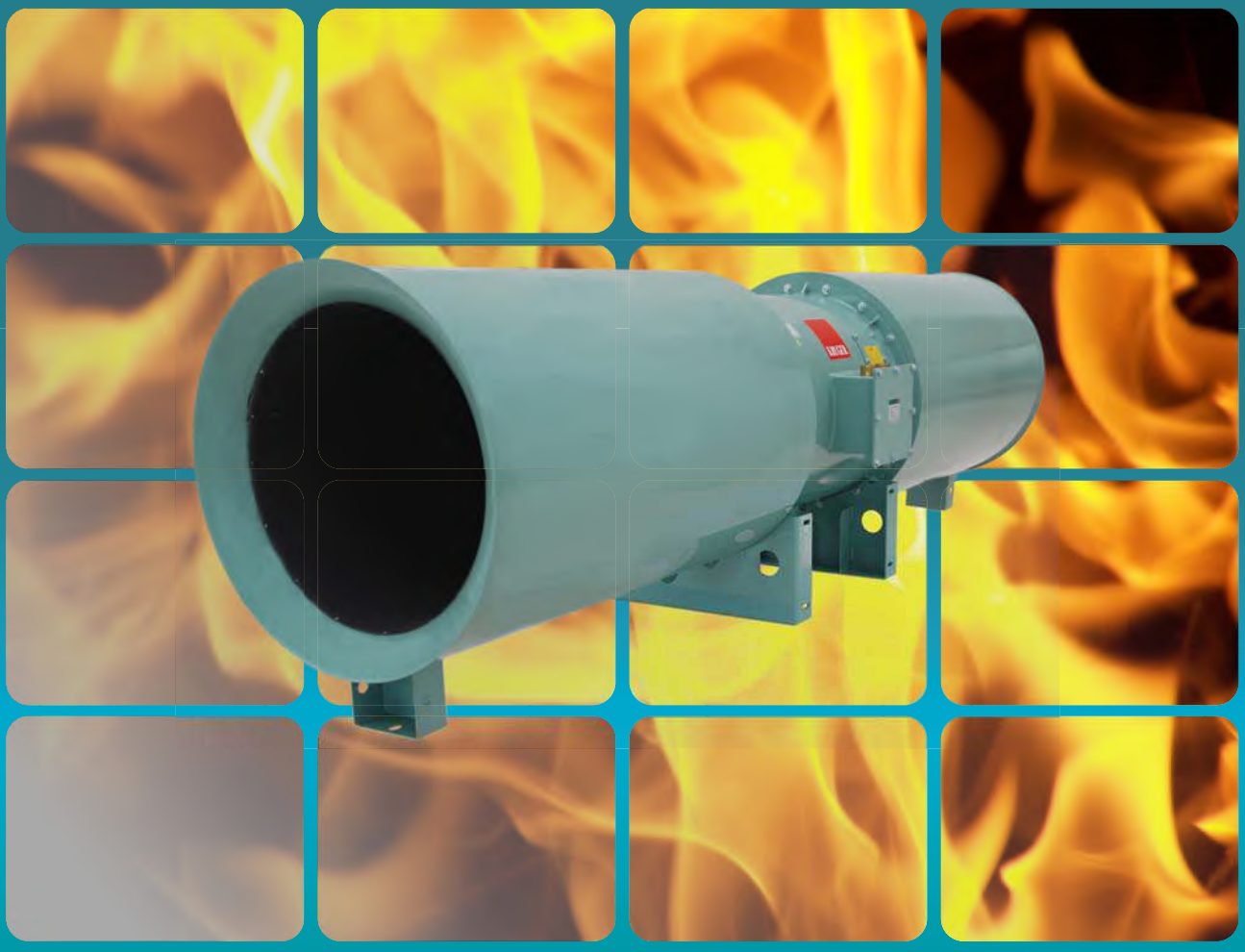
KRUGER

TUNNEL FAN

KJF & KJF-R Series



Company Profile

Established in Singapore since 1985, Kruger Ventilation is a full subsidiary company of Soler & Palau Ventilation Group. For decades, Kruger Ventilation continues to be a leading supplier of ventilation solutions for residential, commercial, industrial, and infrastructure applications; the last of which demands a high degree of specialization as in road and metro tunnel ventilation systems. The industry has grown to expect from us to deliver value in unmatched Quality, Delivery, and Service, which are made possible with our engineering expertise, world class manufacturing, and dedication towards innovative excellence. Meeting the needs of our customers is our success.

