Copeland™ Scroll Compressors for Transport Applications

The Answer to Transport Cooling, Heating and Refrigeration

COPELAND™

EMERSON™

Setting Industry Standards for Our Transport Customers

Copeland™ Scroll Compressors - Innovative, Reliable, High-Performing

Copeland scroll vertical and horizontal compressors and flow controls

Copeland compressors for transport applications have been recognized by customers for decades for their high efficiency, reliability and sustainability as well as their lower sound emissions and lower weight than other types of compressors used for these applications. They are used along with Alco Controls™ flow controls to provide comfort to bus/ rail passengers, and to supply uninterrupted refrigeration to trucks/trailers. Emerson solutions are designed to provide consistent temperatures and enhance comfort.

Benefits of Copeland Scroll vs. Reciprocating Compressors

Efficiency

- Continuous flank contact, maintained by centrifugal force, minimizes gas leakage and maximizes compressor efficiency
- No transmission losses (pulley + belt) as with open reciprocating compressors in the refrigeration unit of conventional vehicle architecture
- One compressor model can provide both heating and cooling
- High efficiency thanks to low superheat and vapor or liquid injection capabilities of refrigeration scroll models
- Wide range of variable frequency inverter drives for capacity-modulated compressor models
- Tandem applications

Reliability

- Fully hermetic design with no risk of leakage
- The scrolls “wear in” rather than “wear out“, which increases compressor life
- Axial and radial compliance scroll set
- Double oil pump (for horizontally-aligned models)
- Increased reliability in heat pump and reversible applications

Compact & Quiet

- Vertical or horizontal alignment for footprint flexibility and compactness
- Very low sound emissions and low weight
- Height down to 200mm for horizontal models
- Scroll compressors take less space than traditional reciprocating compressors

Ready for Electric Vehicles

- Emerson‘s portfolio of Copeland compressors is perfectly suited to the transition towards electric vehicles, providing close temperature control, flexibility in applications such as heat pumps, efficiency for the whole system and including battery cooling

Future Refrigerants in Transport Applications

Bus and Rail Comfort

In their efforts to reduce carbon emissions, cities are increasingly adopting electric buses and looking at natural refrigerants. When comparing propane (R290) and CO_2 (R744), two natural refrigerants available today, propane has multiple benefits as described in the table below.

Comparison of R290 and R744 for Transport Applications

	R290	R744
Pressure at 35°C	20 bars	120 bars
Technology	Scroll	Reciprocating
Liquid handling capabilities	High	Low
Speed range	25-100 Hz	35-75 Hz
Compressor weight	49	83
Height	191	220
Moving parts	3	many
Seasonal heating COP	5.6	3.7
Field skill technician	Standard	Highly skilled
Serviceability	High	Low
Design life	+++	+

Equipment for R744 systems must be designed to withstand high pressure. The materials used for the exchanger and tubing will be significantly thicker and heavier. Since the weight of HVAC equipment in vehicles contributes to energy consumption, thicker/heavier material will increase the system running costs.

Truck / Trailer / LCV Refrigeration

Today, the market for refrigerated transport is predominantly captured by applications with R452A. What the future brings is still unclear. The ongoing F-Gas HFC phase down regulation is pushing OEMs to design their refrigeration systems with refrigerants with a lower Global Warming Potential (GWP) and the electrification of trailer refrigeration units (i.e. BETRU; Battery-electric TRU) is progressing. Future regulations may however further impact refrigeration applications, both for stationary and transport.

In this context, Emerson is preparing its portfolio of Copeland™ scroll compressors with future-proven technologies for refrigerated transport for A2L HFO-blends (GWP under 300) and natural refrigerants (R290 and CO_2 with a very low GWP).

	Today in TRUs*	Tomorrow in BETRUs** *(with HFC Phase Down)*
Trailer	R452A (predominantly) R404A R134a	A2Ls < 300 GWP
Truck		A2Ls < 300 GWP Hydrocarbons
LCV***		

* TRU: Transport Refrigeration Unit
** BETRU: Battery Electric TRU
** LCV: Light Commercial Vehicle

Copeland™ Compressors for Rail Applications

A Reliable Solution for Cooling and Heating

Train air-conditioning systems should be small, light and very reliable, but their maintenance costs should also be low. Equally important are their comfort and energy-saving aspects.

Emerson has many years of experience providing reliable solutions for train air-conditioning. Compactness and low weight are design inherent strengths of Copeland scroll compressors. We provide standard scroll compressors with a cooling and heating capacity of 3 - 40 kW for this application. Copeland scroll (vertical) compressors can be used as multiples to double the capacity and they can be integrated into reversible systems for improved heating performances.

