in outside ambient temperatures affect movement of air in lift shaft ?.

4 FIRE SUPRESSION SYSTEMS IN THE MACHINE ROOM.

The choice of fire supression equipment in the machine room is very important, the application of the wrong type of equipment could cause considerable damage to the control equipment, and delay the lift being placed back into service, water or chemical systems are usually not required, dry head sprinklers are suitable for an alarm, and CO2 for extinguishing the flames. With today's electrical protection systems fires in machine rooms are not very common, the monitoring of smoke detectors and heat sensors by building management systems also reduces the rise of fire damage.

5 FIRE LIFT

The number of lifts required for fire lifts can vary from usually a minimum of two to all lifts being available and fitted with fire control features. It is even more complex when there are several banks of lifts serving sky lobbies. There is also a varying requirement for how many lift shafts should be required; for example, some building requirements state that a minimum of two fire lifts shall be provided one of which must be in a shaft of its own. In some cases a single high speed lift has been placed in a single shaft which satisfies the fire requirements but gives the lift designer considerable problems with noise.

6 SUPPLY MAINS and MAIN SWITCH BOARD

In many cases great effort is concentrated on the Fire resistive properties of Lift rising mains,(see Fig;1-8) which are to ensure the lifts return to the main floor when called on fire service. This requirement is full of loopholes, and the following weak links are the main switch board to the building does not always have its own fire resistant enclosure; the mains to the main switch board (see Fig;1-9) from the street are not always properly protected against fire or mechanical damage

7 EMERGENCY POWER SUPPLY.

Again like the supply mains, the protection of standby generator and wiring to lift circuits needs adequate protection if the generator is the back up means to run the lifts back to main floor and also for fire service.

8 CAR (CABIN) ENCLOSURES.

The material used in lift car, particularly for walls and floors (see Fig;1-5) needs to be selected for its fire resistant properties such as Ignitability index, Spread of flame index, Heat evolved index, Smoke developed index. The actual index values may vary from country to country and in some places may not be required. Other factors that influence fires starting are the type of texture that initially passes the above index values, but after a period of time collect dust.

9 CAR (CABIN) VENTILATION FANS.

There do not appear to be any requirements on the direction of air flow for car fans, and as many lifts have key switches to control fans it is not always possible to turn the fan off during a fire inside car. (see Fig;1-4)

10 UNDER CAR FLOOR FIRE PROTECTION

This requirement for fire resistant protection under the car floor (see Fig;1-6) is mainly to reduce the risk of fires starting under the floor from burning travelling cables or pit fires that often run up the oil and dust on the guide rails.

11 TRAVELLING CABLES

The reliable operation of the lift is dependent on the connection of car controls via the travelling cables, (see Fig;1-7) but it must be remembered that car security and communications are very much dependent on these cables also. Under normal circumstances unless there is a fire in the lift pit there should be no problem; but with the changes or variations to door test failure criteria we are now having to consider damage to the travelling cables due to radiation temperatures thru the landing door panels. The location of travelling cables and distance from panels should be considered at the lift well layout stage.

12 LANDING ENTRANCES.

Landing door assemblies on today's modern lifts are designed to fulfil several functions, (see Fig;1-11) the main one being that of protecting the opening into the lift shaft when the lift is not at that floor; next to reduce the spread of fire to other parts of the building. The fire resistant rating required in different countries varies from half an hour to two hours but in most cases one hour is the normal requirement. In recent times there has been increased interest in smoke seals or smoke resistant doors. These requirements which usually apply to fire escape doors, are not easy to achieve on lift doors that operate very frequently. Some building codes have recognised this fact and are allowing the option of either smoke seal lift doors or smoke lobbies at each floor. (see Fig;1-15). A variety of smoke sealing methods have been tried in the past but their life and reliability have not come up to expectations.

13 FIRE TEST ON DOOR ASSEMBLIES

Testing lift landing doors from well or hall side has been the subject of discussion for some time, (see Fig;1-11). The doors would in most cases perform differently if tested from the well side compared with the results on the hall side. It has been considered that for passenger lifts it is unlikely that a fire would start or be maintained on the well side as there is insufficient fuel, yet on the other hand a goods lift could be loaded with materials that would increase the time and extent of fire on the well side. The majority of fire tests carried out around the world have been from the hall side. Valadity or repeatability of tests is under review, there is also some work being done on computer modelling with the idea of reducing the number of tests in the future. With the increase in light weight walls coming onto the market, lift door manufacturers could be involved in many new tests unless there is some system of evaluating similar combinations of door frames and well walls.

