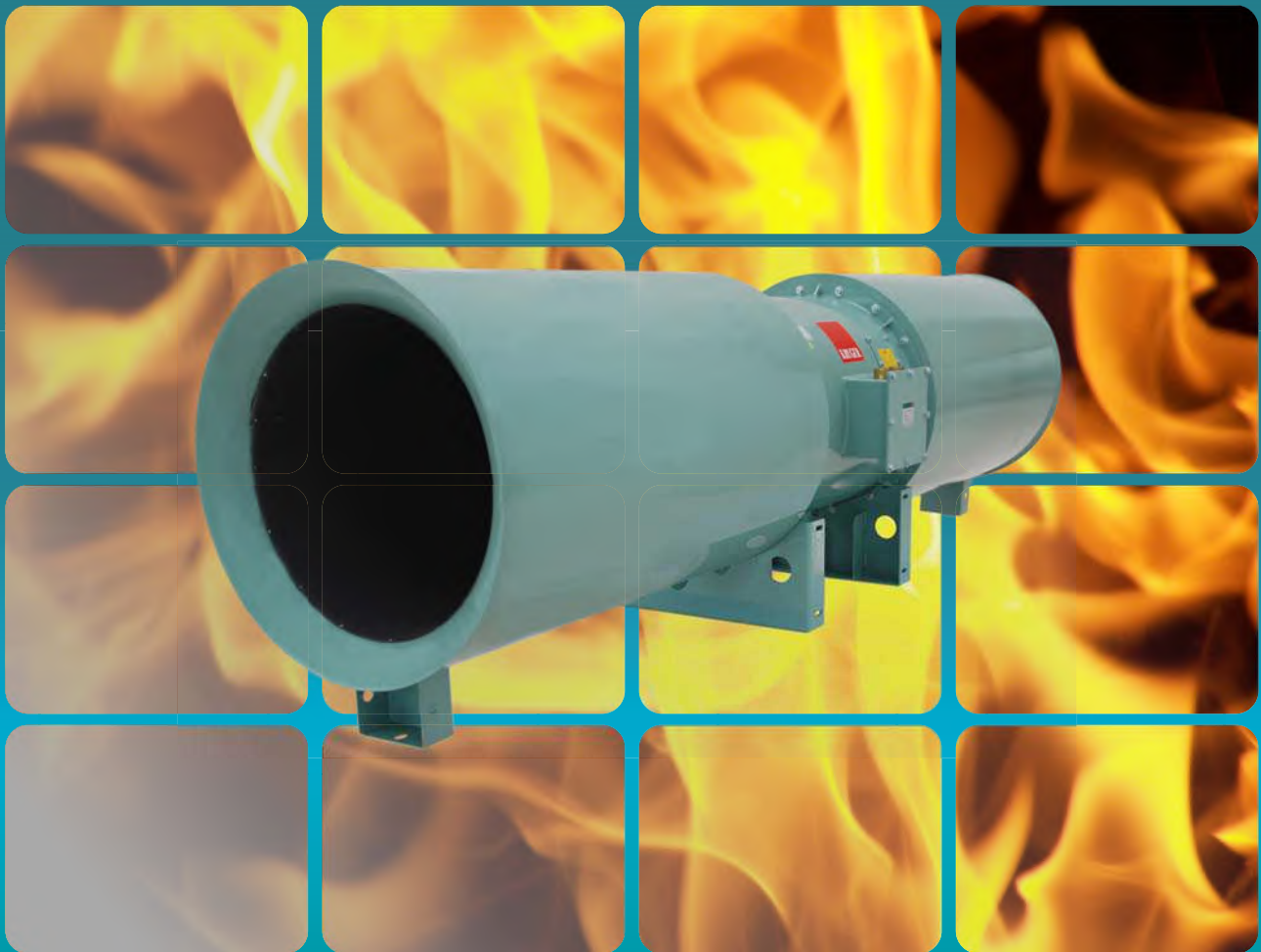




# TUNNEL FAN

## 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 250°C / 2H, 300°C / 1H (F300) and 400°C / 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 250°C / 2H, 300°C / 1H (F300) and 400 °C / 2H (F400) by TUV SUD.



- **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 of 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 .



