



'SEDIA MENYELAMAT'

Ruj. Tuan :
(Your Ref)
Ruj. Kami : JBPM:BKK/013/2/28 (11)
(Our Ref)
Tarikh : 31 Mei 2010
(Date)

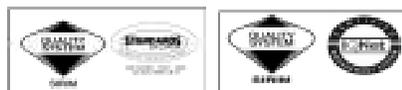
YS Pengarah Jabatan Bomba dan Penyelamat W.P Kuala Lumpur
YS Pengarah Jabatan Bomba dan Penyelamat Negeri Selangor
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YS Pengarah Jabatan Bomba dan Penyelamat W.P Labuan
YS Pengarah Jabatan Bomba dan Penyelamat W.P Putrajaya

YS Dato'/Tuan,

ARAHAN KESELAMATAN KEBAKARAN BILANGAN 1 TAHUN 2010: GARISPANDUAN PENGGUNAAN SISTEM JET FAN SEBAGAI PEPASANGAN KESELAMATAN KEBAKARAN UNTUK KAWALAN ASAP DI RUANGAN LETAK KERETA

Saya dengan hormatnya merujuk perkara di atas adalah berkaitan.

2. Sukacita dimaklumkan bahawa bersama-sama ini disertakan Arahan Bahagian Keselamatan Kebakaran Bilangan 1 Tahun 2010, yang bertajuk, **Arahan Keselamatan Kebakaran Bilangan 1 Tahun 2010: Garis Panduan Penggunaan Sistem Jet Fan Sebagai Pemasangan Keselamatan Kebakaran Untuk Kawalan Asap di Ruang Letak Kereta.**



3. Arahan ini penting bagi dijadikan garis panduan kepada pegawai-pegawai bomba dan pihak *industry players* tentang kaedah dan tatacara amalan terbaik penggunaan jet fan sebagai salah satu alternatif sistem pengurusan asap dalam ruang letak kereta di sesuatu bangunan yang berkaitan.

4. Sehubungan dengan itu, mulai dari tarikh surat ini, semua permohonan baru bagi penggunaan Sistem Jet Fan atau permohonan yang sedang diproses hendaklah mematuhi sepenuhnya Arahan Keselamatan Kebakaran Bilangan 1, 2010 ini. Maka, bagi seliap Pegawai Bomba khususnya yang terlibat dalam memproses perakuan pelah bangunan dan juga pemeriksaan bangunan hendaklah menggunakan garis panduan ini sebagai rujukan dan juga asas pertimbangan.

Sekian, terima kasih.

“BERKHIDMAT UNTUK NEGARA”

“1 Malaysia” Rakyat didahulukan, Pencapaian diutamakan.

Saya yang menurut perintah,

(DATO' RUSMANI BIN MUHAMAD)

Penolong Ketua Pengarah

Bahagian Keselamatan Kebakaran

b.p. Ketua Pengarah

Jabatan Bomba dan Penyelamat Malaysia

s.k :

- i. YAS Ketua Pengarah
- ii. YAS Timbalan Ketua Pengarah (Operasi)
- iii. YAS Timbalan Ketua Pengarah (Pembangunan)
- iv. YS Penolong-penolong Ketua Pengarah
- v. YS Komandan FRAM, KKB, Wakaf Tapai, Ipoh, Sabah & Sarawak
- vi. Pegawai Memerintah Pangkalan Udara JBPM



**JABATAN BOMBA DAN PENYELAMAT,
MALAYSIA**

**ARAHAN KESELAMATAN KEBAKARAN
BILANGAN 1 TAHUN 2010**

**GARISPANDUAN PENGGUNAAN SISTEM JET FAN
SEBAGAI PEPASANGAN KESELAMATAN KEBAKARAN
UNTUK KAWALAN ASAP DI RUANGAN LETAK KERETA**

1. Latarbelakang

- 1.1 Pemasangan sistem *jet fan* di negara mula diperkenalkan bagi sistem pengudaraan dan pengeluaran asap dalam terowong untuk laluan sehalu. Walau bagaimanapun, sistem ini diperluaskan penggunaannya di dalam bangunan yang melibatkan ruangan letak kereta. Setakat ini ianya dipasang berdasar spesifikasi syarikat pengeluar peralatan *jet fan* tersebut. Memandangkan penggunaannya sebagai satu pilihan kepada sistem pengurusan asap dalam bangunan, maka ianya perlu suatu garis panduan, peraturan dan sistem kawalan yang sewajarnya.

