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A Study on Fire Safety and Security at Kitchen in Apartment Buildings

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Abstract: Kitchen is the one of the most important components of an apartment building. It is seen that most of the time kitchen is used by female members in comparison to other rooms (i.e. – bedrooms, living rooms). In Bangladesh, cooking is the leading cause of home fires. The majority of fires began from food left unattended on the stove. The most common materials ignited are grease, oil, and flammable items such as plastic bags and paper products left on or near the stove. The paper focuses on the main causes of fires in the kitchen and aims to identify the solutions to provide fire protection in the kitchen for all and vulnerable and to assess the safety strategic appropriateness in terms of effectiveness, reliability and quality. Besides, the paper focuses on providing a framework to assess the level of fire risk associated with persons. This article is based on secondary data sources and online based information, published articles and some authorized data from newspapers. This study is prepared on the basis of several reports published in some publications about fire safety and security.
Keywords: Kitchen, Fire risk, fire protection, apartment building

I. INTRODUCTION

Through the centuries there has been such an intimate connection of fire with the cultural growth of humanity. Logically we assume there was once a time when man had no fire, but very early he must have become acquainted with fire derived from natural sources, and made use of it; for no remains of man's art show him without fire as his companion. Much later in the scheme of things he invented processes for making fire artificially. Worship or deification of fire is known from various religions. Fire has been an important part of human culture since the Lower Palaeolithic, as when people could not curtail fire easily, they started to revere it. Fires -needed watching, not only to keep them from going out, but from spreading, or theft, so a fire-keeper was delegated to the work, thus starting a social organization. The early fires also formed a nucleus for human grouping, and became tribal or communal fires, from which the individual family fires derived. For as long as cities have existed, fires have been a problem. People have been concerned with an organized response to fire fighting. A fire can start very easily and can spread with frightening speed. Every year there are more than 68,000 fires in people's homes, resulting in 400 deaths and 13,800 injuries. Fire in an apartment building often involves more than one unit. Many building occupants may be affected. The dense nature of apartment living allows for the spread of smoke, heat, and fire. Fire is always unexpected. Preparing for it shouldn't be. Responding to a fire requires quick decisions and fast actions in a setting that can be loud, smoky, dark, and hot. Lives and property can be saved by being prepared before fire strikes. It is seen that almost half of all house fires start from kitchen. The major areas of origin of apartment fires are kitchen (56.2% at high rise buildings and 46.1% at mid-rise building of total percentage) [table-1]. In Bangladesh, cooking is the leading cause of home fires. Cooking causes more fires than any other sources. Over a third of all fires in multi-residential buildings started in the kitchen. The Bangladesh National Building Code (BNBC) guides fire safety regulations for residential buildings. These rules require property owners or developers to develop a fire emergency guide for people.

Table 1Areas of origin of apartment fire

Area	High-Rise	Not High-Rise
Kitchen	56.2%	46.1%
Bedroom	10.0%	15.1%
Means of Egress	6.4%	4.8%
Living Room, Family Room	5.2%	7.2%
Other Area	22.2%	26.8%

II. AIMS AND OBJECTIVES

This study aims toexplain how we can reduce the chances of having a fire in our home by taking common-sense precautions. This paper's practical and clear-cut advice will help us reduce the chances of a fire happening in our home especially in the kitchen. This studyis developed to assist property managers in their fire safety efforts. With an intention toestablish fire prevention the study searches for the following issues:

- Life Safety: The primary goal of fire safety efforts is to protect building occupants from injury and to prevent loss of life.

- Protection of Property: The secondary goal of fire safety is to prevent property damage. According to BNBC law, minimal fire safety equipment is mandatory for any developed property.
- Protection of Operations: By preventing fires and limiting damage we can assure that work operations will continue Scope and limitation of the work.
- Planning the escape: This section explains how to make an action plan for home to make sure that everyone gets out safely.

III. FIRE RISK ISSUE IN THE KITCHEN

Cooking is the leading cause of house fires and house fire injuries. Most of the fire starts from kitchen in apartment buildings. A fire must have three things to ignite and maintain combustion

1) Fuel, 2)Heat & 3)Oxygen

The basic strategy of fire prevention is to control or isolate sources of fuel and heat in order to prevent combustion. If all of these three elements are not present in sufficient quantities a fire will not ignite or a fire will not be able to sustain combustion.

