



California Transit
Association



Orange County Transportation Authority

ISL-G Near Zero Engine Repower

PRESENTER: BILL HABIBE
MANAGER TRANSIT TECHNICAL SERVICES
BHABIBE@OCTA.NET / (714) 668 - 4574

ISL G **NEAR
ZERO**



About the ISL-G Near Zero



Improvements with the Near Zero

- ▶ Emits **0.02 g/bhp-hr NO_x** instead of previous 0.2 g/bhp-hr NO_x
- ▶ Meets CA 2023/2031 NO_x reduction goals
- ▶ Larger Three-Way Catalyst
- ▶ Single Dual Intake Sensor for intake temperature and humidity
- ▶ Closed Crankcase Ventilation (CCV) reduces engine related methane emissions by 70%
- ▶ **300 hp** and **1,000 lb-ft** torque
- ▶ Stoichiometric EGR Spark Ignited (SESI) technology used in both engines
- ▶ Internal and external mounted engine components match, so current inventory can remain the same

Engine Installation Requirements

1. New Catalyst is larger than old catalyst; Mounting hardware had to be modified, and the exhaust system compartment was vented, and thermal insulation was added.
2. Crankcase Ventilation System was installed(Required by Cummins) and all rubber Hoses & Belts will be replaced as part of the repower.
3. SKF High Capacity Dual Turbo 2000 Air Dryer system with air cooling coil installed to handle the volume of air produced by the twin cylinder air compressor upgrade.
4. No Infrastructure or Mounting Changes are Needed for the Current Fleet already using the Standard ISL-G Engine
5. The low coolant sensor was relocated to a reduce expansion space above coolant level sensor, the max. spec is 16% for transit.