We offer a wide range of vertical and horizontal scroll compressors. Because of the need to switch to alternative refrigerants with a lower GWP, Emerson provides alternatives for medium or low-pressure refrigerants as well as solutions for R290.

Copeland scroll compressors provide comfort throughout trains

Features and Benefits

- Large operating envelope, with heat pump and extreme condition capabilities
- Axial and radial compliance, for superior reliability in heat pump applications
- Variable speed with capacity modulation 25-100Hz, for increased performance and comfort
- Fully hermetic design, without leakage risks
- Compact height and low weight
- Tandem assembly to increase the capacity and add modulation to improve performance

Cooling Capacity (kW)* for Vertical Fixed Speed Models by Size

	Refrig.	GWP	Class	04	06	07	09	11	13	16
ZH*KCU	R290	3	A3	4.6	6.3	8.0	9.3	11.5	13.4	16.8

				04	06	07	09	11	13	16
YH*K1E	R454C	148	A2L	4.5	6.3	8.0	9.0	11.4	13.7	17.5
	1234yf	4	A2L	3.4	4.6	5.8	6.6	8.3	9.9	12.4

	23	28	33	38
YH*K1G	23.1	28.0	33.5	38.2

	23	28	33	38
YH*K1E	23.1	28.0	33.5	38.0
	16.2	19.6	23.5	26.6

				24	28	36	42	48	61	72	81	92	108	125	144	160	190
ZR*KRE	R513A	631	A1	3.5	4.2	5.2	6.2	6.9	9.0	10.5	11.6	13.5	15.8	18.4	20.7	22.9	27.4

				22	28	34	40	48	61	72	81	92	108	125	144	160	190
ZR*K3E/KCE	R407C	1774	A1	4.5	5.9	7.0	8.2	10.1	13.0	15.6	17.0	20.6	23.0	27.0	30.9	33.4	39.3
	R134a	1430	A1	3.2	4.2	4.9	5.7	6.9	8.8	10.5	11.8	13.5	15.7	18.3	21.0	22.7	27.2

Cooling Capacity (kW)* for Horizontal Fixed Speed Models by Size

	Refrig.	GWP	Class	72	81	87	100	116	136
YRH*KTG	R290	3	A3	13.6	14.9				
YRH*KTE	R454C	148	A2L	13.7	15.2				
ZRH*KTR	R513A	631	A1	10.4	11.7	13.3	15.2	17.9	20.9
ZRH*KTE	R407C	1774	A1	15.2	16.9	19.1	21.9	24.8	29.1
	R134a	1430	A1	10.3	11.5	12.9	14.8	16.7	

* Conditions: Evap. 5°C / Cond. 50°C - 50Hz
Models in development
Model identifyer
e.g., YRH 72 KTG (R290 capacity 13.6kW)

Copeland™ Compressors for Electric Buses

A Future-Proof Solution for Cooling and Heating

Highly efficient, energy-saving, and safe vehicles are set to be the future of buses. However, the overall energy efficiency of a vehicle is significantly impacted by the energy required by its heating and air-conditioning system.

Choosing to incorporate Copeland technology into the HVAC system of new buses ensures that they will be able to meet the cooling and heating requirements of these vehicles, as well as achieve high energy efficiency and reliable operation. In addition to being a perfect fit for passenger/driver HVAC comfort systems, Copeland scroll solution is commonly used for battery thermal management systems (BTMS).

Thanks to an all-hermetic design, Copeland scroll compressors eliminate the potential risk of refrigerant leakage through the drive shaft sealing, a problem frequently encountered with open compressors in bus air-conditioning and other applications.

This contributes to system reliability as well as environmental friendliness. Owing to fewer moving parts, scroll compressors are more reliable than piston compressors for this application.

Copeland scroll compressors provide bus passenger comfort as well as battery cooling

Features and Benefits

- Large operating envelope, with heat pump and extreme condition capabilities
- Axial and radial compliance, for superior reliability
- Double oil pump for defect lubrication
- Variable speed with capacity modulation 25-100Hz, for increased performance and comfort
- Fully hermetic design, without leakage risks
- Compact height and low weight

Emerson provides solutions with a cooling and heating capacity of 7 - 35 kW for the air conditioning of traditional buses, as well as for electric buses. Heat pumps with the natural refrigerant R290 are ideal for electric buses.