3.1 The main causes of cooking fires:

- Leaving food cooking on the stovetop unattended.
- Leaving burners or ovens on after cooking.
- Placing combustible materials too close to heat sources.
- Wearing loose-fitting sleeves near hot burners.

3.2 The other factors that can start cooking fires:

- Nearly all cooking equipment fires start with the ignition of food, other cooking materials (e.g., grease, cooking oil), or other items normally found or installed in a kitchen (e.g., cabinets, wall coverings, paper or plastic bags, curtains).
- 59% of reported home cooking fire injuries occurred when victims tried to fight the fire themselves (NFPA, 2008).

3.3 The most common place for a residential fire to start:

- The majority of accidental fires in the home start in the kitchen. Ranges accounted for the largest share of home cooking fire incidents, followed by ovens, portable cooking devices, microwaves, grills, and deep fryers.

IV. KITCHEN SAFETY IN APARTMENT BUILDINGS

4.1 How to cook safely

Make sure not to get distracted when cooking and-

- take pans off the heat or turn the heat down if we are called away from the cooker, for example by a phone call
- take care if wearing loose clothing as it can catch fire easily
- don't cook if we have been drinking alcohol or taken prescription drugs - we may get drowsy or lose concentration
- Never leave children alone in the kitchen. Keep matches, lighters and saucepan handles where children can’t reach them, and fit a safety catch on the oven door.
- Keep the oven, hob, toaster and grill clean – a build-up of fat, crumbs or grease can easily catch fire.
- Don’t use matches or lighters to light gas cookers – spark devices, which you can buy from hardware stores, are safer.
- Don’t leave pans on the hob when we are not around. Take them off the heat if we have to leave the kitchen.
- Angle saucepan handles so they don’t stick out from the hob, or over a naked flame.
- Don’t put anything that is made of metal or is metallic inside the microwave.
- When we have finished cooking, make sure switch off the oven and hob.

4.2 Cooker and toaster safety

- Turn saucepans so the handles don't stick out over the edge of the hob or over another ring
- Double check that the cooker is off when finished cooking
- Make sure tea-towels aren’t hanging over the cooker and don't put oven gloves on top of a hot cooker
- Keep the oven, hob and grill clean - built-up fat and bits of food can start a fire
- Check that the toaster is clean and well away from curtains and empty the crumb tray regularly

4.3 Cooking with oil

We need to be especially careful when deep-fat frying or cooking with oil because hot oil can catch fire easily. Make sure:

- Don't fill a chip pan or other deep-fat fryer more than one-third full of oil
- Use a thermostat-controlled deep-fat fryer, which will make sure the fat doesn't get too hot

4.4 The microwave

Don't put anything in the microwave that is made of metal or has a metallic finish or parts, and don't dry clothes in the microwave.

4.5 Dealing with a fire in kitchen

If a pan catches fire in your kitchen:

- Don't move it because it will be very hot
- Turn off the heat if it's safe to do so - don't lean over the pan to reach the controls
- Don't use a fire extinguisher on a pan of oil because the force of the extinguisher can spread the fire
- Never use water on chip pan fires as this will cause a fireball - use a fire blanket to smother the flames if it safe to do so
- Get out, stay out and call emergency.

If an electrical appliance catches fire, don't throw water on it. If it is safe to do so, you may be able to put out the fire immediately by:

- Pulling the appliance's plug out
- Switching off the power at the fuse box.

4.6 Eight Steps for Cooking Safety

- Always stay in the kitchen while cooking.
- Keep anything that can catch fire, such as dishtowels, paper or plastic bags, potholders, and curtains at least 3 ft away from the stove top.
- Before cooking, role up sleeves and use oven mitts. Loose-fitting clothes can touch a burner and catch on fire. If you catch on fire - STOP, DROP, and ROLL.
- Keep stove tops, ovens, and burners clean.
- Always use cooking equipment tested and approved by a recognized testing facility.
- Keep children and pets away from cooking areas by creating a three-foot "kid–free zone" around the stove
- Monitor hot oil carefully and heat it slowly, keeping the pan lid and oven mitt close at hand. Guard against splattering grease.
- Place objects where they cannot be pulled over or knocked over.