Kruger tunnel fans are precision engineered for superior performance and trouble-free operation for years to come. Advancements in technology have allowed our tunnel fans, manufactured and assembled in our state-of-the-art ISO 9001 certified factory to achieve world class performances in tunnel ventilation applications. Every Kruger tunnel fan is test run and quality recorded for performance assurance and quality compliance. Full F.A.T. in our AMCA certified test facility with third party certification further ensures our fans comply with the most demanding specifications.

With our continuous commitment towards excellence, and our localization of manufacturing capacity, technical support, testing & commissioning, and after-sales service & maintenance across Asia in seventeen locations, our customers' investments entrusted to us are in good hands, and our promises are always delivered.

TUNNEL SYSTEMS
MADE BY KRUGER

Application

Efficient underground space utilization is vital for sustainable urbanization for cities around the world. Consequently, more capitals are invested in underground infrastructure projects in transportation, storage caverns, utility pipelines, etc. Natural ventilation, although is the most economical, has few practical applications due to its limitations. Therefore it is necessary to mechanically ventilate these spaces properly in order to meet the design criteria for system functionality and safety. The applications of tunnel jet fans are many and to name a few:

1. Transportation Tunnel

Road and metro tunnels allow passenger vehicles or trains to go through and under terrains, significantly shorten the commute, making time and energy efficient travel possible. These tunnels also free up valuable land above for other uses. For road tunnel with its high level of contamination from vehicles, and metro tunnel characterized by design complexity for passenger comfort, the tunnel jet fans must work flawlessly in both cases to provide the necessary air circulation, and most importantly, control smoke pattern in case of fire to ensure the safety of the passengers.

2.Underground Construction

Underground constructions such as storage caverns and others require tunnel jet fans during construction as well as for permanent use. The environment demands the fans to efficiently provide fresh air while removing the pollutants, heat, humidity, and purge the environment of dusts from blasting during the construction phase.

3.Utility Tunnel

Utility tunnels are underground construction designed to carry utility lines including electrical power lines, communications cables and optics, water and sewer pipes, making the urban spaces above less obstructed and more aesthetically pleasing. The tunnel jet fans are required to removal heat, to provide fresh air for a working environment, and to maintain the proper ambient conditions for system operation.

Fan Features

- **Complete Range**
  Range from diameter 560 to 1600mm.
- **High Efficiency**
  Thrust efficiency up to 37N/kW.
- **Reliable Performance**
  Kruger tunnel jet fans are tested in AMCA accredited laboratory and rated in accordance with AMCA 210 for air performance, and comply with ISO 1940 and AMCA 204 balancing grade G 6.3/G 2.5. Further more, Kruger tunnel jet fans are tested in accordance with EN 12101-3: 2015 and comply with the high temperature resistance requirement for 250ºC / 2H, 300ºC / 1H (F300) and 400ºC / 2H (F400) by TUV SUD.
- **Truly Reversible**
  Reversibility of 97~100%.
- **Adjustable Blade Angle**
  Blade angle can be adjusted to suit tunnel development/control needs.
- **High Strength Blades**
  Specially designed aluminum alloy homogenous aerofoil blades with high yield strength cater for high thrust and thermal shock in case of fire.
- **Robust & Durable Design**
  Major components are made from high strength steel.
- **Reliable Corrosion Protection**
  Hot dipped galvanization as per ISO 1461 to enable fan operation in almost all adverse environments.

Quality Assurance

- **High Temperature Test**
  Kruger tunnel jet fan KJF & KJF-R series are tested in accordance with EN 12101-3: 2015 and comply with the high temperature resistance requirement for 250ºC / 2H, 300ºC / 1H (F300) and 400 ºC / 2H (F400) by TUV SUD.