14 LIFT FRONTS.

Types of lift fronts eg; small frame, fullframe, and lift fronts. There are a variety of door assemblies being used. In Europe many door panels are built into a complete assembly the full width of lift well. These are often referred to as full fronts. Then there are smaller fronts that are only about 300 or 400 mm wide on each side of clear opening. Because of different building regulations some countries (including Australia) only use small frames or finished jambs. This is because of temperature limitations placed on walls and sourounds. In some countries there is no temperature requirements on the door panels. (see Fig,2 for typical arrangements),these arrangements can be installed in full masonary walls, light weight walls, and dry walls (shaft Wall)subject to the required fire test certificate being available if required.

15 INSULATED OR NON-INSULATED LANDING DOORS.

There is considerable discussion going on around the world about door testing criteria, in some countries doors for lift entrances have to be insulated to comply with local building regulations, where as in other countries it is only the surrounding walls that have a temperature rating. The RADIATION effect from non-insulated doors must be considered in respect to; travelling cables, cabin exterior walls, cabin exterior wiring, and goods on the landing if the fire is in the hoistway.

16 EVACUATION OF AGED OR THOSE WITH DISABILITIES

In high rise building there must be ways to evacuate the building in the event of fire. Some aged and disabled persons would not be able to negotiate the fire stairs, and as it would be a very slow process by fire ladder some other ways must be considered. In most cases ladders can only reach about 25 metres.

17 COULD LIFTS RUN IN A FIRE SITUATION ?.

There is a false concept of the ability of fire lifts to run in a fire situation. Even if we could pay for a "Fire proof" lift the designer would have great difficulty in overcoming the following;

Water running into the shaft and shorting electrical equipment.
Main switch board shutting down from water or fire damage
Standby generator not starting up (if there is one).
Fire services turning the lift off.

Lift being out of service for repairs.
Landing doors jaming due to heat distortion.
Smoke in the lift shaft.
Means of rescuing persons from the lift if it stopped.

18 TESTING OF LIFT FIRE SERVICE CONTROLS.

There have been cases of lifts not responding to "Fire Service Recall" when required, it must be clear who is responsible to check and maintain this equipment. Is it the, Owner, Inspecting Department, Fire Authorities, or the Lift Service Contractor.

19 LIFT PIT HAZARDS.

In many old lift installations the accumulation of rubbish in the pit (see Fig;10) was very dangerous, particularly when a cigarette was dropped between the car and landing sill. Many of these old wells were not fully enclosed with solid walls. On new installation the situation is much better for all lifts other than motor vehicle lifts where there is a danger of petrol being spilt or leaking into the pit.

20 FIRE INSURANCE.

The cost of insurance premiums are often increased if the door assembly does not have a fire certificate or label, the doors do not park closed, or are not self closing. The degree of compliance depends on the age of the lift equipment. In most modern buildings these requirements are required by today's building codes.

21 FIRES IN CEILING SPACES.

The fire in ceiling spaces (see Fig;1-14) is not a concern of the lift contractor unless we are talking about the area in front of and above the lift entrances. With the introduction of high entrances and, in some cases, transom panels, in conjunction with the reduction in floor heights the ceiling material and materials in the ceiling space can reduce the time the lift remains in service.

22 FIRES IN FLOOR SPACES.

The increase in cabling to computers has brought about a space requirement under the floor (see Fig;1-13)not only in the computer rooms but right up to the lift fronts. This total raising of the floor prevents steps or changes in level. However the arrangement of raised floor outside lift entrances has required a different treatment to door sill fixings and opinions relating to the original test.

23 FIRES IN ATRIUM'S.

The problem of fires spreading from the Atrium into the remainder of the building is of concern, and in some countries lifts are not permitted to pass from the Atrium into the building or the building into the Atrium. If the landing doors open into the main building they would require a fire rating. Where the doors only open onto a walkway that is within the Atrium there is no need for a fire rating on such doors.

24 FIRE CONTROL PRIORITIES.

A set proceedure must be established for the switching OFF or ON, of the following building equipment at the onset or during a fire;

Ventilation system, Air conditioning, Sprinklers,
Smoke detectors, Chemical extinguishers,Supression systems

This proceedure must nominate the person responsible to avoid unskilled persons taking action that may endanger life or property

25 SECURITY SYSTEMS

In many cases building occupiers only see the need for a security system that protects their property. It is not usually permitted for the security system to operate in a fire situation. But there are many cases where testing of the fire service, maintenance and inspection and cleaners have switched the system off and, in fact reduced security. There have been cases where the security system was in a remote building down town and for some reason it could not be accessed. Careful consideration must be given to all aspects of security in a fire situation.