V. SAFETY MEASURES

People must be trained to prevent or limit the risk of fire, recognize and neutralize potential fire hazards, and know how to respond to an emergency individually and collectively by actions and communications. Good management of fire safety is essential to ensure that fires are unlikely to occur; that if they do occur they are likely to be controlled or contained quickly, effectively and safely. Some safety measures in the kitchen are-

5.1 If food starts burning on the stove:

- Turn off the burner.
- Do not move the pan.
- Put on a potholder or oven mitt.
- Slide a lid over the pan or use baking soda to smother the fire.
- Leave the lid on until the pot is cool.
- If lift the lid too soon, the air will feed the flames and the smoke will set off the fire alarm.
- If we can't do this without being burned, then evacuate and activate the fire alarm.

Fig 1: Wrong steps to control fire in kitchen

Fig 2: Right step to control fire in kitchen

5.2 If food starts burning in a toaster oven or microwave:

- Turn the power off and/or unplug.
- Keep the door closed to smother the fire.
- If open the door, the air will feed the flames and the smoke will set off the fire alarm.
- If we can't do this without being burned, then evacuate and activate the fire alarm.

5.3 If there is an oven fire:

- Turn off the heat and keep the door closed to prevent flames from burning you and your clothing.
- Have the oven serviced before you use it again.

5.4 If there is a grill fire:

- Always place the grill several feet away from a house or vehicle. If the fire gets out of control, it could quickly move to other nearby items.
- Be ready to extinguish flames and keep a phone close.
- Turn off the gas if the fire is in the grill itself. This will stop feeding the fire.
- Close the lid.
- Shut the gas tank off if the fire is in the hose itself. If you are unable to reach the knob, use the fire extinguisher. The fire may quickly move to the tank which would be extremely hazardous.
- If someone is burned, cool the burn with cool water for 3 to 5 minutes. If the burn is bigger than your fist, or if you have any questions, seek medical attention right away.

VI. PREVENTION OF FIRE

6.1 Fire safety equipment for the kitchen

Consider keeping a fire blanket in the kitchen, mounted on the wall, where we can get to it easily and quickly. Fire blankets can be used to put out a fire or wrap a person whose clothes are on fire. In the kitchen, a heat detector is more suitable than a smoke detector. If we do opt for a smoke alarm though, don't fit it where it could be set off by cooking fumes or steam. If we find smoke alarm goes off a lot accidentally, we can buy one that is fitted with a 'hush' button. This means we can silence it instantly so we are not tempted to remove the battery (except to change it for a new one).

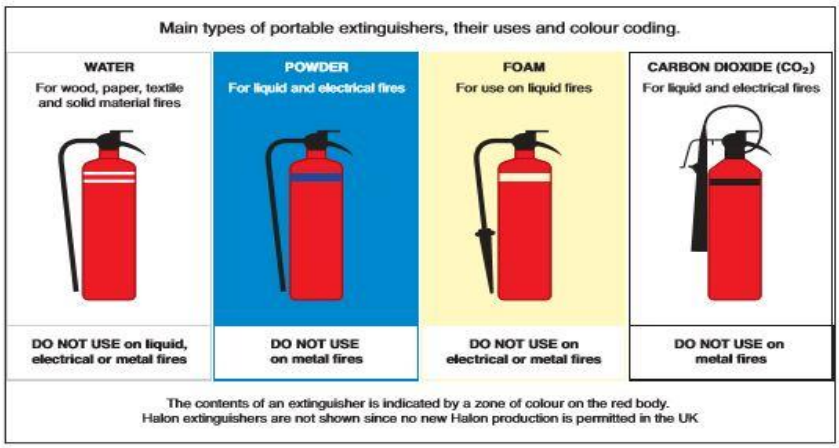

Fig 3: Types of Fire extinguishers

6.2 Smoke alarms and fire emergency equipment

6.2.1 Use smoke detector

- Smoke detectors won't prevent a fire but they save lives by alerting us to smoke. If we don't have smoke detectors, install them now. Install a smoke detector in each sleeping room, outside each sleeping area, and on each level of home.
- Test each smoke detector at least monthly.
- To prevent nuisance alarms during cooking, move smoke detectors farther from the kitchen and install a smoke alarm with a silence button.

