An Overview of a Proposed Shift from the Prescriptive Approach to a Risk-Based Approach in the Provision of Fire Extinguishers in Hong Kong

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Law governing provision of fire extinguishers in Hong Kong

- **Fire Services (Installations and Equipment) Regulations**
  - **Control only sale & maintenance of F.E.**
  - **Does not control the standard for the provision of F.E.**

Stipulation of Provision of F.E. in Hong Kong

- **Fire Services Department Fire Prevention Notice No. 13**
  - **- A 9-litre water/CO_2 F.E. required for every 200 m^2 of construction sites**
- **Fire Safety (Commercial Premises) Ordinance Schedule 3**
  - **Fire Services Department Fire Safety (Commercial Premises) Ordinance - An extinguisher for every 100 m^2 of specified commercial premises**

Stipulation of provision of F.E. in Hong Kong

- **Agricultural, Fisheries & Conservation Department Safety Guidelines for Storage of Pesticide**
  - **2 foam or 6-kg dry powder F.E. for the first 50 m^2, an extra one for an additional 100 m^2**
- **Factories and Industrial Undertakings (Spraying of Flammable Liquid) Regulations**
  - **a 9-litre foam or a 1.4 kg BCF F.E. for every 40 m^2 of paint spraying room, or a 2 kg dry powder or 2 kg CO_2 for every paint spraying room or area of 33 m^2 or less**

Stipulation of provision of F.E. in Hong Kong

- **Factories & Industrial Undertakings (Work in Compressed Air) Regulations**
  - **Reg. 21(6)(e) – Water F.E. in medical lock**
- **Merchant Shipping (Safety) (Fire Protection) (Ships Built before 25 May 1980) Regulations / Merchant Shipping (Safety) (Fire Protection) (Ships Built after 25 May 1980 but before 1 September 1984) Regulations**
  - **Reg. 62 / Reg. 69 – CO2 F.E. not less than 3 kg; Powder F.E. not less than 4.5 kg; Other types equivalent to 9 litre fluid F.E.**

Stipulation of provision of F.E. in Hong Kong

- **Merchant Shipping (Safety) (Fire Protection) (Ships after 1 September 1984) Regulations**
  - **Reg. 67 – CO_2 F.E. not less than 3 kg; Powder F.E. not less than 4.5 kg; Halon not less than 7 kg; Other types equivalent to 9 litre fluid F.E.**
- **Merchant Shipping (Fire Appliances) Regulations**
  - **Reg. 11(2) / Reg. 12(a) / Reg. 20 / Reg. 28(14)(a) / Reg. 28(16) / Reg. 29(11) – a min. 10 gallon foam F.E. or min. 35 lb CO_2 F.E.**
  - **Reg. 36 – CO_2 F.E. not less than 7 lb; Powder F.E. not less than 10 lb; Others equivalent to a 2 gal F.E.**

Provision of F.E. overseas

- **Prescriptive approach also exists**
  - **Finland Ministry of Transport & Communications – a 6 kg F.E. in buses instead of 2 kg**
  - **Erewash Borough Council – a 9 kg powder F.E. for mobile catering**
  - **Huntingdonshire District Council – a 9 litre water F.E. near each exit, a 2.5 kg CO_2 F.E. adjacent to each electric risk, & a 2.5 kg powder F.E. by the side of cooking area of barn dances**
  - **Mid and West Wales Fire & Rescue Services – a 9 litre water F.E. for every 200 m2 of barn dance & barbacue, & a 4.5 kg powder F.E. near cooking area**
  - **U.N. Office for the Coordination of Humanitarian Affairs – a 2.5 kg powder F.E. for each basic fire fighting package**

The Question is :-

- **Should the requirement on the provision of fire extinguishers be stipulated in terms of the type, weight or capacity (volume) of the materials contained inside?**
- **Why?**

Equivalency of F.E.

- **Hong Kong**
  - In the past, equivalency of F.E. published by Hong Kong Fire Services Department in its Circular Letter & CoP
  - Deleted in latter revisions
- **Overseas – equivalency still exists**
  - E.g. Atomic Energy Regulatory Board of Government of India – a 9 litre water F.E. equivalent to a 9 litre foam F.E., a 9 kg CO_2 F.E., or a 5 kg powder F.E.