Cooling Capacity (kW)* for Horizontal Variable Speed Models by Size

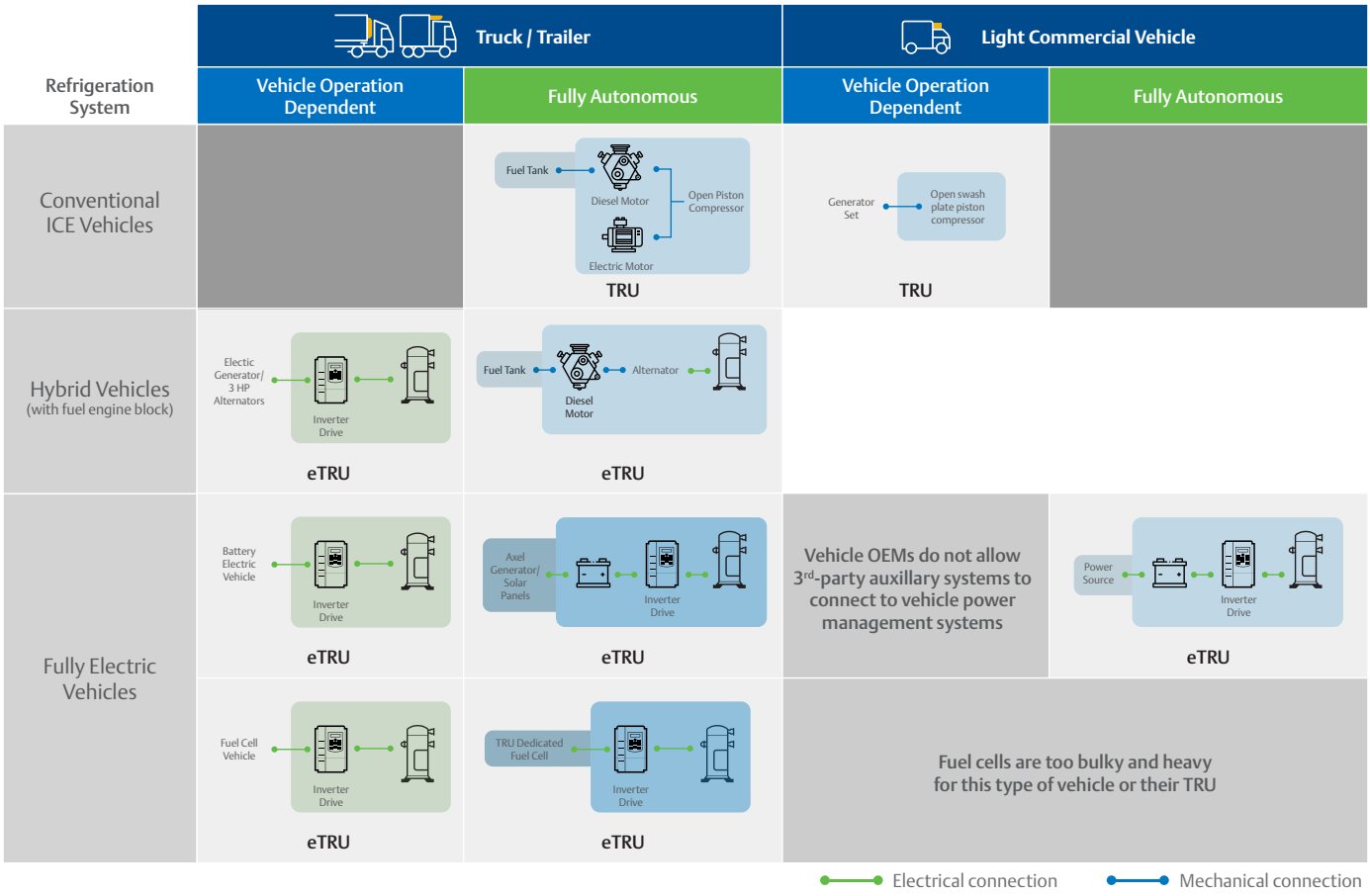
	Refrig.	GWP	Class	72		81		94	
				Min	Max	Min	Max	Min	Max
YRHV*KTG	R290	3	A3	6.1	25.6	6.7	28.2		
YRHV*KTE	R454C	148	A2L	7.3	25.4	8.0	27.9		
ZRHV*KTR	R513A	631	A1	6.2	17.0	6.8	18.9	8.5	20.9
ZRHV*KTE	R407C	1774	A1	7.3	28.9	7.8	30.2	12.7	31.1
	R134a	1430	A1	6.0	16.6	6.9	18.8	8.6	21.1

* Conditions: Evap. 5°C / Cond. 50°C - 50Hz

Model identifyer

e.g., YFI 10 K1E (R452A capacity 4.9kW)

Transport Refrigeration System Types and Architecture



Thanks to the electrification trend in the transport market and diesel bans in some regions of the world, we are in an important transition phase that began in the early 2010s. This transition has reached new levels thanks to recent developments of hybrid and fully electric commercial vehicles and this has a deep impact on the architecture of their refrigeration system.