Engine Compartment

4

Before Repower

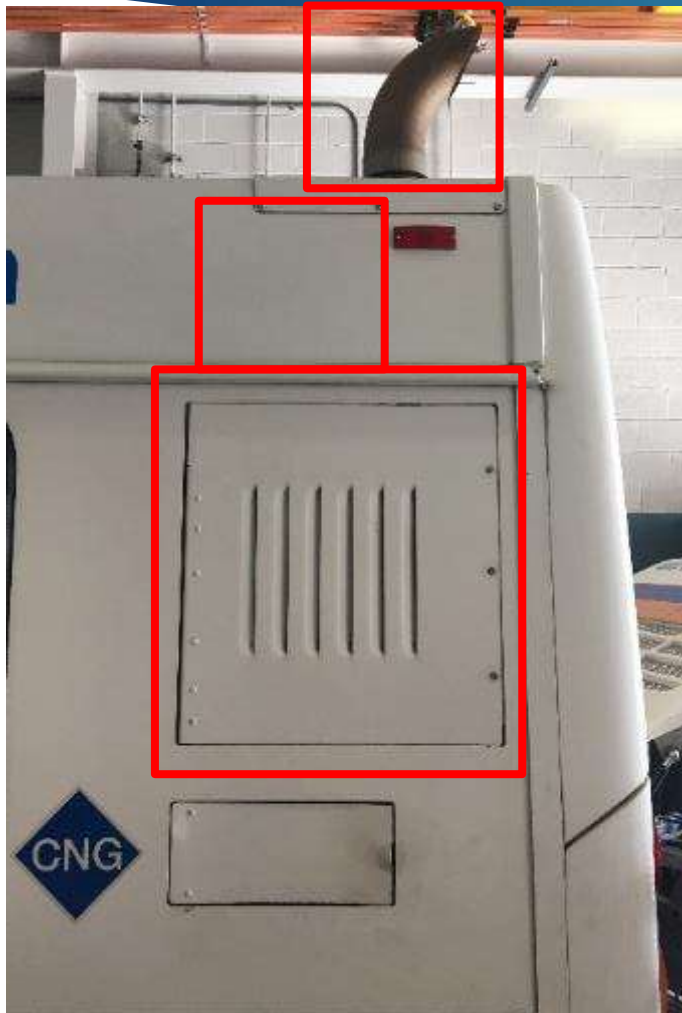


After Repower

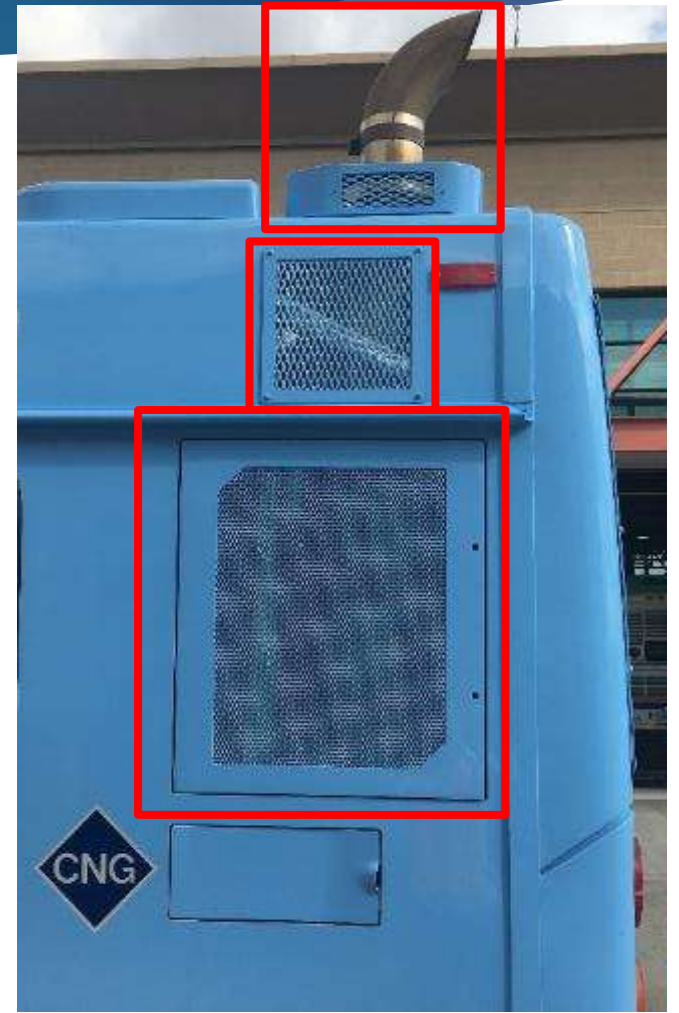
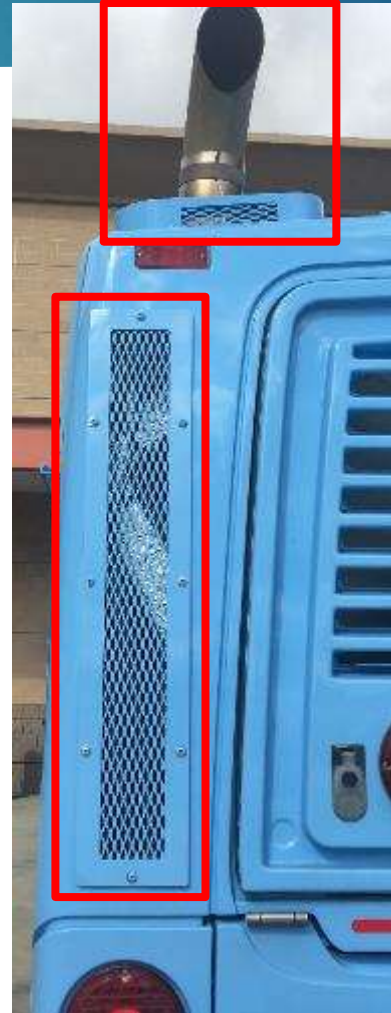