The Question is:-

- **Should there be an equivalency in different types of fire extinguishers?**

Classes of Fire

- Class A – fires involving ordinary combustible materials (CEN & ANSI / UL)
- Class B – fires involving flammable liquids or liquefiable solids (CEN & ANSI / UL)
- Class C – fires involving gases (CEN); fires involving energized electrical equipment (ANSI / UL)
- Class D – fires involving combustible metals (ANSI / UL)
- Class F (CEN) / Class K (ANSI / UL) - fires involving fats & cooking oils

Class F / K Fire Extinguishers

- Brought about by increased use of vegetable cooking oils & new high efficiency cooking appliances with improved insulation
- Results in increase in auto-ignition temperature, longer heat retention & slower cooling, finally leading to increased risk of reflash
- Aging cooking oils results in decrease in temperature required for reflash
- Class F / K fights fire by saponification effect, & also accelerates cooking effect due to water contained in the mixture removing heat from the oil
- However, local fire authority still prescribes a 4.5 kg CO_2 for every three electrical / gas cooking appliances – no saponification effect

The question is:-

- With the introduction of Class K fire extinguishers in NFPA 10 : 1998, should we still prescribe the use of CO2 fire extinguishers which do not provide the required saponification and cooling effect?
- Without considering the proper classification of fire, how should the provision of fire extinguishers be prescribed?

Fire Rating

- An extinguisher may attain an A- or a B- rating if it is capable of extinguishing within a pre-set time Class A or Class B test fires respectively
- A Class A test fire involves a crib of layers of wooden sticks
- A Class B test fires involves a heptane fire pan
- No test requirement for Classes C, D and K, standard 75F size (75 litres) for Class F

Fire Rating

- A CEN 5-A / 8-A / 13-A … fire rating correspond respectively to 5 / 8 / 13 … nos. of 500 mm of wooden sticks in each transverse layer, so that the length of test fire is 0.5 / 0.8 / 1.3 m …
- A CEN 21-B / 34-B / 55-B … fire rating corresponds to a test fire involving 21 / 34 / 55-litres … of mixture of fuel (two-third) with water (one-third)
- The nos. are different for the ANSI / UL fire ratings but the principles are the same. The larger the crib, or the pan size, the higher will be the fire rating

Fire Rating

- The CEN fire tests have shown that for a 1-kg powder extinguisher, the fire ratings can range from 5A to 55A, and from 21B to 233B.
- The same exists for extinguishers of other types or nominal charges
- This illustrates that the weight or volume of an extinguisher is NOT a reliable indicator of its fire fighting capacity
- Put it the other way round, it will be wrong to think that for water type extinguishers, only those having 9-litre capacity can achieve a 13-A fire rating

Fire Rating

- Even a 3-litre water additive extinguisher is able to produce the desired 13-A fire rating
- In comparison a 9-litre water extinguisher is more bulky for use in office environment
- Similarly, a 5-kg CO_2 extinguisher of one brand may not have a better fire fighting capability than a 2-kg CO_2 extinguisher of another brand
- If intended to protect Class B hazard, there should be a choice between foam, powder or CO_2 extinguishers all of which should have attained some class B fire rating

The question is:-

- **If a smaller or lighter extinguisher can perform as good as, or even better than, a large or heavier one, then why should we still impose rigid requirements insisting on the latter instead of allowing for a choice by the user?**

Water Additive Extinguisher

- Water from a water type extinguishers, due to the surface tension of the water, stays at the surface of the solids without penetrating deep into them
- However, a water additive type extinguisher lowers the surface tension & thus enable the water with the wetting agent to penetrate into the burning solids, thereby improving the fire extinguishing efficiency by 5 times
- Cannot be accurately named a water type extinguisher, for fear of the water additive being replaced with ordinary water when the next contractor does the annual maintenance
- Under the existing convention, the water additive or other innovative extinguishers would have limited market competitiveness

The question is:-

- With thousands of chemicals in the world, and surely many of these can be good fire inhibitors, where are extinguishing materials limited to only 5 types, viz. water, foam, dry powder (dry chemical), CO_2 and vaporizing liquid (such as BCF, FM200, HCFC-123 etc.)?
- For example, a wet chemical (Class F or K) extinguishing material is not water, will not foam, and is of course not solid powder nor gaseous substance, then is it fair to stipulate the above 5 types only for new installations?