The refrigeration unit of trucks, trailers or light commercial vehicles with conventional combustion engines, is generally driven mechanically and they often feature open piston compressors. This is not possible with the more efficient and future-proof refrigeration units of electric vehicles which are powered by electric-driven hermetic compressors. Electric-driven TRU architecture is now more commonly accepted and considered as the future of transport refrigeration. In the coming years we will see more electric vehicles on the road, and ICE vehicles will be progressively replaced.

Efficiency will eventually become the most important aspect of next-generation TRU architecture since the source of the electric power will not always be unlimited. In other words, eTRUs in the vehicle-dependent architecture should not withdraw electric power inefficiently from fully electric vehicle power systems in order not to reduce the e-vehicle mileage, and eTRU in the fully autonomous architecture should not withdraw electric power inefficiently from TRU-dedicated battery packs which are charged faster and continuously by axel-generators, solar panel, etc..

Thanks to their **hermetic design**, **higher COP**, **low sound emissions**, **low weight** and their qualification for refrigerants with a **low global warming potential**, Copeland™ scroll compressors are the ideal solution for the transport refrigeration system of commercial electric vehicles.

Copeland™ Compressors for Trucks and Trailers

Reaching Efficiency Targets Throughout the Cold Chain

Copeland scroll vertical and horizontal compressors

Transportation companies play a crucial role in the cold chain, preserving and protecting temperature-sensitive cargo while it is transported around the globe. In order to maintain commodity quality at every step, Emerson provides compressors, drives and controls that meet safety and reliability requirements for refrigerated trailer units, over-cabin truck units, under-mount truck units, as well as light commercial vehicle units:

Quiet operation

Ideal for "silent" TRUs making deliveries in noise-sensitive urban areas

Reliable operation

Prevent the cold chain for temperature-sensitive products to be broken

Features and Benefits

- Copeland compressors feature a dedicated design and features to support customers in the cold chain journey.
- Vertical or horizontal alignment for footprint flexibility
- Fixed speed or variable speed for capacity modulation
- Multiple refrigerant capabilities (R452A, R290, HFO-blends)
- Fully hermetic design, eliminating high leakage risks of conventional unit design
- High efficiency thanks to injection technology
- Quieter operation and less sound emissions
- Major weight reduction thanks to removal of electric engine

Cooling Capacity (kW)* for Vertical Fixed Speed Models by Size

	Refrig.	Term. Box	Freq. (Hz)	10	15	19
YFI*K1E	R452A	IP54	50	4.9	7.2	9.0
	R454C	IP54	50	4.0	5.8	7.3
	R455A	IP54	50	4.2	6.2	7.8

Cooling Capacity (kW)* for Vertical Variable Speed Models by Size

	Refrig.	Term. Box	Freq. (Hz)	23		46		50		80	
				Min	Max	Min	Max	Min	Max	Min	Max
YBV*	R290	IP66	25-91.6			0.9	3.3				
ZFW*	R452A	IP65	25-120	0.7	3.4	1.4	6.8	1.7	8.0	3.2	13.5

Cooling Capacity (kW)* for Horizontal Variable Speed Models by Size

	Refrig.	Term. Box	Freq. (Hz)	72		81	
				Min	Max	Min	Max
YRHV*KTG	R290	IP56	25-100	1.7	6.4	1.9	7.0

* Conditions: Evap. -30°C / Cond. 40°C

Models in development

Model identifyer

e.g., YFI 10 K1E (R452A capacity 4.9kW)

Emerson is With You Every Step of the Way

In an increasingly competitive world, we don't just offer precise energy-saving scroll compressors to protect your products' temperature and maintain your comfort. We also offer reliable mechanical and electronic flow controls, as well as some of the most robust monitoring services on the market. We will help you keep losses down and profits up.

Emerson offers the innovative solutions you need and protects your bottom line.

Flow Controls for Transport

Emerson offers a broad range of expansion valves, filter driers, solenoid valves, oil management products, pressure transducers and thermostats for transport HVAC systems, to maximize efficiency and reliability and optimize system performance.

For more information:
https://climate.emerson.com/en-gb/brands/alco-controls

In-Transit and Cargo Monitoring Solutions

Emerson also provides cold chain solutions to provide visibility into in-transit cargo shipments, to help enable streamline supply chains and promote better quality and safety decisions.

For more information:
Emerson.com/Cargo

Pneumatic and Control Technologies for Rail Applications

As a specialist provider of pneumatic systems and rail technology, Emerson Automation Solutions offers an extensive range of products that not only set standards for quality, reliability and functionality, but also provide lower life cycle costs and maintenance requirements.

For more information:
Emerson.com/Rail

For more details, see www.climate.emerson.com/en-gb

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