## 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

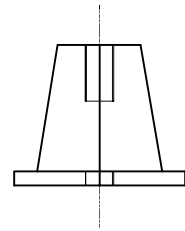
For fan selection of size 1600 and thrust force requirement exceed the above range, please consult Kruger.  
Data shown above are for maximum performance. Please consult Kruger if optimum performance (highest efficiency) is desired.

**Accessories**

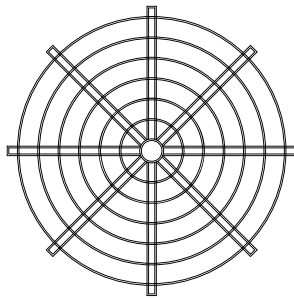
Safety Wire



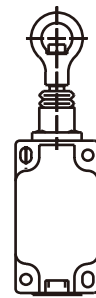
Rubber Isolator



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)			Axial Fan	2800
	Xin Bao Expressway (Yun Zhong Shan Tunnel)		China (Shanxi)	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

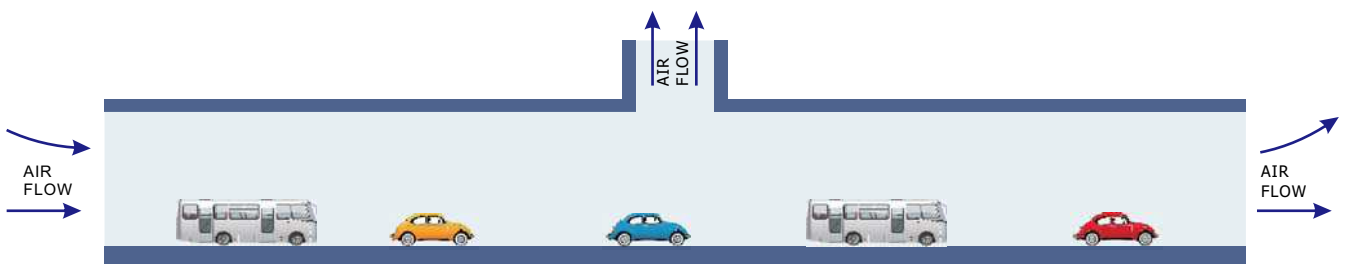
Different countries/regions may have different requirements/regulations on tunnel ventilation systems. There are many types of ventilation systems. However, only two types of fans are used: axial fans and jet fans. Axial fans are used to supply fresh air and extract contaminated air / smoke. Jet fans 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.**