6.2.2 Fire equipment

- Fire extinguishers should be mounted in the kitchen.
- Learn how to use your fire extinguisher before there is an emergency.
- Use extinguisher on small fires only. If there is a large fire, get out immediately and call for help.
- Trying to fight a fire when it's too large can cause far more extensive damage and can result in greater damage or unnecessary injury.

Fig 4: Fire extinguishers

Fig 5: Fire extinguishers in kitchen

6.3 Ventilation equipment in the kitchen

Check regularly that the ventilation in the kitchen, like range hoods or fans, is working properly and is not blocked up. This is especially important if we have a gas cooker in case any leaking gas builds up.

VII. PLANNING THE ESCAPE

Once a fire starts, it takes hold quickly and spreads even faster. On average, people can survive for less than five minutes in a smoke-filled room. Preparing and practicing a plan of action will help to act quickly if there's a fire – it could even save life. This section explains how to make an action plan for home to make sure that everyone gets out safely.

7.1 Choose an escape route

Occupants normally evacuate using familiar routes, mostly the main exit which is normally the entrance of a building [Graham & Roberts, 2000; Sandberg, 1997]. The choice of route depends upon the familiarity of the occupants with the building, the availability of exits, and the accessibility of the route towards exits and upon the lay-out complexity [O'Connor, 2005; SFPE, 2002]. Furthermore affiliativebehavior is considered to effect route choices during an evacuation [Cornwell, 2003]. Not the actual length but how it is perceived determines the route choice [Graham & Roberts, 2000; Sandberg, 1997; Gwynne et al., 2001]. For example, corridors with several corners and unfamiliar routes are experienced to be longer than straight and familiar routes [Løvås, 1998].

Once a fire has started from kitchen, been detected and a warning given, everyone should be able to escape to a place of total safety, either unaided or with assistance, but without the help of the fire and rescue service. However, some people with disabilities may need help from staff who will need to be designated for the purpose.

Escape routes should be designed to ensure, as far as possible, that any person confronted by fire anywhere in the building should be able to turn away from it and escape (or be taken) to a place of reasonable safety, e.g. a protected area or stairway. From there they will be able to go (or be taken) directly to a place of total safety away from the building.

Those who require special assistance (e.g. very young children, the elderly and infirm or people with disabilities) could be accommodated on the same level as the final exit from the premises to facilitate escape.

Where they need assistance to evacuate, we should make sure that there are sufficient staff to ensure a speedy evacuation.

The level of fire protection that should be given to escape routes will vary depending on the level of risk of fire within the premises and other related factors. Generally, premises that are small, consisting of a single storey, will require fairly simple measures to protect the escape routes, but large or multistoried buildings should have a more complex and inter-related system of fire precautions.

In all cases, escape routes should be designed to ensure, as far as possible, that any person confronted by fire anywhere in the building, should be able to turn away from it and escape (or be evacuated) to a place of reasonable safety, e.g. a protected area, corridor or stairway. From there, further escape should be possible either to another protected area or direct to a final exit. When determining whether your premises have adequate escape routes, we need to consider a number of factors, including:

- The type, number and dependency of people using the premises;
- Assisted means of escape;
- The evacuation strategy;
- Escape time and travel distance;
- The age and construction of the premises;
- The number of escape routes and exits;
- The management of escape routes; and
- Emergency evacuation of persons with mobility impairment.

Escape routes must be sustainable. We should ensure that your escape routes are:
(a) suitable; (b) easily, safely and immediately usable at all relevant times; (c) adequate for the number of people likely to use them; (d) usable without passing through doors requiring a key or code to unlock; (e) free from any obstructions, slip or trip hazards; (f) well lit by normal or emergency escape lighting; and (g) available for access by the emergency services

7.2 Plan of escape together

- Discuss with everyone how would get out if there were a fire. When making a plan, take account of everyone in the household, especially children and older or disabled people.
- Talk through escape plan, and regularly remind people what to do – and what not to do – if there's a fire.
- Put a reminder of what to do somewhere where it's easily seen (for example, on the fridge door or the kitchen notice board)

7.3 Emergency escape lighting

People in the premises must be able to find their way to a place of safety if there is a fire by using escape routes that have enough lighting.