TÜV SÜD PSB

- **Pre-Assembly Examination**

  X-Ray examination for Aluminum alloy blades as per ASTM E-155 and dye penetration (non destructive) tests for welds on fan hubs as per ASME Section V, Art. 6 & 24 (identical with ASTM E-165) are available upon request to ensure the impellers are capable of withstanding the effect or all stress and load during starting, operation and reversal.

- **After-Assembly Examination**

  All Kruger tunnel jet fans are balanced in accordance with ISO 1940 and AMCA 204 standard and comply with G4.0 or G2.5 requirement.
  Whirl test (over speed test) at 125% of full speed for a minimum of 15 minutes for the impeller is available upon request to ensure the fans are capable of withstanding the effect of all stress and load in case of emergency of malfunction .

Nomenclature

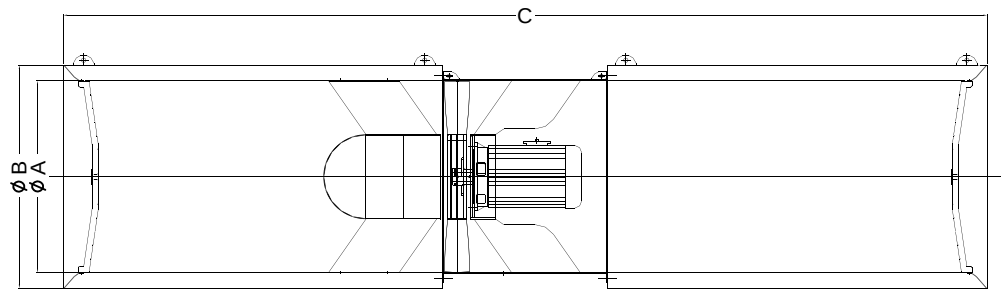
MODEL: KJF 1000 — Uni-Directional

- 1000 — Nominal Fan Diameter
- KJF — Kruger Tunnel Jet Fan

KJF-R 1000 — Reversible

- 1000 — Nominal Fan Diameter
- KJF — Kruger Tunnel Jet Fan

Dimension



Model	ØA	ØB	C (1D)	C (2D)
560	560	710	1740	2860
630	630	780	1980	3240
710	710	860	2220	3640
800	800	950	2520	4120
900	900	1050	2900	4700
1000	1000	1200	3150	5150
1120	1120	1320	3400	5680
1250	1250	1450	3800	6300
1400	1400	1600	4200	7000
1600	1600	1800	4700	7900

Model sizes are nominal diameter

All Dimensions in mm

Quick Selection Chart

Uni-Directional

Model	50Hz				60Hz			
	Operating speed (rpm)	Max Flow Rate (m3/s)	Max Outlet Velocity (m/s)	Max Thrust (N)	Operating speed (rpm)	Max Flow Rate (m3/s)	Max Outlet Velocity (m/s)	Max Thrust (N)
560	2900	9.4	38.0	426	3500	9.4	38.0	426
630	2900	11.8	38.0	540	3500	11.8	38.0	540
710	2900	15.0	38.0	686	1750	12.3	31.0	457
800	2900	19.1	38.0	871	1750	18.1	36.0	782
900	1450	20.4	32.0	782	1750	24.2	38.0	1102
1000	1450	28.3	36.0	1221	1750	29.8	38.0	1361
1120	1450	37.4	38.0	1707	1750	37.4	38.0	1707
1250	1450	46.6	38.0	2126	1750	46.6	38.0	2126
1400	1450	58.5	38.0	2667	1150	58.5	38.0	2667

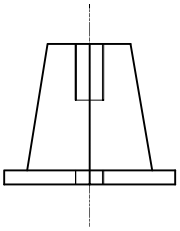
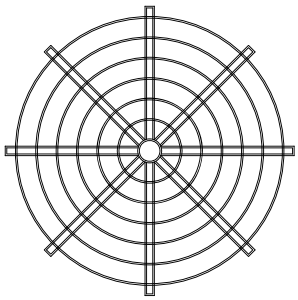
For fan selection of size 1600 and thrust force requirement exceed the above range, please consult Kruger.
Data shown above are for maximum performance. Please consult Kruger if optimum performance (highest efficiency) is desired.