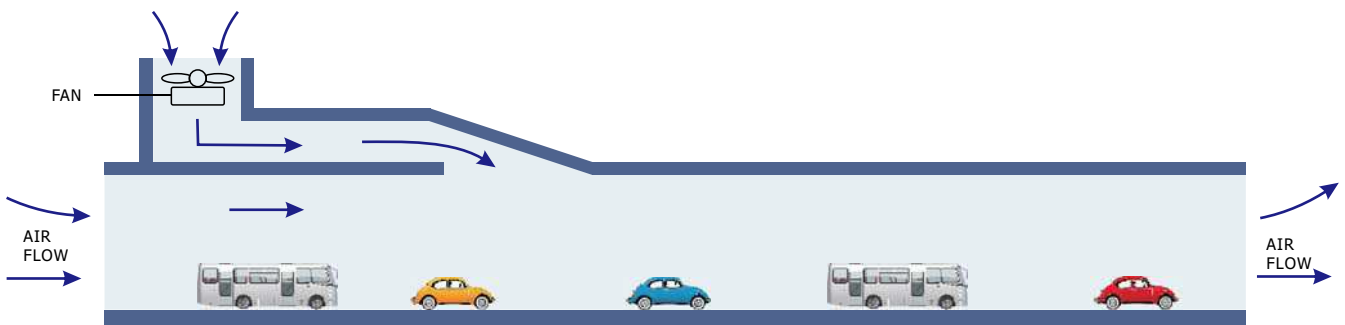
■ 1. Natural Ventilation



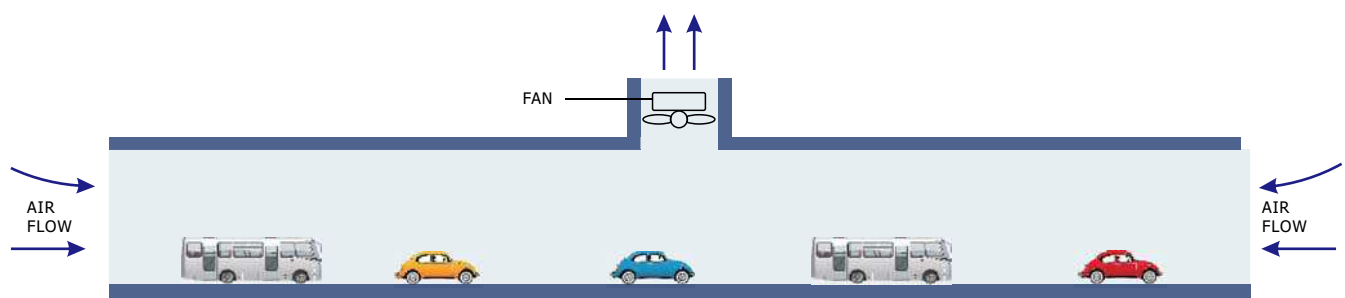
■ 2. Natural Ventilation with Central Shaft



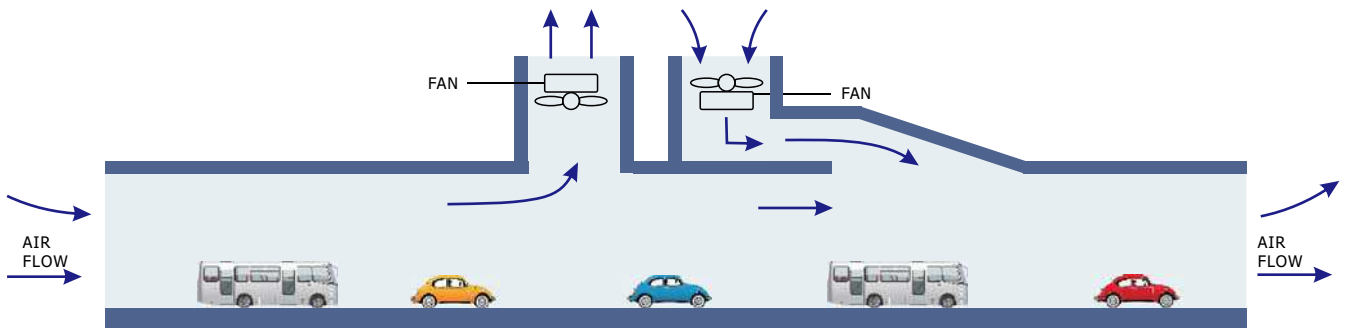
■ 3. Injection Type Longitudinal Ventilation



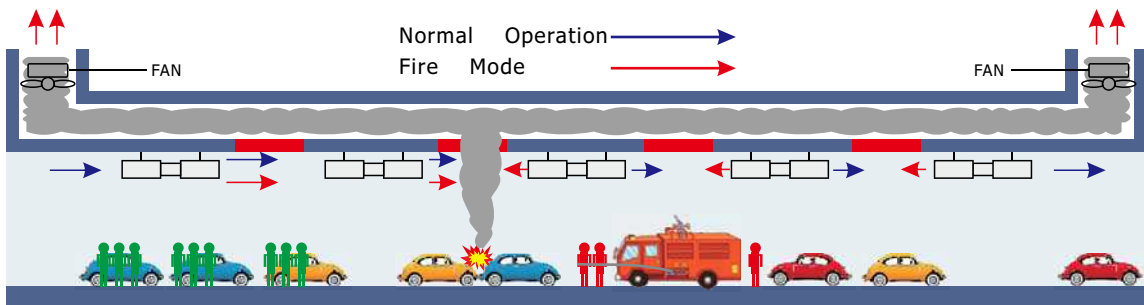
■ 4. Central Exhaust Shaft Type Longitudinal Ventilation