Bus Body

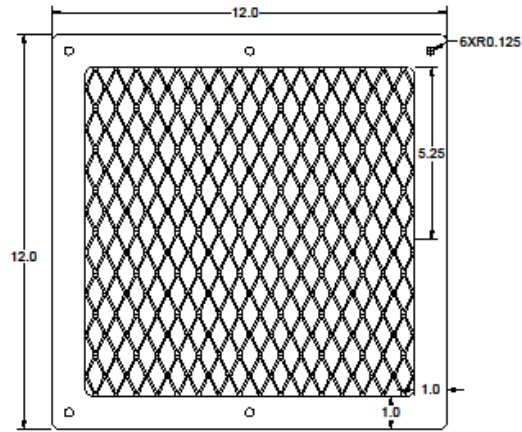
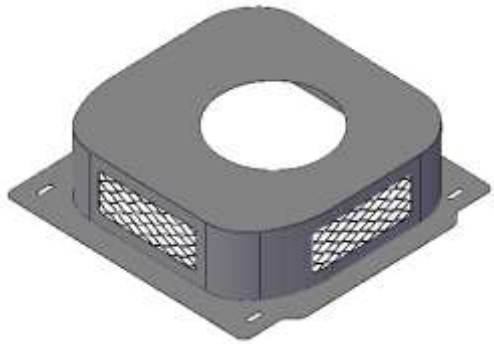
Before Repower



After Repower