- 1.2 Kawalan terdahulu yang dibuat adalah ke atas *jet fan* itu sendiri iaitu ianya perlu mendapat kelulusan Perakuan Bahan JBPM sebelum boleh diguna pada mana-mana premis.
- 1.3 Penggunaan *jet fan* menjadi pilihan kerana ianya tidak perlu memasang sistem *ducting (ductless)* dan ini akan dapat mengurangkan penggunaan ruang.

2. Tujuan

Arahan ini bertujuan untuk :

- 2.1 Memberi panduan dan kawalan ke atas penggunaan pemasangan *jet fan*. Di ruangan letak kereta dalam bangunan.
- 2.2 Memberi panduan kepada pegawai bomba dalam memproses pelan Mekanikal dan Elektrikal berkaitan dengan pemasangan *jet fan*.
- 2.3 Memberi panduan kepada pegawai bomba dalam membuat pemeriksaan dan pengujian *jet fan* di tapak projek.

3. Keterangan berkaitan Jet Fan

Jet Fan merupakan satu sistem yang dipasang bagi tujuan mengeluarkan asap apabila berlaku sesuatu kebakaran.

- 3.1 Ianya boleh dipasang secara individu atau kumpulan yang mana setiap kumpulan terdiri tidak lebih 3 *jet fan*.
- 3.2 *Jet Fan* ini digerakkan kuasa motor tersendiri dengan bekalan kuasa elektrik.

4. Had Penggunaan

4.1 Sistem *Jet Fan* ini hanya dibenarkan penggunaannya pada tempat-tempat berikut sahaja :-

4.1.1 Ruangan tempat letak kereta bawah tanah kategori *conventional basement car park (mechanical carpark* tidak dibenarkan)

4.1.2 Ruangan *tunnel*

5. Pemasangan Jet Fan

5.1 Reka bentuk dan pemasangan *jet fan* perlulah menurut zon kawalan asap (*smoke control zone*)

5.2 Setiap zon kawalan asap tidak melebihi 2600 meter persegi.

5.3 Setiap zon perlu mempunyai set sistem pengurusan asap iaitu terdiri daripada :-

5.3.1 *Jet fan*

5.3.2 *Exhaust fan*

5.3.3 *Make-up air*

5.4 Kedudukan *jet fan* dipasang pada jarak tidak melebihi 15 m selari (*sideways*) dan tidak melebihi 30 m siri (*air-throw distance*). Jarak yang sama digunakan antara *jet fan* dan *exhaust inlet*.

6. Pengiraan Pemasangan Jet Fan

- 6.1 Setiap cadangan pemasangan *jet fan* perlulah dikemukakan pengiraan keperluannya berdasarkan rekabentuk pemasangannya.
- 6.2 Pengiraan terperinci bagi *Smoke Extraction* dan *Make-up Air* berdasarkan normal dan fire mode perlulah dikemukakan.
- 6.3 Reka bentuk pemasangan *jet fan* perlulah mematuhi keperluan *smoke clearance 2.1 meter* dari paras lantai.
- 6.4 Dalam situasi *fire mode*, sistem *jet fan* perlulah direkabentuk untuk memberi 12 pertukaran udara (*airchange*)
- 6.5 Reka bentuk pemasangan dan pengiraan yang dikemukakan perlu berdasarkan kepada piawaian yang telah ditetapkan menurut UBBL 1984
- 6.6 Setiap pengiraan perlulah disahkan oleh Jurutera Profesional (Mekanikal atau Elektrikal).

7. Keperluan Mengemukakan Computational Fluid Dynamics (CFD) Modeling

- 7.1 Bagi tujuan keberkesanan sesuatu cadangan penggunaan *jet fan* pada ruangan yang bersaiz lebih 2600 meter persegi, pihak konsultan disyaratkan mengemukakan *CFD modeling* berasaskan kepada sesuatu senario kebakaran. Analisis laporan CFD ini perlulah disahkan oleh pihak Jurutera Profesional (Mekanikal atau Elektrikal)

8. Ujian Pemasangan

- 8.1 Setiap pemasangan *jet fan* pada sesuatu premis perlulah diperiksa dan diuji bagi memastikan ianya mematuhi garis panduan yang ditetapkan.
- 8.2 Ujian 'performance' perlulah dibuat di lokasi pemasangannya. *Hot smoke test* atau *cold smoke test* perlu dibuat bagi memastikan keupayaan sistem tersebut bertindak.
- 8.3 Kegagalan sistem ini berfungsi semasa ujian akan menyebabkan ianya perlu dinilai semula dari aspek pemasangan, pengiraan dan aspek-aspek lain yang berkaitan.