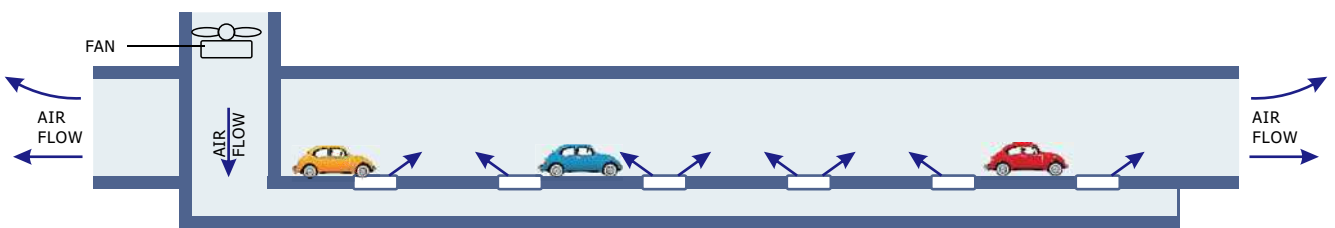
5. Central Supply & Exhaust Shaft Type Longitudinal Ventilation



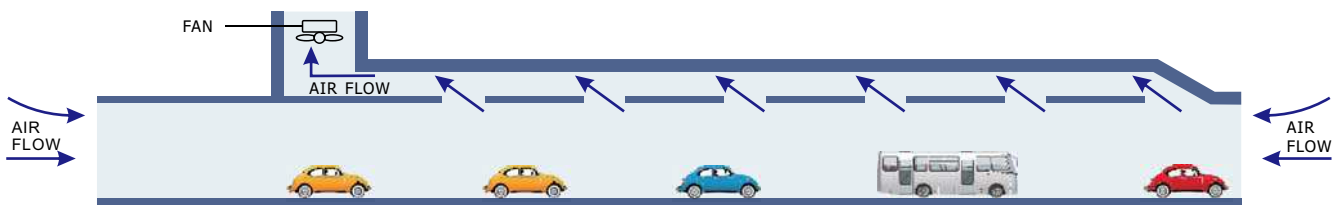
6. Point Extraction Type Longitudinal Ventilation (PEV)



