



Transit Bus Repower Guide Specification

This guide specification lists the requirements of what a transit bus *repower kit* shall contain, to allow the replacement of an existing engine with a newer, different engine, i.e. replacing a Detroit Diesel Series 50 engine with a Cummins ISL engine.

The repower kit shall include *all* the parts needed to install the newer different engine in place of the original engine installed by the bus OEM. For example, *all* the parts is every bracket, mount, adapter, tube, fitting, electrical connection, and hose, down to the smallest nut, bolt or washer, to assure a complete and running installation. The repower kit shall be manufactured by a company with at least 4 years experience in the design and production of transit bus repower kits in North America.

The repower kit shall be PowerUp, Inc. part number **RK100-A**, or equal. All parts shall be new.

Section 1.0 Engine mounting

- 1.1 The engine supports shall be fabricated of at least 3/8" thick hot rolled steel, strong enough to support the engine and transmission, including g-forces at all points. The mounts shall be primed and painted with industrial grade, rust resistant high gloss enamel, or electrostatically powder coated.
- 1.2 Engine supports shall position the engine properly in the chassis, and bolt to the existing engine mounting points on the coach frame. Welding or cutting the coach frame is not acceptable.
- 1.3 Rubber vibration isolators of the proper load rating and durometer rating shall be used to prevent excessive vibration and roll of the engine.
- 1.4 All bolts, locknuts, and washers used in the engine mounting system shall be SAE J429, Grade 8, zinc plated.
- 1.5 Driveline angles are to be within acceptable limits as specified by SAE standards and Cummins Bulletin No. 3387085-R, "Driveline Troubleshooting and Maintenance."
- 1.6 The coach OEM's design ride height shall be maintained with the replacement engine installation, to prevent driveline induced vibration.

Section 2.0 Driveline components

- 2.1 Existing driveshaft and U-joints shall be examined and reused provided they are in sound and working condition. If not, new replacements shall be provided at the customer's expense. If the new installation renders the existing driveshaft too short or too long, a new drive shaft shall be provided in the repower kit along with new U-joints. The new driveshaft and U-joints shall be sized sufficiently to handle the torque of the replacement engine.

Section 3.0 Cooling System

- 3.1 All tubing shall be made of 16 gauge aluminized steel. The tubing shall be mandrel bent (to assure smooth bends) to match the engine and radiator connection points, with the minimum amount of hose connections. Welded tubing will be allowed *only* if the radius cannot be achieved with mandrel bending. The tubing shall be properly supported to prevent damage from engine vibration and movement. Each tube end shall be free of burrs and sharp edges, and machine beaded to insure proper clamping to hose.
- 3.2 All hoses over 1 inch diameter shall be 4 ply silicone, 1 inch diameter and smaller shall be at least 2 ply silicone. EPDM rubber hose is not acceptable in the cooling system. Hoses over 1 inch diameter may not be over 8 inches in length overall; tubing as per 3.1 shall be used instead.
- 3.3 Clamps shall be 100% stainless steel, with smooth interior bands so as not to damage the silicone hose. Clamps for hose over 1 inch diameter shall be T-bolt type. Clamps for hose 1 inch diameter or less may be worm screw type, with smooth interior bands.
- 3.4 Deaeration lines shall be made of Teflon tube stainless steel braid, with end connections made of stainless steel.
- 3.5 Fittings shall be made of brass, bronze, plated steel, or galvanized pipe. Black iron pipe or PVC is not acceptable.
- 3.6 A new coolant level sensor shall be provided for installation in the surge tank, to replace the existing sensor. Electrical connection shall match the existing wiring harness. The sensor shall be compatible with the Cummins engine ECM.

Exhaust System 4.0

- 4.1 All tubing shall be made of 16 gauge aluminized steel. The tubing shall be mandrel bent (to assure smooth bends) to match the engine and radiator connection points, with the minimum amount of hose connections. Welded tubing will be allowed *only* if the radius cannot be achieved with mandrel bending. The tubing shall be properly supported to prevent damage from engine vibration and movement. The routing of the exhaust tubing shall not allow it to be closer than 2 inches from any adjacent non-exhaust component.
- 4.2 A section of bellows type flexible stainless steel tubing shall be used to provide for engine movement and thermal expansion of the tubing system. This flexible section shall be placed at the area(s) of the tubing run that experiences the most movement during engine operation. The section may be welded in place, clamped with stainless steel band/seal clamps, or a combination of both.
- 4.3 Each end of the tubing shall be flared and free of burrs and sharp edges to accommodate the proper size stainless steel V-band clamp at the engine turbocharger and muffler. These V-band clamps shall be provided in the repower kit.