26 UPGRADING OF EXISTING BUILDINGS.

During the modernisation of lifts in existing buildings the consultants and lift engineers must work together, the inclusion of many of the fire controls, fire products and changes to existing building components needs careful consideration to avoid high costs for only marginal improvements to the fire security of the building.

27 CONCLUSION.

The above items only cover a few of the aspects relating to fire and smoke prevention, containment or control. Space available in this paper has restricted the inclusion of many others.

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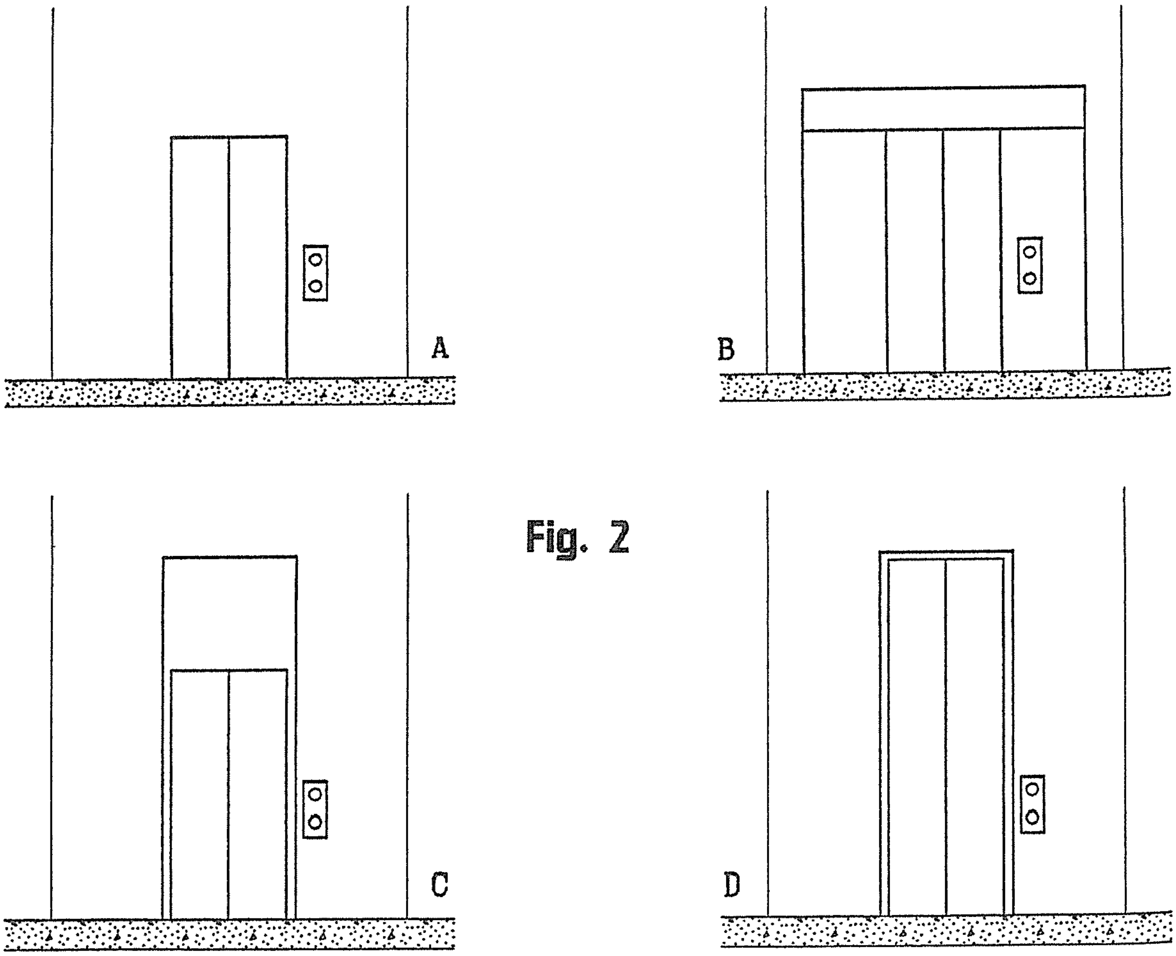
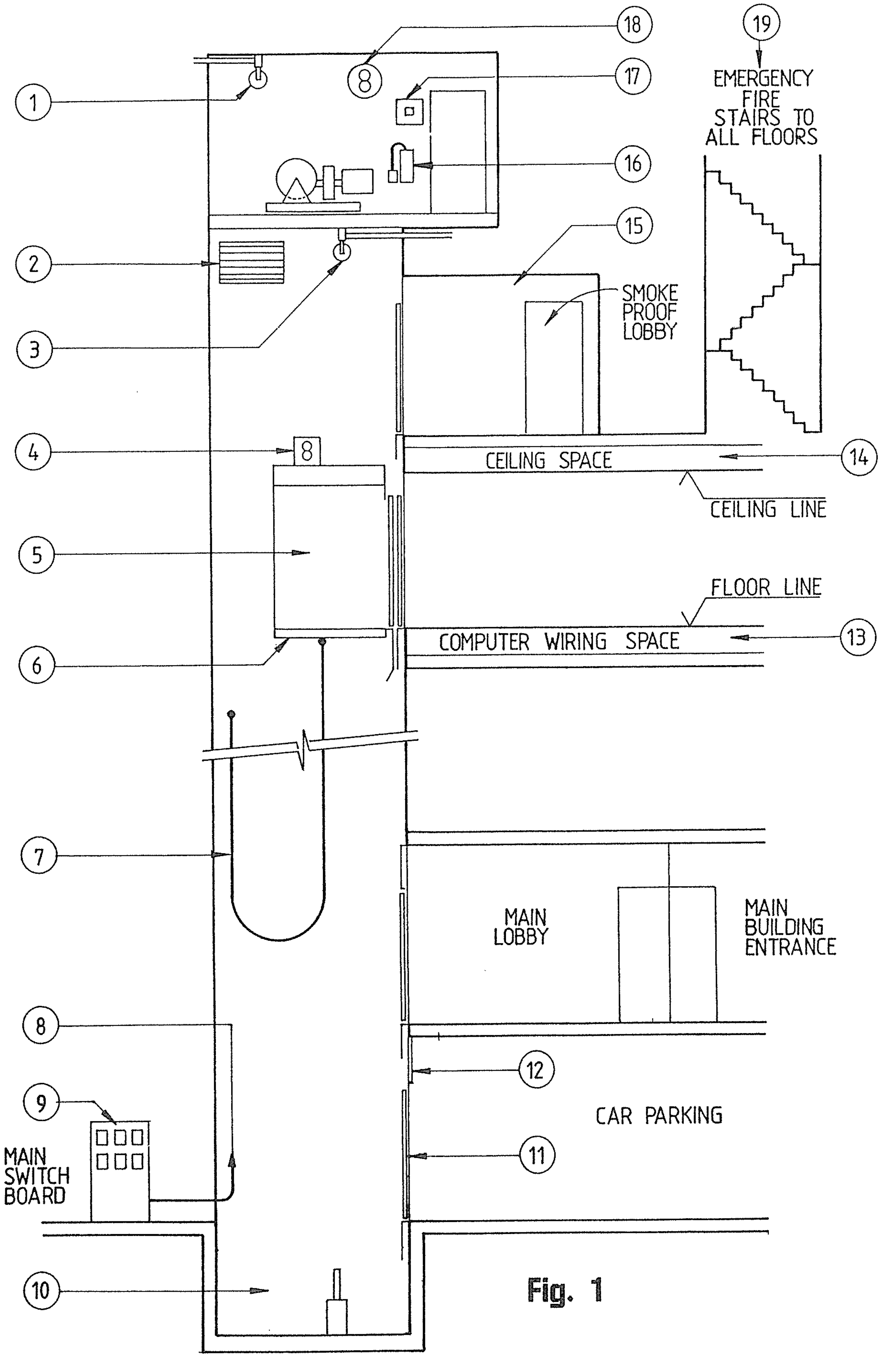


Fig. 2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19
EMERGENCY FIRE STAIRS TO ALL FLOORS
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SMOKE PROOF LOBBY
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4
8
CEILING SPACE
14
CEILING LINE
5
FLOOR LINE
COMPUTER WIRING SPACE
13
6
7
MAIN LOBBY
MAIN BUILDING ENTRANCE
8
12
9
CAR PARKING
11
MAIN SWITCH BOARD
10

Fig. 1