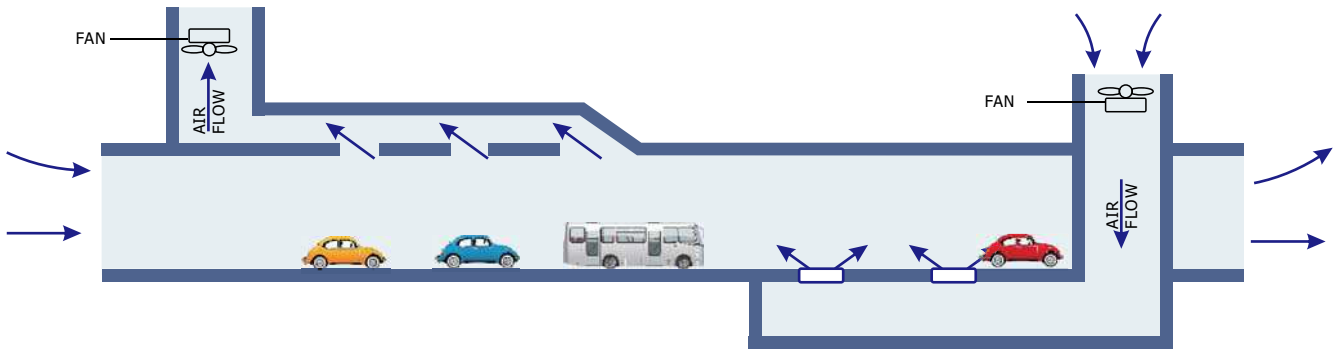
7. Semi-Transverse Supply Type



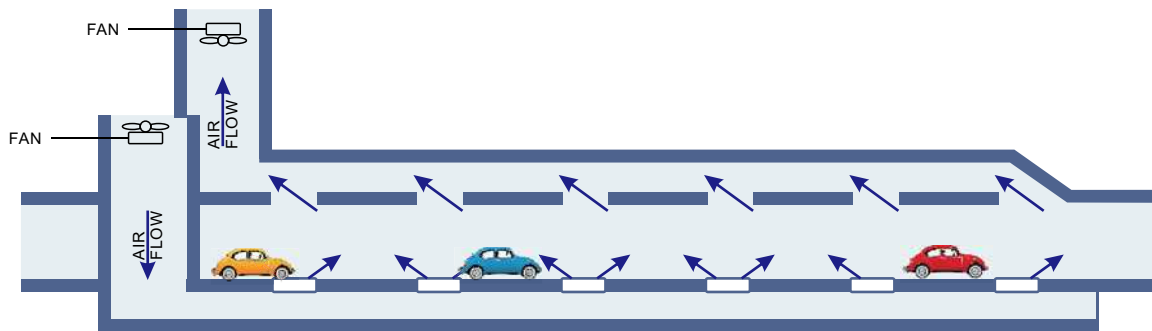
8. Semi-Transverse Exhaust Type



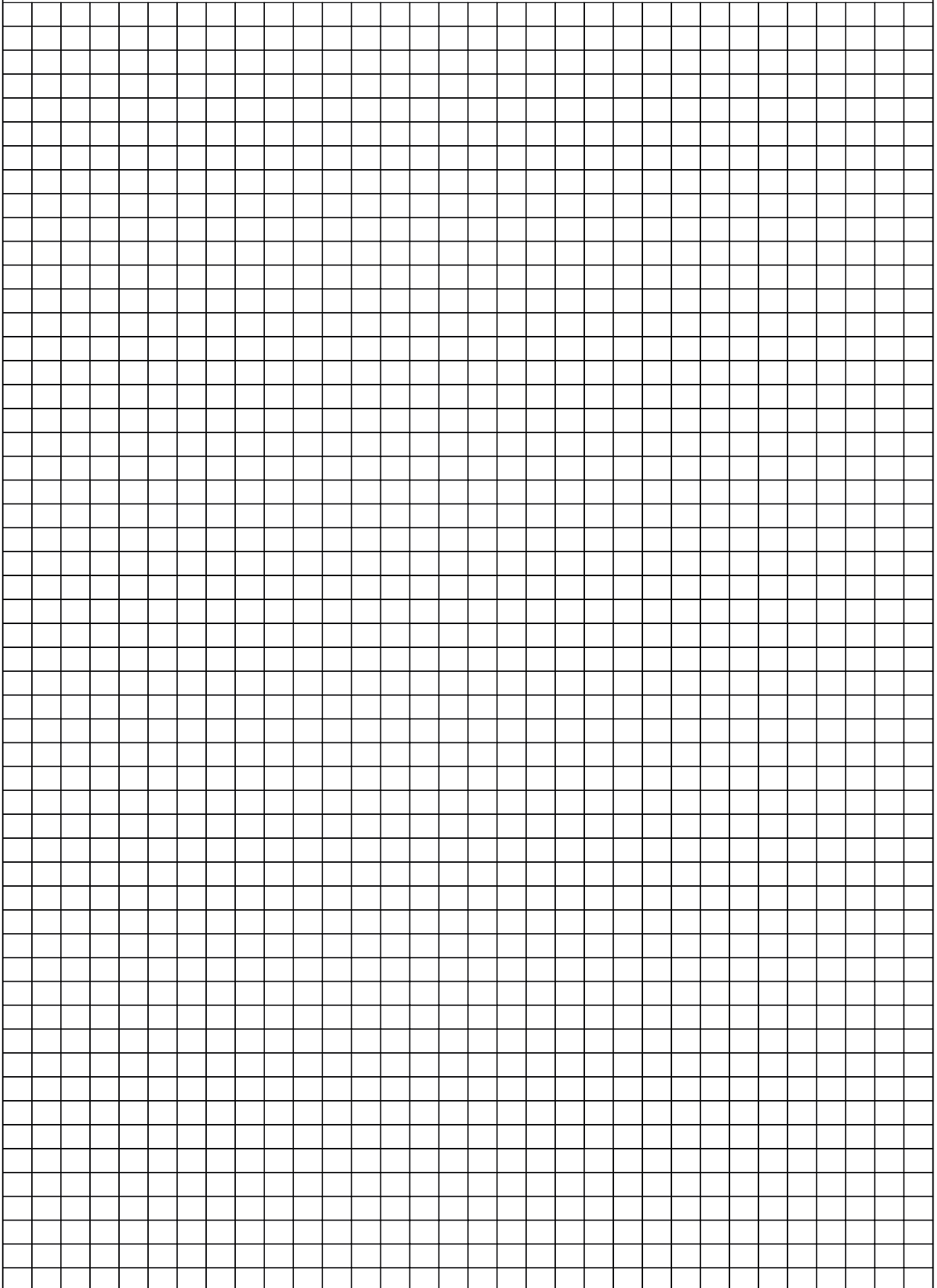
■ 9. Semi-Transverse Half Supply Half Exhaust Type