Truly Reversible

Model	50Hz				60Hz			
	Operating speed (rpm)	Max Flow Rate (m3/s)	Max Outlet Velocity (m/s)	Max Thrust (N)	Operating speed (rpm)	Max Flow Rate (m3/s)	Max Outlet Velocity (m/s)	Max Thrust (N)
560	2900	7.4	30.2	270	3500	8.5	34.4	350
630	2900	9.8	31.3	366	3500	10.2	32.9	404
710	2900	14.1	35.5	600	1750	9.1	23.1	254
800	2900	19.1	38.0	871	1750	14.1	28.0	473
900	1450	16.5	25.9	513	1750	20.4	32.0	782
1000	1450	25.6	32.6	1000	1750	29.0	36.9	1285
1120	1450	31.5	32.0	1211	1750	35.5	36.0	1532
1250	1450	46.6	38.0	2126	1750	46.6	38.0	2126
1400	1450	58.5	38.0	2667	1150	52.3	34.0	2135

For fan selection of size 1600 and thrust force requirement exceed the above range, please consult Kruger.
Data shown above are for maximum performance. Please consult Kruger if optimum performance (highest efficiency) is desired.

Accessories

Saftey Wire 	Rubber Isolator 
Protection Net 	Cable Pull Safety Switch 

Typical Project Reference

Application	Project Name	Country & Region	Type	Fan Size
Metro	Metro Downtown Line – Stage 2	Singapore	Axial Fan	1800, 2000
			Jet Fan	630, 1250
	Metro Xin Zhuang Line CK 378 A/B/D/H	Taiwan (Taipei)	Axial Fan	1800
			Jet Fan	1120, 1400
	Metro Xin Yi Line CR 388 A/B		Axial Fan	1600, 1800
			Jet Fan	1120
	Metro Tao Yuan Airport CA 384		Axial Fan	1250, 1800
	Metro Project Mass Rapid Transit Lembah Kelang: Jajaran Sungai Buloh - Kajang	Malaysia	Axial Fan	1800, 2000
			Jet Fan	1120
	Chile Metro Line 3 and 6	Chile	Axial Fan	2500
	Mexico Metro Line 3, 7 and 12	Mexico	Axial Fan	1600, 2000, 2240
Road Tunnel	Xiang An Subsea Tunnel	China (Fujian)	Axial Fan	2240, 2500, 2800
			Jet Fan	630, 1120
	Ning Wu Expressway (Dong Gong Shan Tunnel & Fen Shui Guan Tunnel)		Axial Fan	2500, 2800
			Jet Fan	1120
	Jian Tai Expressway (Tai Ning Tunnel)		Axial Fan	2500, 3150
			Jet Fan	1120
	Zhang Yong Expressway (Guan Tian Tunnel)		Axial Fan	2500
			Jet Fan	1120
	JingTai Expressway (Tian Long Shan Tunnel)		Axial Fan	2500, 3150
			Jet Fan	1120
	JingTai Expressway (Huang Zhu Shan Tunnel)		Axial Fan	3150
			Jet Fan	1120
	JingTai Expressway (Niu Yan Shan Tunnel)		Axial Fan	2500, 2800
	JingTai Expressway (Yan Qian Tunnel)		Axial Fan	2500
	Meiyu Expressway (Qi Shan Tunnel)		Axial Fan	2500, 2800,3150
	Shen Hai Alternated Route Expressway (Ci Gan Yan Tunnel)		Axial Fan	2800
	Shen Hai Alternated Route Expressway (You Che Ling Tunnel)		Axial Fan	3150
	Wuhan East Lake Under Lake Tunnel	China (Hubei)	Axial Fan	2240, 2500
			Jet Fan	630, 1000, 1250
	Second Link Road Hankou Railway Station Road Tunnel		Jet Fan	560
	Chang Ping Expressway (Hong Ti Guan Tunnel)	China (Shanxi)	Axial Fan	2800
	Xin Bao Expressway (Yun Zhong Shan Tunnel)		Axial Fan	2500
	Tai Gu Expressway (Xi Shan Tunnel)		Axial Fan	2500
	Hai He Cross River Tunnel	China (Tianjin)	Axial Fan	1600, 2240
			Jet Fan	800
	Yuewu Expressway (Ming Tang Shan Tunnel)	China (Anhui)	Axial Fan	2240
	Xin Zhong Zhou Tunnel	China (Tianjin)	Jet Fan	630
	Luntou-Shengwudao-HEMC Tunnel		Jet Fan	710
	Hangzhou Xiao Shan Airport Tunnel	China (Zhejiang)	Jet Fan	710
	Hong Kong-Macau-Zhuhai Bridge Tunnel Project	China (Hong Kong-Macau-Zhuhai)	Axial Fan	2500, 3150
			Jet Fan	630, 1120, 1250
	Jurong Rock Cavern	Singapore	Axial Fan	1600, 1800, 2000
	Singapore Woodsville Tunnel		Jet Fan	1250
	Ba Gua Shan Tunnel	Taiwan (Changhua)	Axial Fan	2500
Storage	Jurong Rock Cavern	Singapore	Axial Fan	1800