9. Garispanduan Terperinci

- 9.1 Garis panduan terperinci pemasangan jet fan pada **Lampiran A**.

10. Tarikh Berkuat kuasa

- 10.1 Arahan Keselamatan Kebakaran Bilangan 1 Tahun 2010 ini berkuat kuasa mulai dari arahan ini ditandatangani.

11. Penutup

- 11.1 Ketua Pengarah dengan ini berhak untuk meminda atau membuat sebarang arahan-arahan lain selain daripada arahan-arahan yang terdapat di dalam Arahan ini mengikut keperluan dari semasa ke semasa. Adalah diharapkan dengan Arahan ini, segala aktiviti-aktiviti berkaitan dapat dilaksanakan dengan lebih cekap dan berkesan.

“BERKHIDMAT UNTUK NEGARA”

“1 Malaysia” Rakyat didahulukan, Pencapaian diutamakan.

Saya yang menurut perintah.

(DATO' HAMZAH BIN ABU BAKAR)

Ketua Pengarah,
Jabatan Bomba dan Penyelamat, Malaysia.

Tarikh: 27/05/2010

Kepada: YAS Timbalan Ketua Pengarah (Operasi),
YAS Timbalan Ketua Pengarah (Pembangunan),
YS Penolong-penolong Ketua Pengarah Bahagian,
YS Pengarah-pengarah Bomba Negeri.

GUIDELINES ON THE USE OF DUCTLESS JET FAN SYSTEM IN CAR PARKS

1. OBJECTIVES

1.1 The objectives on the jet fan system (under fire mode operation) are as follow:

- a) To relief heat and smoke from the car park in the event of fire
- b) To assist fire-fighters in locating and attacking the fire

2. APPLICATION

2.1 This set of guideline is only applicable to conventional basement car parks where passenger cars/light weight vehicles are parked alongside each other with common driveways and is not intended for mechanized car park system or other forms of car parking systems.

3. PRESCRIPTIVE & ENGINEERED SYSTEM DESIGN

3.1 Provision of sprinkler system in car park

3.1.1 The basement car park shall be sprinkler protected in accordance with the MS 1910:2006 (Fixed Firefighting Systems – Automatic Sprinkler Systems – Design, Installation and Maintenance)

3.1.2 The arrangement or the sprinkler heads and the jet fans shall be such that, upon operation of jet fans, the effect on the spray

pattern of the sprinklers is minimized. To achieve this, the jet fan shall be located such that the inlet & outlet are not less than 1 meter from any sprinkler point.

3.2 Zoning of car park

3.2.1 The car park space shall be divided into smoke control zones with each zone not larger than 2600m² (excluding plant rooms and circulation spaces) for purpose of containing smoke within the zone boundaries, unless the fire is located across the zone boundaries.

3.2.2 Each smoke control zone shall have its own jet fan system (with dedicated exhaust fans and fresh air make-up) to purge smoke from the affected zone.

3.2.3 The jet fans shall be spaced not more than 15m apart (sideways) and not more than 30m apart (air-throw distance). The same limit applies to distance between jet fans and main exhaust inlet.

3.3 Jet fan system

3.3.1 The jet fan system shall be connected to the fire alarm system for automatic and immediate activation of the exhaust fans but with a 2-minutes time delay for the jet fans in the event of fire alarm activation (but excluding manual call point alarm). A manual ON switch for each group of jet fans shall be provided at the Main Fire Alarm Panel (MFAP). Main exhaust and supply fan shall be activated without any delay.

3.3.2 The jet fan system shall be provided with a secondary source of power supply through automatic operation of an emergency generator in case of failure of the primary power supply source.

3.3.3 Interlocking of the jet fan system shall be done in the following manner:

- i. Each exhaust fan shall be interlocked with its corresponding groups of jet fans.
- ii. If the exhaust fan stops/fails, its corresponding groups of jet fans shall stop.
- iii. The exhaust fan shall continue to run even if any corresponding group of jet fans fails.
- iv. All remaining groups of jet fans shall continue to run even if any one group of jet fans fails.
- v. If the fire alarm signal is isolated, the exhaust fans and jet fans shall continue to run under fire mode condition (at high speed where applicable). If the fireman stops the fans and restart them, both the exhaust fans and jet fans shall continue to run under fire mode condition (high speed where applicable). This mode of operation shall continue until the fans are reset to normal condition (or low speed where applicable) at the field control panel.