In premises of limited size/occupation, e.g. ground and first floor, with a small number of residents (up to four) who do not rely upon staff for assistance with evacuation, and where the escape routes are simple and straightforward, borrowed lighting from a dependable source, e.g. from streetlamps where they illuminate the escape routes, may be acceptable.

In most care homes particularly those that are larger and more complex with more residents, a more comprehensive system of automatic emergency escape lighting should be in place to illuminate all the escape routes. Where people have difficulty seeing conventional signs, a 'way-guidance' system may need to be considered. An escape lighting system provided for escape purposes would normally cover the following:

- Each exit door;
- Escape routes;
- Intersections of corridors;
- Outside each final exit and on external escape routes;
- Emergency escape signs;
- Stairways so that each flight receives adequate light;
- Changes in floor level;
- Windowless rooms and toilet accommodation exceeding 8m2;
- Firefighting equipment;
- Fire alarm call points;
- Equipment that would need to be shut down in an emergency;

Fig 6: A way guidance system

Fig 7: Luminaires

7.4 Signs and notices

7.4.1 Signs

In care premises it is important to avoid an 'institutional' environment. However, signs must be used, where necessary, to help people identify escape routes, find firefighting equipment and emergency fire telephones. These signs are required under the Health and Safety (Safety Signs and Signals) Regulations and must comply with the provisions of those Regulations.

Other than in the smallest and simplest of premises where the exits are in regular use and familiar to staff, residents and visitors, a fire risk assessment that determines that no escape signs are required (because, for example, trained staff will always be available to help residents and visitors to escape routes), is unlikely to be acceptable to an enforcing authority.

For a sign to comply with these Regulations it must be in pictogram form (see Figure 10). The pictogram can be supplemented by text if this is considered necessary to make the sign more easily understood, but you must not have a safety sign that uses only text.

Where the locations of escape routes and firefighting equipment are readily apparent and the firefighting equipment is visible at all times, then signs are not necessary. In all other situations it is likely that the fire risk assessment will indicate that signs will be necessary.

Fig 8: Typical fire exit sign

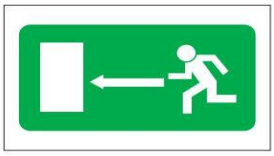

Fig 9: Sign of fire exit

Fig 10: Safety sign

7.4.2 Notices

Notices must be used, where necessary, to provide the following:

- Instructions on how to use any fire safety equipment;
- The actions to be taken in the event of fire; and
- Help for the fire and rescue service (e.g. location of sprinkler valves or electrical cut-off switches).

All signs and notices should be positioned so that they can be easily seen and understood. This may require essential signs to be duplicated at two levels (i.e. for ambulant and wheelchair residents).

Fig 11: Simple fire action notice

Fig12: Fire door keep shut notice

7.5 Think about creating a safe room

- If we can't escape we will need to find a room where we can wait for the Fire and Rescue Service. This is particularly important if we have difficulty moving around or using the stairs.
- If possible, safe room should have a window which opens and a phone.

7.6 Make sure everyone knows where keys are kept

Decide where the keys to doors and windows should be kept and always keep them there. Everyone in the household should know where the keys are kept.

7.7 Raise the alarm

If the smoke alarm goes off when we are asleep, shout to wake everyone up, get everyone together, follow the escape plan and get out of the building.

- Don't stop to investigate the fire or to collect valuables or pets.
- Use escape route to get everyone out and meet at an agreed point.
- Close any doors which are open, and only open the doors we need to go through (this will help to stop the fire from spreading so rapidly).
- Check doors with the back of our hand. If a door is warm, don't open it – the fire is on the other side.
- If there is a lot of smoke, crawl along the floor as the air will be cleanest there.
- Once we have got everyone out of the building, use a mobile phone, a neighbour's phone.
- Don't go back into the building for anything. If there is still someone inside, tell the Fire and Rescue Service when they arrive – they'll be able to find the person quicker and more safely than we.
- Find somewhere safe to wait near the building, and give the Fire and Rescue Service as much information as possible about the fire and the building.

7.8 If the escape route is blocked

- Get everyone into one room, preferably one with a window that opens and that has a phone in it. Close the door and wait to be rescued.
- Put bedding or towels along the bottom of the door to seal the gap and to prevent smoke and fumes from getting into the room.
- Open the window and stay near it for fresh air, and to let the firefighters see where we are.
- If have a phone, call the Fire and Rescue Service. If don't have a phone, shout for help so that someone else can phone for us.