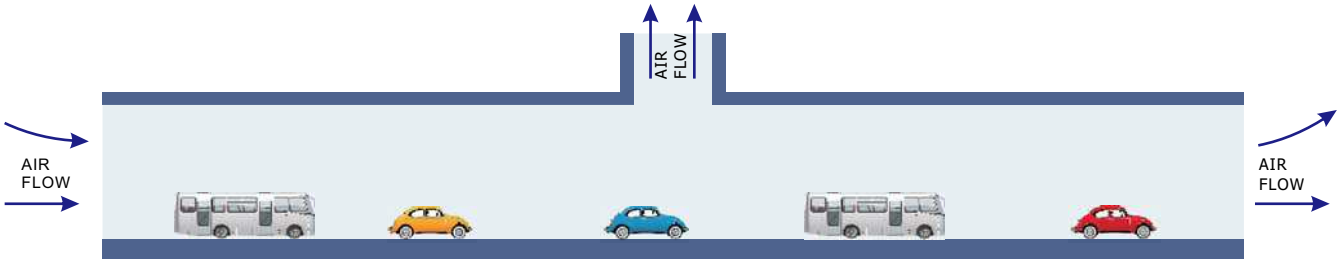
Tunnel Ventilation Methods

Different countries/regions may have different requirements/regulations on tunnel ventilation systems. There are many types of ventilation systems. However, only two types of fans are used: axial fans and jet fans. Axial fans are used to supply fresh air and extract contaminated air / smoke. Jet fans are used in longitudinal ventilation system to push the contaminated air / smoke to a place where it can then be extracted out by axial fans. The following are illustrations of different tunnel ventilation systems that are in common use.

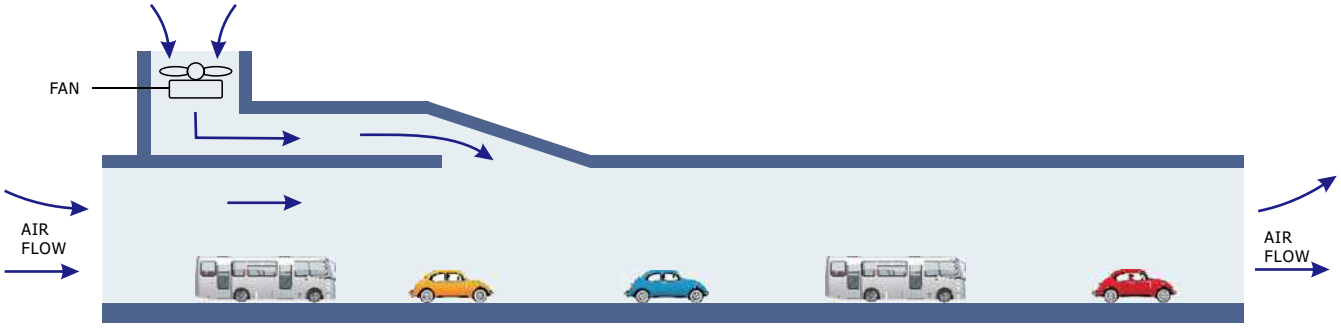
This applies to both road tunnel and subway (metro) tunnel, road tunnel is used for illustration purpose.