3.3.4 The jet fan system (for fire mode operation) shall be independent of any system serving other parts of the building.

3.3.5 The jet fan system design shall be such that the bulk air velocity induced by the jet fans is sufficient to stop the advance of the ceiling jet within 5m from the fire location in the direction opposite to the induced bulk air flow.

3.3.6 The Mechanical Ventilation (MV) sub-panel in each smoke control zone shall be connected to the main MV panel, such that

any isolation of a jet fan system at a particular zone is automatically displayed at the main MV panel.

3.3.7 In the event of failure of the primary source of power supply and subsequent operation of the secondary power supply, the mode of operation on the jet fan system during the fire mode shall follow that prior to the failure of the primary power supply. For example, if the operation of jet fan system in a particular smoke control zone is switched off by the fireman during fire mode condition and the primary source of power fails, the subsequent operation of the secondary power supply will be such that the jet fan system remains in the previous fire mode condition i.e. non-operational mode for that smoke control zone while the other smoke control zones resume operation.

3.3.8 The jet fan system design shall take into consideration the presence of any down-stand beams and other obstruction of depths more than 1/10 of the car park floor to ceiling height so as to minimize any resistance to airflow and turbulence.

3.4 Operation of jet fans

3.4.1 On activation of the jet fans, the movement of smoke towards the extract points should not adversely affect the means of escape and cause smoke to be blown into the lobby area or exit staircases.

3.4.2 The operation of the jet fans should be such that there are no stagnant areas (below 0.2m/s air velocity) exceeding 10m² where smoke can accumulate in the event of fire.

3.4.3 The operation of the jet fans should not cause the volume of air movement to be greater than that extracted by the main exhaust fans.

3.5 Wiring arrangement of jet fans

- 3.5.1 All jet fans shall be connected to the local jet fan control panel in groups of not more than 3 jet fans.
- 3.5.2 Each group will be connected by minimum 2-hour fire rated cabling of minimum 2.5mm².
- 3.5.3 Each group of jet fans shall be protected by a miniature circuit breaker (MCB).
- 3.5.4 The incoming power supply shall be protected by an MCB of the appropriate rating and a residual current circuit breaker (RCCB). Should there be a fault with one jet fan, it will trip the RCCB of the group only; it should not trip the RCCB protecting the other groups. As each group of 3 jet fans is also protected by an MCB, this MCB will trip before
- 3.5.5 The connection of the jet fans shall be such that in the event the motor “burns out” for any one of the jet fans, it will not trip the other 2 fans in the group. And in the event the motor “shorts to earth”, the RCCB protecting the group will trip first before affecting the RCCB protecting the main incoming supply.
- 3.5.6 The jet fans shall also be wired in a zigzag configuration such that in the event of failure of 1 group of jet fans, the next corresponding group will be able to entrain the smoke towards the exhaust location to be extracted (please refer to diagram under **Annex A**). should one group of jet fans fail, all other groups shall still continue to run.
- 3.5.7 The local control panel for the operation of the jet fans within each zone should be located such as to minimize the risk of a fire affecting the control panels serving jet fans of other zones.

3.6 Provision of supply air

3.6.1 Supply air to the car park can be provided via mechanized supply air fans or by permanent openings equal to or not less than 2.5% of the floor area. The permanent openings should be distributed over the car park areas.

3.6.2 The air velocity within escape routes and ramps shall not exceed 5m/s to prevent escapes from being hindered by the air flow.

3.6.3 The make-up air intakes should face away from any smoke exhaust points and sited at least 5m apart so as to prevent recirculation of smoke.

3.6.4 The make-up air intake should also be located on the opposing end of the smoke exhaust point so that there is
The fans, ducts and wiring shall be tested in accordance with relevant approved standards such as BS7346: Part 2, BS476: Part 24 or equivalent.

4. CFD MODELING

For applications to car parks exceeding 2600m², the jet fan design shall be demonstrated with CFD modeling and submissions are to be endorsed by the submitting person (Professional Mechanical Engineer).