Fig 13: Call emergency

Fig 14: Call someone for help

7.9 Escaping from a window

If we are on the ground floor or first floor, may be able to escape from a window. If we have to break the window, cover the jagged glass with towels or thick bedding.

- Throw bedding out of the window to break our fall.
- Don't jump out of the window – lower yourself down to arm's length and drop to the ground.
- If we have any children, elderly or disabled people with us, plan the order we will escape in so that you can help them down.

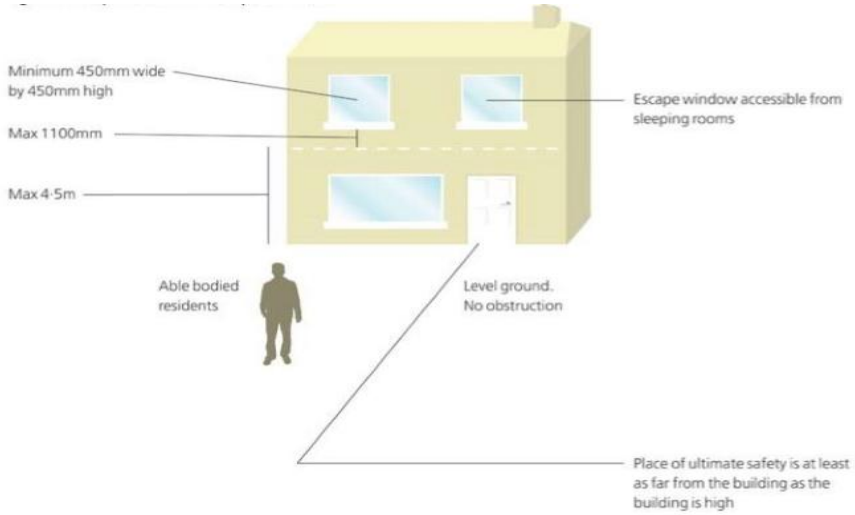

Fig 15: Escape from window

7.10 If the clothes catch fire

- Don't run around – we will fan the flames and make them burn faster.
- Lie down and roll around. This smothers the flames and makes it harder for the fire to spread.
- Smother the flames with heavy material, like a coat, a blanket or a fire blanket.

Fig 16: Wrong way of escape from fire

Fig 17: Right way of escape from fire

VIII. CONCLUSION

To prevent high fatality in case of fire in apartment buildings especially in the kitchen there are four main observations to denote. First of all, in buildings where vulnerable people are present, such as in residential buildings where the people can be asleep, it is vital to prevent a large fire and smoke development. In other words, it is essential to extinguish or suppress an initiated fire as soon as possible. For that reason it is necessary to fit a sprinkler system in apartment buildings with regard to fire fatality. Additionally, in many fires it is found that occupants normally evacuate by using familiar routes, mostly the main exit which is normally the entrance of a building. In a building the familiar route to the main exit is the use of an elevator. Therefore it is essential to make fire safe elevators so it is safe to use lifts in case of fire. For making a safe evacuation possible by the use of staircases it is crucial to make staircase in such a way that they redress the aspects that have a negative influence on the velocity, such as counter flows of fire fighters who want to enter the building by use of staircases. A feasible solution is to make extra staircases that are especially designed and only for fire fighters to make use of. And last but not least, in many evacuations it is found that people hardly respond on signals of fire, such as a fire alarm. People mostly wait for others to take the first respond. In case of fire the very fast

response is nevertheless very critical for the survival of the fire situation. Spoken messages and personnel directives are found to be effective for the direct start of an evacuation and for the use of fire exits. So for making a rapid evacuation possible it is recommended to make use of spoken messages and to educate and train key role employees in organizations in the coordination of an evacuation. In high-rise buildings it is possibly more effective to shelter and wait in a safe place instead of evacuate all the people inside. The strategy of shelter and wait is only reasonable if the building features support this strategy. Therefore it is necessary to have a sprinkler system active during the fire, to fence in the smoke spreading and there have to be measures taken that make it possible to rescue awaiting people in a safe manner and in a short time.

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