- 1. Natural Ventilation

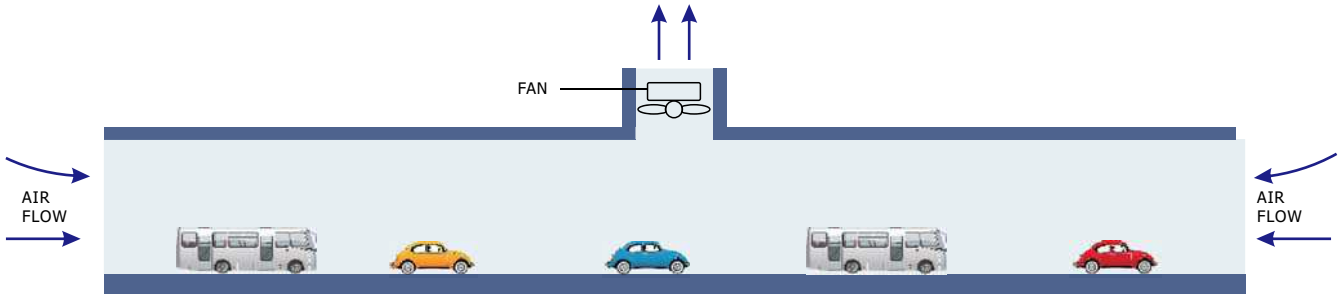
- 2. Natural Ventilation with Central Shaft



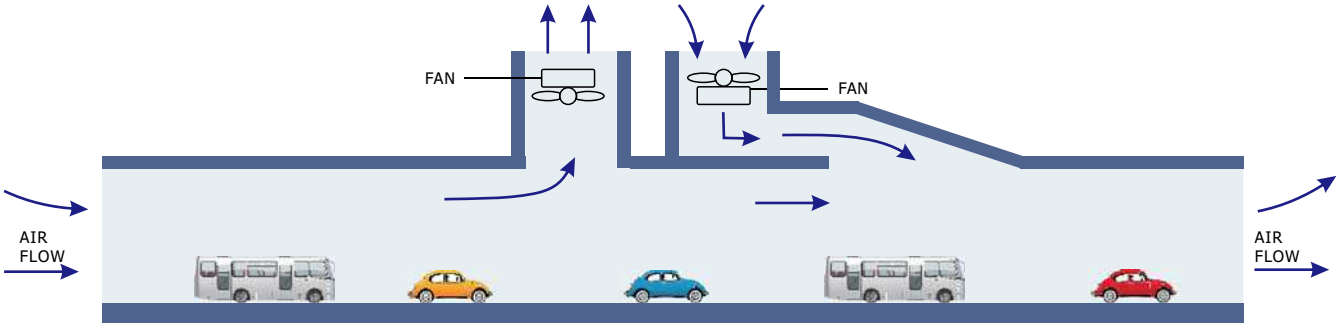
- 3. Injection Type Longitudinal Ventilation



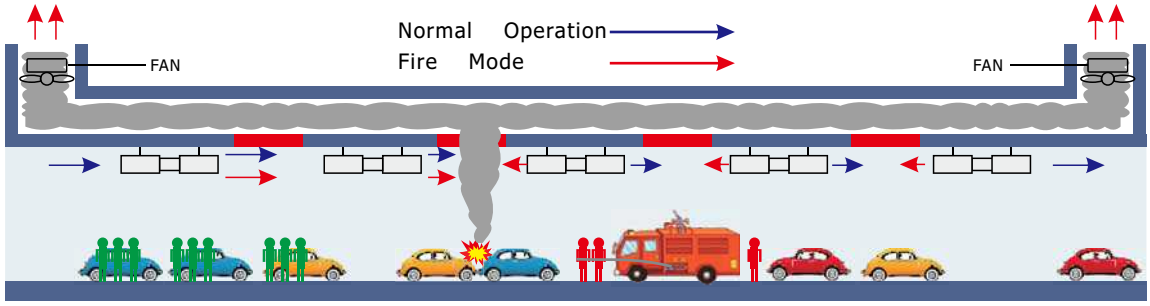
- 4. Central Exhaust Shaft Type Longitudinal Ventilation