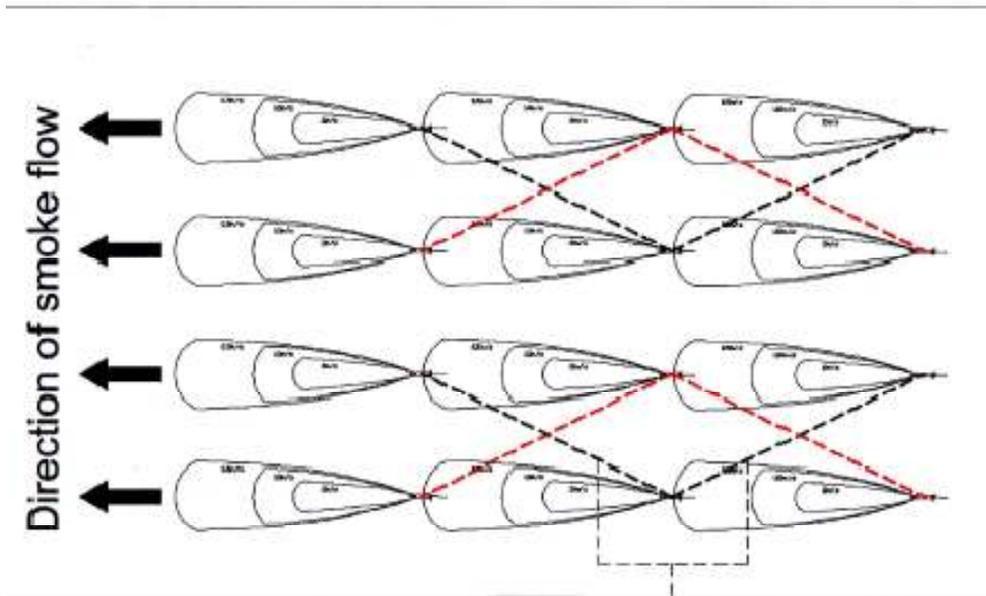
5. SMOKE TEST

For applications to car parks exceeding 2600m², a smoke test shall be carried out to verify the system performance according to requirements by Authorities Having Jurisdiction (AHJ)

6. OPERATIONS AND MAINTENANCE MANUAL

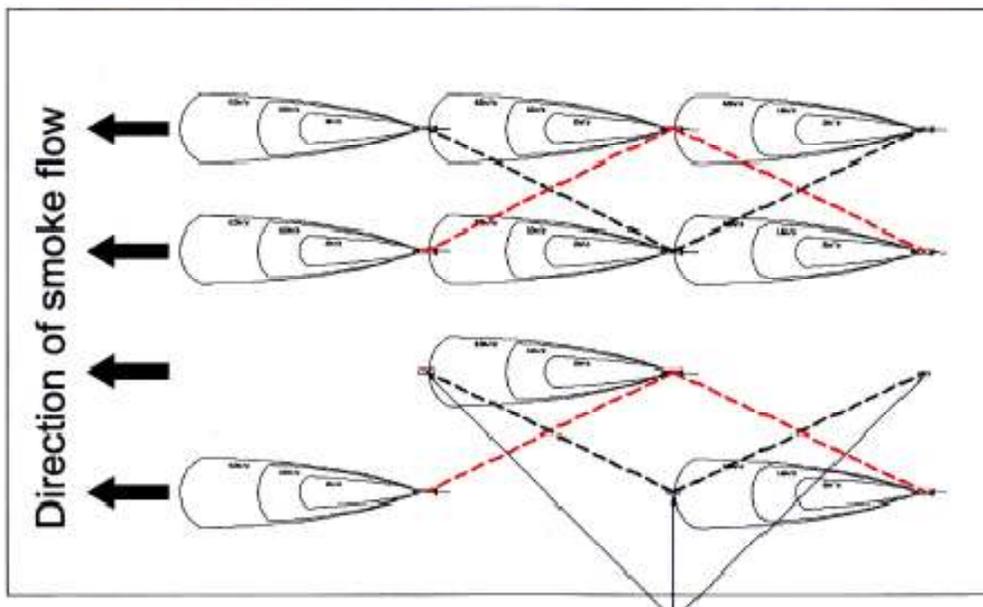
An operations and maintenance manual shall be submitted. The manual should contain the roles and responsibilities of the building owner/operator, the restrictions placed on the building, identification of the sub-systems, servicing and maintenance plan, fault identification, etc. the manual is to be used as a guide for future renovations and changes to the building.

Normal operation of jet fans



Group wiring of 3 fans

Operation during group failure



Fan failure