Catalyst Modification and Ventilation



Cat is 4"
higher

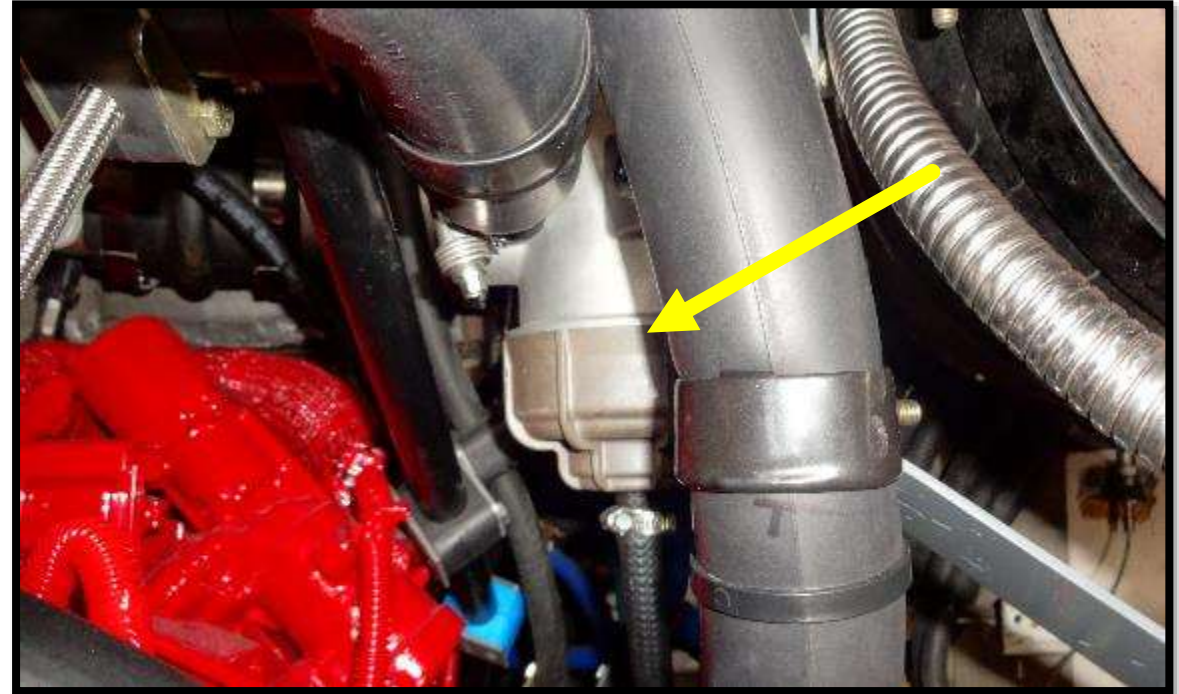
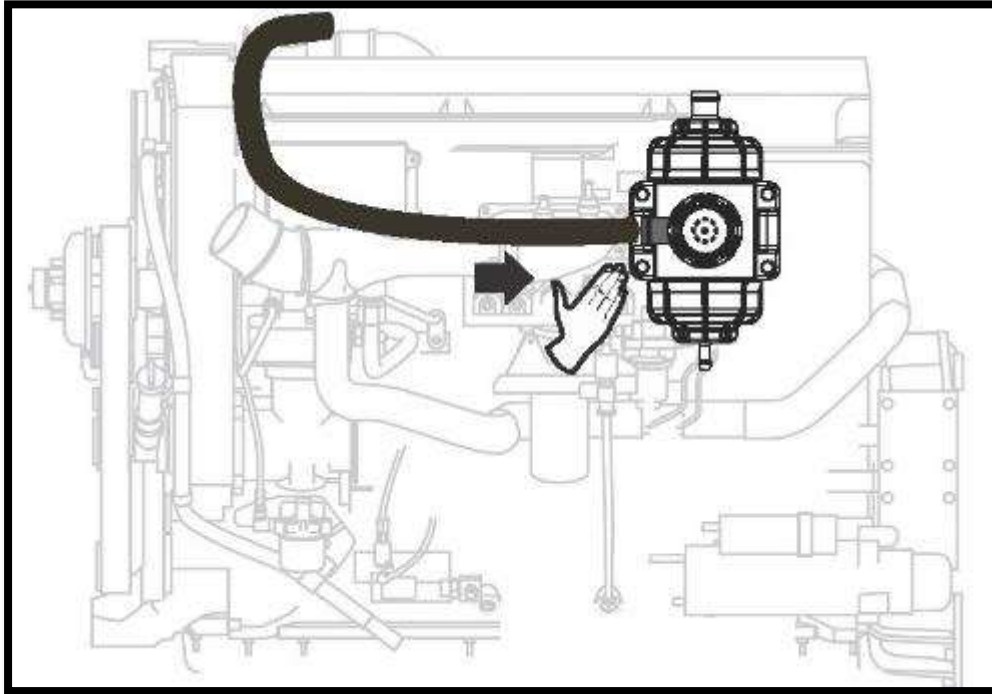