Intake System

5.0

- 5.1 Tubing shall be made of 16 gauge aluminized steel. The tubing shall be mandrel bent (to assure smooth bends) to match the engine and radiator connection points, with the minimum amount of hose connections. Welded tubing will be allowed *only* if the radius cannot be achieved with mandrel bending. The tubing shall be properly supported to prevent damage from engine vibration and movement. Each tube end shall be free of burrs and sharp edges.
- 5.2 Hose connections shall be preformed EPDM rubber, of the type specifically made for heavy duty engine applications. Flexible duct, spiral wrapped, or radiator hose is not acceptable.
- 5.3 Clamps shall be 100% stainless steel T-bolt type.

Charge Air Cooling System

6.0

- 6.1 Tubing shall be made of 16 gauge aluminized steel. The tubing shall be mandrel bent (to assure smooth bends) to match the engine and radiator connection points, with the minimum amount of hose connections. Welded tubing will be allowed *only* if the radius cannot be achieved with mandrel bending. The tubing shall be properly supported to prevent damage from engine vibration and movement. Each tube end shall be free of burrs and sharp edges, and machine beaded to insure proper clamping to hose.
- 6.2 Hose connectors shall be 4 ply reinforced silicone bellows type, with steel retaining rings to prevent expansion due to pressure. These connectors shall be 6" minimum in length overall.
- 6.3 Clamps shall be 100% stainless steel T-bolt type.

Fuel System

7.0

- 7.1 Fuel lines shall be of a material compatible with diesel fuel, stainless steel braid reinforced, polyester braid covered, rated for a minimum of 250 PSI. They must be sized to meet the restriction limits of Cummins, Inc. installation recommendations. End connections shall be JIC flare type, and machine crimped on the hose. Hose lengths must allow for adequate engine movement without undue stress on the hose and connections.
- 7.2 Fittings must be steel only. Galvanized, black pipe or copper fittings are not acceptable.
- 7.3 A primary fuel water separator filter assembly must be provided, 25 micron rated, between the fuel tank and engine fuel transfer pump. This filter is to be mounted to the chassis frame, not on the engine, in an easily serviceable location. This filter shall have an electronic water sensor compatible with the Cummins electronic engine

controller. The filter shall not cause a restriction of flow that exceeds the level published by Cummins, Inc. engine installation recommendations.

**Engine Mounted
Air Compressor
System
8.0**

- 8.1 Connection hose to the engine mounted air compressor shall be Teflon tube stainless steel braid. Compressor end shall be female swivel JIC flare type, steel. Minimum length shall be 24", with ½" diameter. The other end shall match the chassis connection.
- 8.2 A new air governor shall be provided with pressure settings the same as the one being replaced on the coach. Air governor connection lines shall be Teflon tube stainless steel braid. Ends shall be female swivel JIC flare type, steel.
- 8.3 Intake air line to the compressor shall be as manufactured by Cummins, Inc. and connected directly to the intake manifold of the engine.
- 8.4 Water cooling lines to and from the compressor shall be factory installed on the engine by Cummins, Inc. Lines installed by others are not acceptable.

**Hydraulic System
(Cooling fan motor and Power Steering)
9.0**

- 9.1 All hydraulic cooling fan motor and power steering hoses are to be replaced with new. They shall be of the same type and pressure rating as supplied on the coach by the OEM. Acceptable hose manufacturers are Parker, Gates, or Aeroquip. All end fittings shall be machine crimped on the hoses. Reusable fittings are not acceptable.
- 9.2 A new tandem hydraulic pump, PowerUp, Inc. PN: M902, shall be provided. The pump will mount to the end of the engine mounted air compressor, and be supported to the engine with a bracket, PowerUp, Inc. PN: B904. This pump provides power for both the hydraulic fan motor and power steering.
- 9.3 A new hydraulic fan motor shall be provided, with the same specifications as the one supplied on the coach by the OEM. The original cooling fan shall be inspected and reused if acceptable. If not, a new replacement will be supplied at the customer's expense.
- 9.4 A new hydraulic fan control manifold will be provided, PowerUp, Inc. PN:M905. This enables the fan to run at variable speed according to coolant temperature. A new control module will also be provided with proper parameter settings.
- 9.5 Hydraulic fittings shall all be steel, JIC flare type.
- 9.6 All hydraulic hoses shall be routed and supported so as not to cause rub points directly against frame members or engine. With hoses that have unavoidable points of contact, sleeve protectors shall be provided.