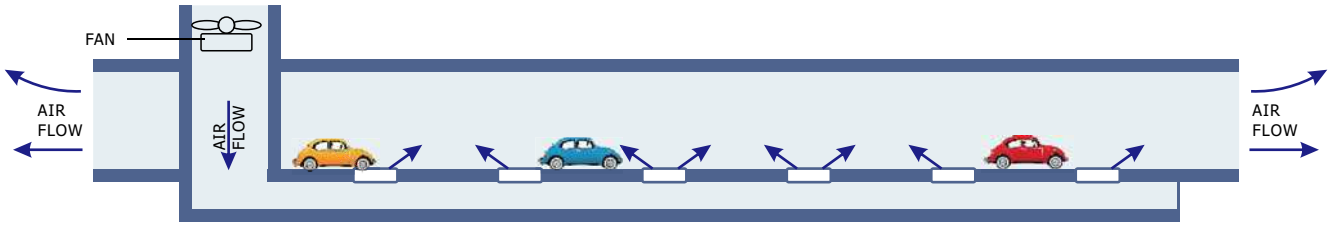
5. Central Supply & Exhaust Shaft Type Longitudinal Ventilation



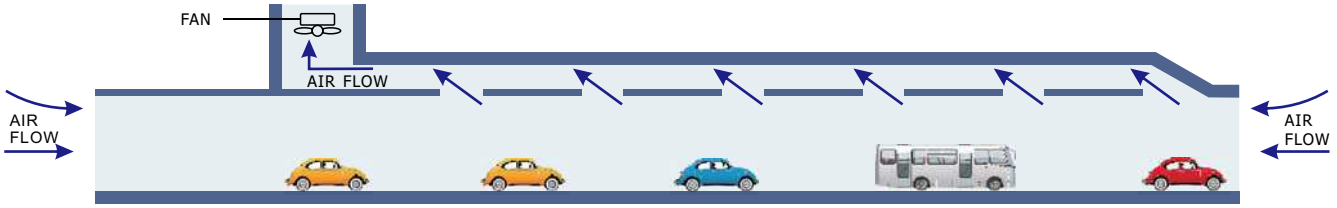
6. Point Extraction Type Longitudinal Ventilation (PEV)



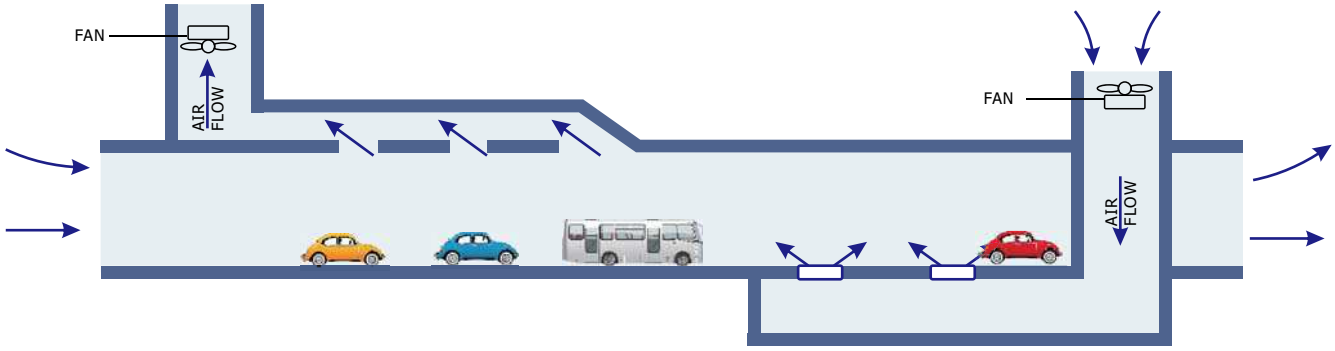
7. Semi-Transverse Supply Type



8. Semi-Transverse Exhaust Type



9. Semi-Transverse Half Supply Half Exhaust Type



10. Fully Transverse Type