New Three-Way
Catalyst



Old Catalyst

New Crankcase Ventilation System

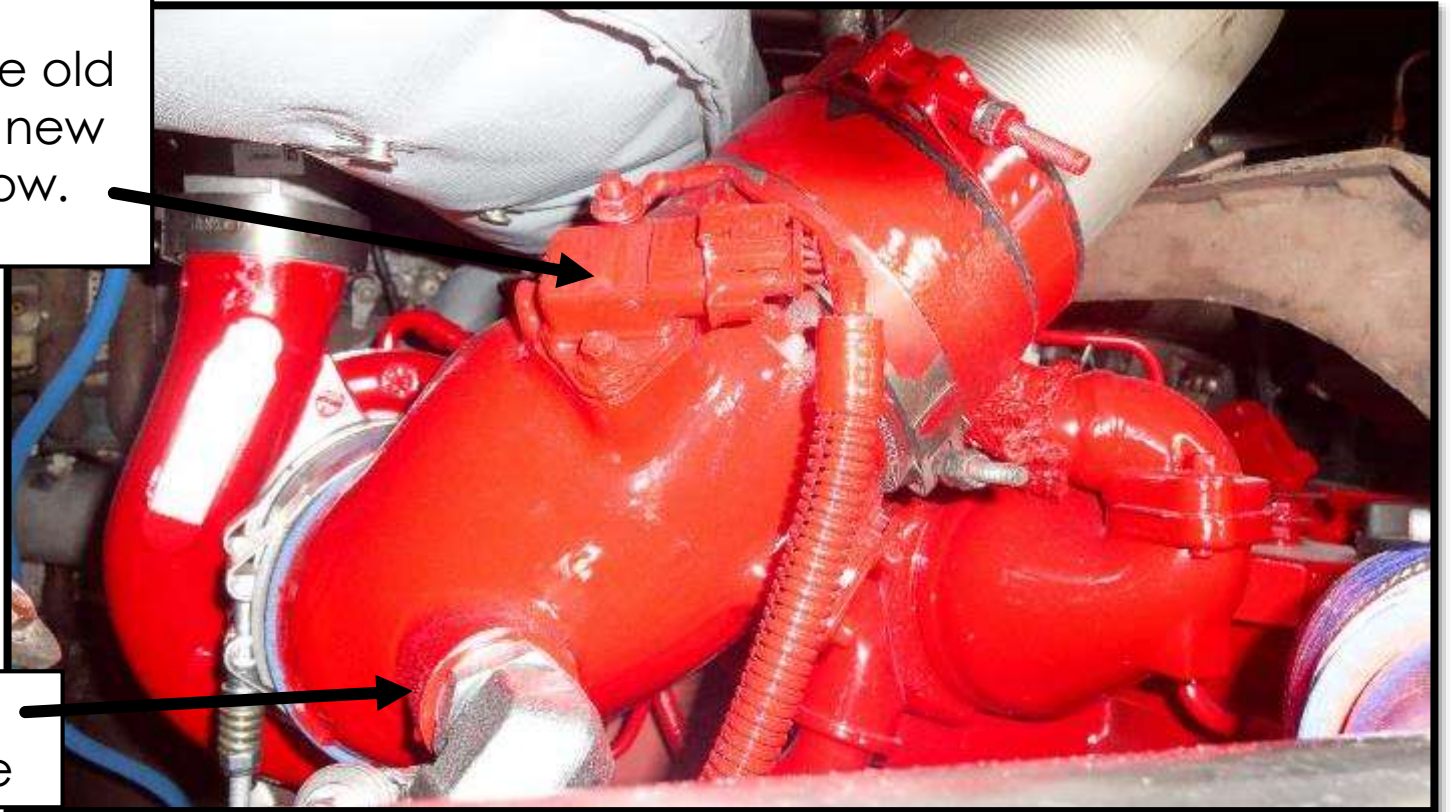


The Closed Crankcase Ventilation system (CCV) redirects the crankcase emissions through a filter that removes the oil and then pushes it back into the intake manifold. This system removes methane emissions by 70%.