Standard on the Provision of Extinguishers

- In Hong Kong, it's governed by the Code of Practice for Minimum Fire Service Installations & Equipment & Inspection & Testing of Installation & Equipment
- Criteria for provisions are not quite consistent
- E.g., in kitchens or dangerous goods stores of 42 m^3 capacity & above, extinguishers are to be provided as required by the Director of Fire Services
- For dangerous goods stores under 42 m^3 capacity, extinguishers are to be provided as required by the risk
- However, existing practice is extinguishers of all types of dangerous goods stores are provided as required by the Director of Fire Services

Standard on the Provision of Extinguishers

- In domestic buildings, provision of extinguishers is stipulated for those buildings up to 3 storeys in height For higher ones, fire hydrant / hose reel systems are prescribed instead
- For curtained wall buildings, the provision is based on occupancy
- For basement cold storage areas, some are required by the occupancy, while others are provided according to the plant and construction
- It appears to be a combination of the prescriptive approach and the risk-based approach
- No specific information on how and what extinguishers are to be provided for “as required by risk” or “as required by occupancy”

The question is:-

- **Since codes of practices are meant to be practical guides, how can we interpret the messages such as “as required by occupancy” or “as required by the risk” in the Code of Practice on Minimun Fire Services Installations and Equipment in determining the specification for the provision of extinguishers?**

Applicable Type and Best Type of Extinguisher

- For Class A fires, it is common understanding that water, foam, powder, CO_2 and vaporizing liquid are applicable. For Class B fires, water is not applicable while foam, powder, CO_2 and vaporizing liquid are applicable. For Class C (ANSI / UL) electrical fires, both water and foam are not applicable while CO2 and vaporizing liquid are applicable.
- Common understanding that water is best for Class A fires; foam is best for Class B fires; and CO_2 best for Class C (ANSI / UL) electrical fires

Applicable Type and Best Type of Extinguisher

- Using a risk-based approach, CO_2 cannot attain a Class A fire rating and hence is considered not suitable for fighting Class A fire.
- Similarly a BC-dry chemical type extinguisher should be considered not suitable for fighting Class A fire.
- As said above, cooking oil fires are regarded as Class B fires in Hong Kong, and the use of CO_2 extinguishers, and sometimes foam extinguishers, is still stipulated. Using the classification of fire and fire rating concept, the best type of extinguisher should be a wet chemical type (Class F or K)

Applicable Type and Best Type of Extinguisher

- Some water and foam type extinguishers can pass the 35kV dielectric test and it is tendency that they should be considered suitable for electrical fires
- In fact, a water mist extinguisher has been tested and certified to be suitable for use on electrical fire (attain the ANSI / UL Class C fire rating). This matches with the development of new water mist or fog systems designed to fight electrical fires, or even flammable liquid fires
- In terms of the fire rating, usually a dry powder extinguisher attains a much higher B rating than a foam extinguisher of the same size and capacity
- The concept of equivalency of extinguishers crumbles when their performances are based on fire rating

The question is:-

- **Some fire safety videos and literatures are still promoting the concept on the best type of extinguishants for different types of materials. How should the word “best” be interpreted, i.e. what is the yardstick for measurement of which one is the “best” or for comparison sake, which one is “better” than the other?**

Conclusion:-

- Provision of extinguishers should be based on the fire risk inherent in the protected areas, & stipulated by the fire rating instead of on the weight / quantity of certain extinguishants
- There should be no need for an equivalency of extinguishers. If there is, it should also be based on the fire rating classification
- They should be no need for the best type of extinguisher. If there should be, it should be based on the fire rating performance
- There is a need to establish new classes, such as Class F or K for fires of different properties
- Using a risk-based consideration, CO_2 should be considered not suitable for fighting Class A fires


THE END
Thank you