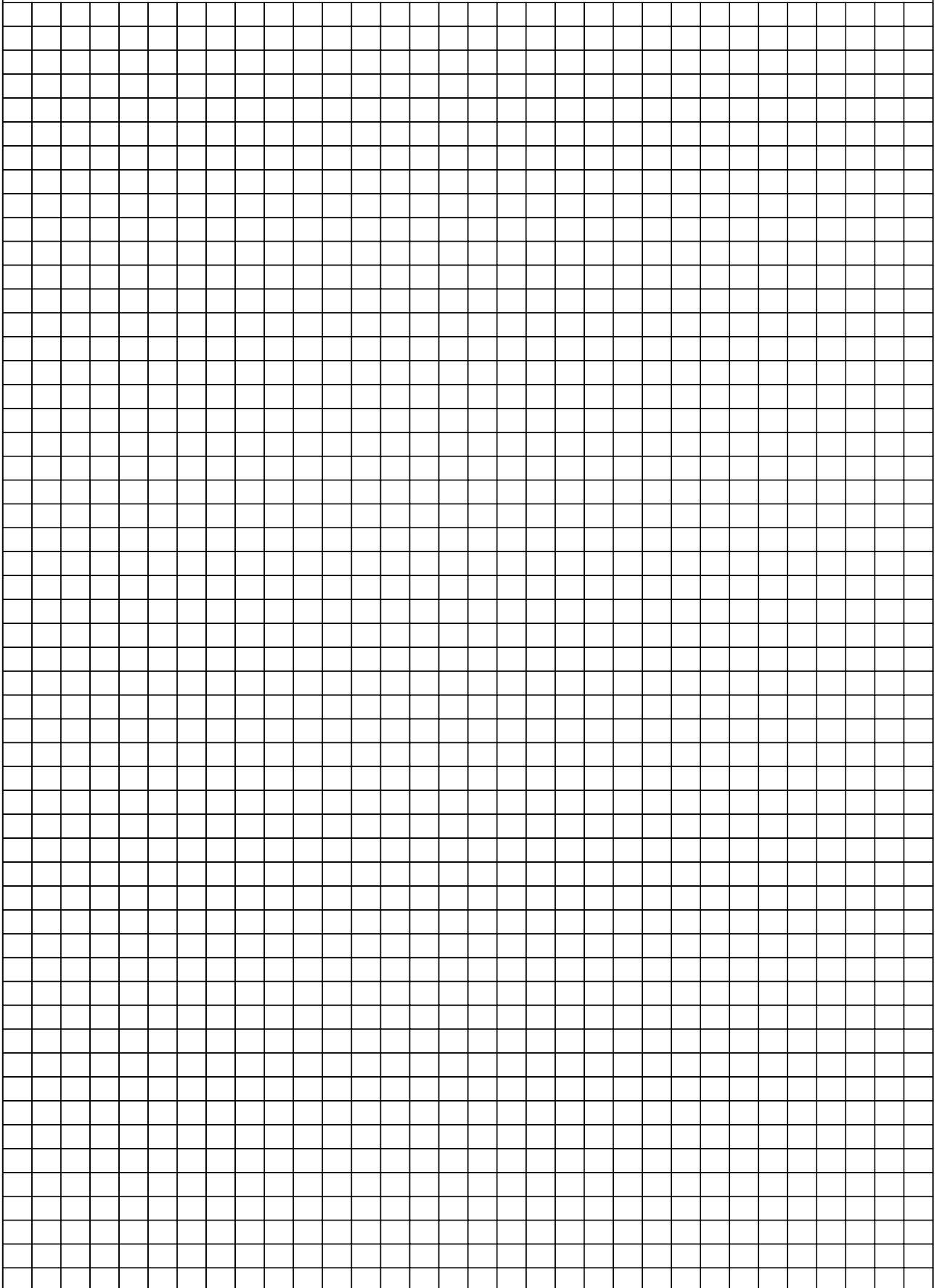
■ 10. Fully Transverse Type



## NOTES



## NOTES



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The company is always improving and developing its products, therefore the company reserves the right of making changes to the illustrated products. Certified dimension can be provided upon request.



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