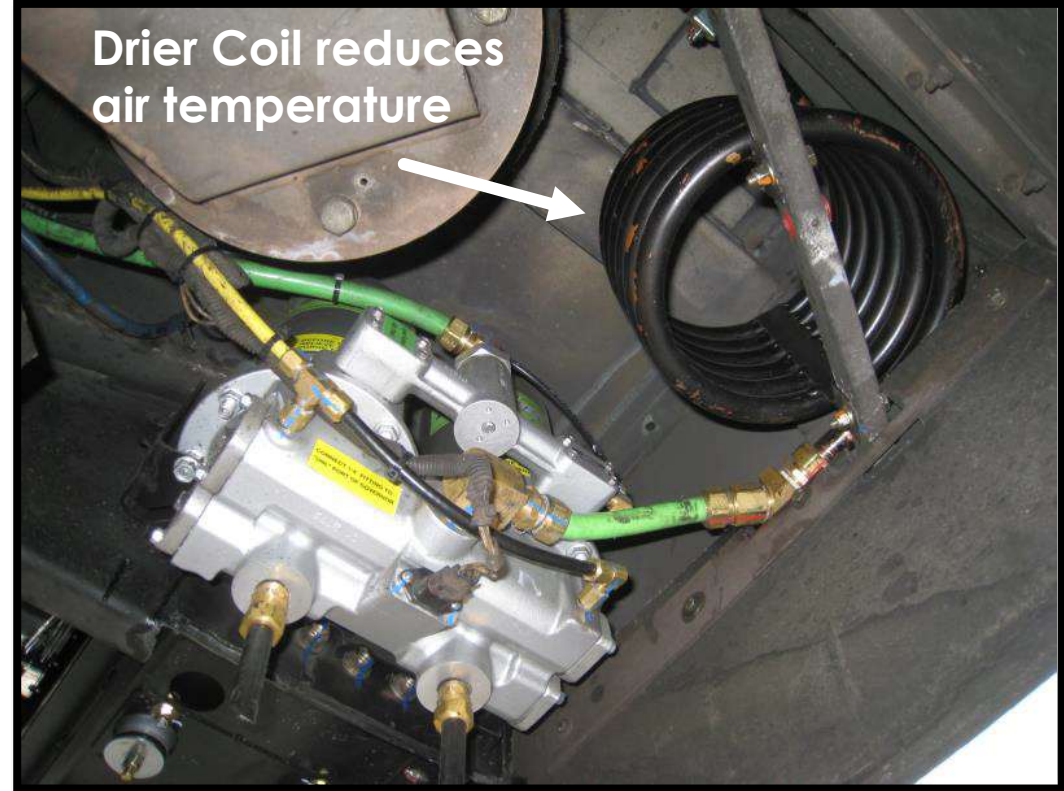
New Intake Elbow

Modification of the air intake pipe at the turbocharger inlet was required, since the old pipe had two bungs for the sensors, and new engine has a dual sensor at the inlet elbow.

Crankcase pressure feeds into turbo intake



Dual Air Drier with Air Cooling Coil



Machine Shop Work

Machine Shop

Weld exhaust pipe flange

Modify old Intake Pipe

Fabricate Muffler, lower bracket

Fabricate Muffler, top bracket

Fabricate Harness Mounts for Split block clamps

Modify surge tank, relocate coolant level sensor

Coolant filter bracket removal

Fabricate Alternator Cable Bracket

Tools Required for Making Cables

Tool	Mfg.	Mfg. P/N	Qty
Stud-Driven Hole Punch 13/16" Hole Dia.	McMaster-Carr	34685A475	4
Universal Hand Crimp Tool (DT Series)	Deutsch	HDT-48-00	2
Rota-Crimp Hand Crimping Tool for 4 AWG wire	TE Connectivity	601075	1
Rota-Crimp Hand Crimping Tool for 4/0 wire	TE Connectivity	600850	1
Color-Keyed Cable Cutter	Thomas & Betts	CSR750	1
Cable Stripper	Greenlee	52040895	1

Installation Phase

Installation

Engine & Transmission:

Installation crews will join new engine w/ transmission & install components (Alternator, hydraulic pump, etc.) after removal.

Radiator & CAC package:

Installation crews will take radiator package apart, and give body shop the shroud and frame pieces to refurbish; then installation crews will reassemble radiator package with new radiator and CAC.

High Temperature Catalyst Harness Assembly:

Rebuild crews will assemble catalyst harnesses in the Rebuild Shop area.

