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Diesel PM Control Technology Options for Complying with TRU ATCM¹, this page last updated June 2011

Equipment replacement options (resets the compliance clock - compliance is required seven years after the engine model year).

Company ²	Technology Description	Estimated Costs
Reviva www.reviva.com	Replace engine with rebuilt engine meeting more stringent standard ³	Kubota engines for Carrier Transicold Trailer TRUs: \$5,000, plus \$250 freight + approx. \$1,000 (8-10 hrs labor and parts)
TRU dealers	Replace engine with new engine kit ⁴	Truck TRU engines: \$4,750, installed (average) Trailer TRU engines: Tier 2 - \$6,000; Tier 4i - \$8,400, installed (average) Genset: \$9,000 installed (average)
TRU dealers	Replace the entire unit	Truck TRU: \$16,300, installed (average) Trailer TRU: \$21,600; installed (average) Genset: \$14,500 (average)

Retrofit with Level 2 Verified Diesel Emissions Control Strategy (VDECS) meeting Low-Emission TRU (LETRU) In-Use Standard

Company ²	Technology Description and Model	Trailer/Truck/Genset Application	Estimated Costs
Proventia Emission Control www.proventiafilters.com	Passive flow-through filter with catalyzed regeneration Model: FTF	Thermo King Trailer TRUs: Model years 1985-2003: Isuzu D201, Yanmar 4TNE82-TK/ETK, and Yanmar 4TNE86TK/ETK See Executive Order DE-08-001-05, Attachment 1 for engine families	\$4,325 plus \$400 for injector replacements and 3-4 hours installation labor (about \$350) Total cost about \$5,075
Proventia Emission Control www.proventiafilters.com	Passive flow-through filter with catalyzed regeneration Model: Bobtail FTF	Carrier Transicold Truck TRUs: Model years 1994-2004: Kubota D722, D1105, D722-E, and D1105-E Thermo King Truck TRUs: Model years 1987-1999: Yanmar 3TNE66-TK and 3TNE72-TK Model Years 2000-2004: Yanmar 3TNE66KC-ETK & 3TNE72KC-ETK See Executive Order DE-08-001-05 ⁵ , Attachment 1 for engine families	\$3,400 with injectors replaced and 2-3 hours installation labor (about \$250) Total cost about \$3,650
Rypos, Inc. www.rypos.com	Active diesel particulate filter (DPF) with automatic electric regeneration Model: DPF/LETRU	Carrier Transicold Trailer TRUs: Model years Pre-1999, 1999-2003 Engine models: Kubota V1903, V2203 Thermo King Trailer TRUs: Model years Pre-1999, 1999-2003 Engine models: Isuzu D201; and Yanmar 4TNE82, 4TNE86 See Executive Order DE-09-001-01, Attachment 1 for engine families	\$3,995 plus \$320 alternator, \$60 shipping, and 3-4 hours installation labor (about \$350) Total cost about \$4,825

¹ Transport Refrigeration Unit (TRU) Airborne Toxic Control Measure (ATCM) is codified in title 13 California Code of Regulations (CCR), section 2477.

² Trade names mentioned herein do not imply ARB endorsement.

³ See TRU Advisory 08-05. Rebuilt/remanufactured engines must meet the rebuilding practices of 40 CFR 89.130 and 1068.120 and 13 CCR 2423(l). The rebuilt replacement engine must be built to a certified configuration meeting the most stringent standard possible. Such a replacement resets the compliance clock for ULETRU to 7 years after the effective date of the certified configuration Executive Order, which may not be the same as the rebuild date. Because of this, rebuilt engines may not provide 7 years of compliance from the rebuild date.

⁴ Replacement engines must meet 40 CFR 1068.240 and 13 CCR 2423(j). Replacement engines must be the cleanest engine available that will fit and perform in the equipment. Replacing an old engine with new or newer engine resets the TRU ATCM's in-use performance standard compliance deadline to 7 years after the replacement engine's effective model year. The effective model year is the last year of a prior-tier emissions standard or the manufacture year of an emissions standard tier that is currently in effect).

⁵ Level 2 VDECS Executive Orders may be downloaded from the Verification Procedure – Level 2 website at: <http://www.arb.ca.gov/diesel/verdev/level2/level2.htm>

Retrofit with Level 3 VDECS meeting Ultra-Low-Emission TRU (ULETRU)⁶ In-Use Performance Standard

Company⁷	Technology	Designed for Trailer/Truck/Gen Set TRUs	Estimated Costs
Huss, LLC www.huss-filters.com	Active DPF (wall-flow filter with automatic fuel burner regeneration) Model: FS-MKS	All Trailer TRUs with engines in good condition that pass opacity test	MSRP \$5,500 plus 6-8 hours installation labor Total cost about \$6,200

Alternative Technologies⁸ for Complying with TRU ATCM (if PM emissions eliminated at distribution facility)