Electrical

10.0

- 10.1 All electrical wiring shall be copper, GXL type, and sized correctly for each circuit load. Terminals are to be crimped with ratcheting type crimpers to assure a tight, consistent crimp. All terminals are to be nylon insulated. Vinyl insulation is not acceptable.
- 10.2 All wire runs are to be encased in nylon, high temperature loom. The loom shall be clamped at each end with black, ultra-violet resistant nylon cable ties. The cable tie shall be clipped closely at its locking point to prevent sharp edges.
- 10.3 The conversion harness between the Cummins ECM and the coach shall be a complete "Plug and Play" type. The harness connects directly to the engine ECM and to the existing connector on the chassis harness. Cutting of the existing chassis data harness is not acceptable. All connections shall be sealed with internal silicone rings to make them weather tight.
- 10.4 The engine intake air heater relay shall be housed in a metal box to be mounted to the chassis frame. It shall be pre-wired with all harnesses, ready to be connected. The relay shall be of the type recommended by Cummins, Inc. engine installation guidelines for electronic engines. It shall be fuse protected.
- 10.5 High current battery cables shall be of the size required for each circuit load, and meet the resistance requirements of Cummins, Inc. installation guidelines. They shall be copper SAE J1127, type SGX, resistant to oil, fuel, acids, grease and abrasion. Lugs are to be crimped on with high pressure, three sided crimper, and sealed with heat shrink tubing; red for positive, black for negative. Swaging lugs on with use of a hammer and die is not acceptable. Cables that are run near a heat source shall be encased in a heat reflective loom.
- 10.6 When installed, all wiring shall be bundled and tie-wrapped neatly to adjacent wiring or structure. No wiring shall be unsupported or allowed excessive movement.
- 10.7 When required, a new throttle position sensor and harness shall be installed, and connected to the conversion harness.

Air Conditioning System

11.0

- 11.1 The existing air conditioning compressor will be reused and relocated to line up with the new engine crankshaft drive pulley. Suitable conversion brackets and mounts shall be provided in the repower kit to accurately place the compressor in the proper location. A belt tensioning system shall be incorporated into the new mounting system, along with a single, 2V belt.

Engine 12.0

- 12.1 The replacement engine shall be a new Cummins ReCon ISL280 diesel engine, rated 280 HP @ 2200 RPM, 900 LB FT @ 1300 RPM for transit bus service. It shall include an air compressor with rear drive for hydraulic pump mounting, and 24VDC starter. The engine shall have the appropriate flywheel housing, front engine mount, turbocharger mounting, dipstick, oil pan, CAC connections, alternator mounting, drive belts, oil fill locations, oil filter location, and fuel filters, to allow proper installation with the PowerUp, Inc. repower kit components.

Transmission 13.0

- 13.1 A rebuilt transmission shall be provided by the customer to the repower facility. The core will be returned to the customer. Transportation of the rebuilt transmission and core shall be the responsibility of the customer.
- 13.2 Hoses from the transmission to the cooler shall be new, as described in section 9.1.
- 13.3 Transmission adaptation parts for the Cummins engine shall be included in the repower kit. These will include flexplates, flange, ring gear adapter, and bolts.
- 13.4 Transmission retarders, if required to be replaced by the customer, shall be provided by the customer. Cores shall be returned with the transmission core to the customer.
- 13.5 The original transmission ECM shall be reused. Reprogramming is not required.

Fasteners and clamps 14.0

- 14.1 All SAE bolts, nuts, and washers above ¼ inch diameter shall be grade 8, zinc plated. Metric bolts, nuts, and washers above 6mm diameter shall be class 10.9, zinc plated. Bolts and screws smaller than ¼ inch or 6mm diameter shall be stainless steel. Lock washers or lock nuts shall be used to prevent loosening due to vibration.
- 14.2 All P-clamps shall be stainless steel silicone cushioned type.

Installation 15.0

- 15.1 The repower installation shall be done by a company with no less than 4 years experience working on transit bus powertrains. Their facility shall have equipment and tooling specific to handling large transit coaches, i.e. lifts, engine cradles, and the computer hardware/software necessary to communicate with the engine and transmission.

Warranty

16.0

- 16.1 The repower kit shall have a published warranty policy that covers all the parts supplied in the kit. This warranty shall cover a period of 1 year from date in service of the repower. The warranty certificate shall be provided as part of the bid documents, and shall provide the same coverage as that published by PowerUp, Inc.

Packaging

17.0

- 17.1 The repower kit shall be packaged according to PowerUp, Inc.'s "SYSTEMPAK" method. This allows for the kit to be quickly received, unpacked, and organized simultaneously by the repower facility. Further, it makes the technician more efficient and accurate in the installation. Other types of packaging are not acceptable.
- 17.2 One repower kit shall be provided for each bus. Bulk parts or mixed shipments are not acceptable. Each bus number shall be clearly marked on every repower kit box, and on every package in the box.

Parts

17.0

- 17.1 A complete parts list shall be provided for ordering replacement parts. The parts shall be supported for a period of not less than 5 years from date of repower, by the repower kit manufacturer.

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