Technology	Company⁷	Designed for Trailer/Truck/Gen Set TRUs?	Estimated Costs
Electric standby ⁹ (ordered as option with new units, available for most new TRU models)	TRU dealers	Yes/Yes/NA	Truck TRU: \$350 to \$1,000 cost for option Trailer TRU: \$2,000 to \$4000 cost for option Electric plug infrastructure costs additional. ¹⁰
Hybrid e-TRU ¹⁰ (diesel engine running electric generator that provides electric power to semi-hermetic electric motor running refrigeration compressor & electric motor-driven fans)	Carrier Transicold Models: Vector 1800MT (multi-temp), Vector 6500 (single temp)	Yes/No/NA	\$3,000 to \$4,000 over conventional TRU; maintenance costs about 30% less than standard TRU
Hybrid Cryogenic Temperature Control Systems ¹¹ (cryogenic in conjunction with diesel-powered TRU)	Thermo King	Yes/Yes/NA	Contact Thermo King

⁶ Any control technology that meets ULETRU could be used to comply with LETRU.

⁷ Trade names mentioned herein do not imply ARB endorsement.

⁸ Alternative Technologies can be used to comply with ULETRU and LETRU if certain qualifications are met (e.g. TRU engine operation is eliminated at distribution centers, and is limited to less than 30 minutes at delivery points). Recordkeeping is required.

⁹ TRU engine operation must be eliminated at distribution centers, and is limited to less than 30 minutes at delivery points. See TRU Advisory 08-02

¹⁰ Range of retail costs shown were provided by TRU manufacturers.

¹¹ TRU engine operation must be eliminated at distribution centers and limited to less than 30 minutes at delivery points. See TRU Advisory 08-13.

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Technologies that are exempt from the TRU ATCM (no integral diesel engine, therefore not a TRU)

Technology	Company/Model/Web Address¹²	Estimated Costs
All-electric-powered refrigeration systems for trailers.	Carrier Transicold, Model: Electra www.trucktrailer.carrier.com	Contact Carrier Transicold
All-electric-powered refrigeration systems for truck vans.	Thermo King, Model: B-100 http://www.thermoking.com/tk/index.asp	Contact Thermo King
All-electric-powered refrigeration systems for shipping containers.	Carrier Transicold Models: PrimeLine, ThinLine, EliteLine www.container.carrier.com	Contact Carrier Transicold
All-electric-powered refrigeration systems for shipping containers.	Thermo King Models: CRR-40 and MAGNUM http://www.thermoking.com/tk/index.asp	Contact Thermo King
All-electric-powered refrigeration systems for truck vans with cold plates and/or evaporators for single-temp or multi-temp applications (plug-in power and/or on-board vehicle power-take-off-driven generator).	Johnson Truck Bodies Models: Cold Plate Blowers with Automatic Defrost/ElectriMax/RouteMax www.johnsontruckbodies.com	Contact Johnson Truck Bodies 1-800-922-8360 or Eduardo Navarro: enavarro@jtb.carlisle.com , 310-418-8905
All-electric-powered refrigeration systems for truck vans with cold plates (plug-in and/or on-board vehicle power-take-off-driven generator).	Kidron Manufacturing, Model: UltraTemp www.kidron.com	Contact Kidron 951-587-8726 dpeterson@kidron.com
All-electric-powered refrigeration systems for trucks with vehicle power-take-off generator.	Global Refrigeration Systems/AuraGen Model: Oasis www.globalcoolingreefer.com	Contact Global Refrigeration Systems
All-electric (battery-powered - 20 hours) refrigerated single pallet shipping container.	Solotemp www.solotemp.com	Contact Solotemp 800-281-9322, eric@solotemp.com
Cryogenic refrigeration (open cycle liquid carbon dioxide) for truck and trailer vans.	Thermo King Models: ST-CR, ST-CR MT http://www.thermoking.com/tk/index.asp	Cost models available. Unit list price is within 10% of diesel unit.
Cryogenic refrigeration (open cycle liquid nitrogen) for truck and trailer vans.	Universal Container, Inc./Cryometrix http://ucontainer.com/products/reefer-trailer/	Approximately \$30,000. Lower operating costs. Liquid nitrogen infrastructure costs vary by fleet size
Cryogenic refrigeration (open cycle liquid nitrogen) for truck and trailer vans.	Ukram/ecoFridge www.ecofridge.info	\$18,000/unit, liquid nitrogen infrastructure costs unknown, 25% less hourly operating cost than TRU
Direct drive refrigeration systems for truck vans (powered off vehicle engine).	Carrier Transicold Models: Integra, 20X, 30X, 40X, and 50X www.trucktrailer.carrier.com	Contact Carrier Transicold
Direct drive refrigeration systems for truck vans (powered off vehicle engine).	Thermo King Models: V-200/Max, V-300/Max, V520/Max http://www.thermoking.com/tk/index.asp	Contact Thermo King
Replace trailer TRU's diesel engine with certified gasoline or LPG engine.	Leonard's Diesel Repair Toll Free 888-537-0880	\$6,200 to \$6,500 plus parts and labor to install, depending on model, make and year

¹² Trade names mentioned herein do not imply ARB endorsement.

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