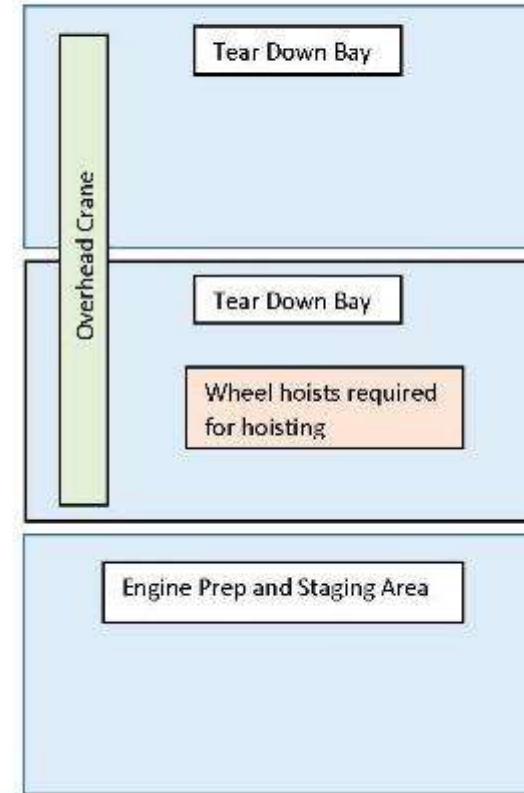
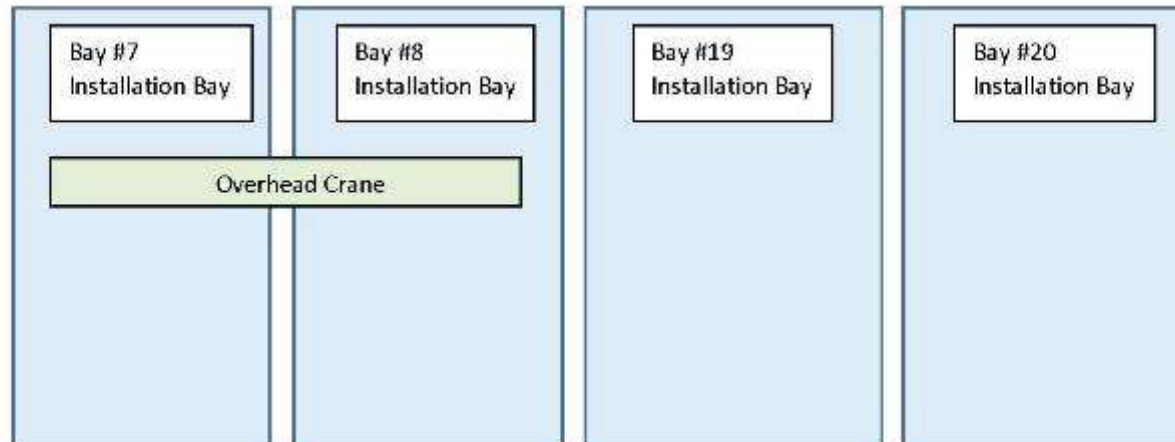
1. Remove old battery and starter cables, and install new cables, and temporarily zip-tie them out of the way.
2. Remove old air dryer, install new air dryer brackets, purge tanks, and install new air dryer and hoses, temporarily zip-tie hoses out of the way.
3. Install new crankcase breather mount and hoses, temporarily zip tie hoses out of the way.
4. Install cable glide chain.
5. Install modified surge tank.
6. Install radiator package.
7. Install engine & transmission package, and torque mounting bolts.
8. Install new hoses, pipes and brackets.
9. Align exhaust pipes, weld exhaust flange, and install and tighten complete exhaust system.
10. Align and tighten intake pipes.

11. Install hydraulic lines.
12. Install air intake pipes and hoses, tighten all clamps.
13. Install and connect all air lines and fittings from air compressor to air dryer.
14. Install all hoses and fittings for crankcase breather.
15. Connect all electrical cables for alternator, starter, batteries, etc.
16. Remove old roof mounted oil cooler & fan, and install new cooler and fan.
17. Fill engine, transmission, power steering system, and coolant system.
18. Perform Cummins procedure for removing air from the coolant system.
19. Run-in engine, and recheck fluids.

Note: The Rebuild bays and bays #7 & #8 should be used as tear down bays, and catalyst removal and installation since they are the only bays with overhead cranes.

Tear Down

1. Steam Clean the engine compartment.
2. Drain all fluids (Engine Oil, Trans Fluid, P/S fluid, etc.)
3. Remove driveline, hoses, pipes, belts, etc.
4. Loosen engine mounts
5. Remove rear bumper.
6. Remove Engine & transmission (Move engine and transmission to Installation bay)
7. Remove radiator package (Move radiator package to Installation bay)
8. Remove old Catalyst.
9. Modify catalyst compartment (Cut vents, install insulation, catalyst mount, new wire harness, etc.)
10. Remove glide chain, and install 4AWG cable.
11. Remove Surge tank, have machine shop modify tank (Reposition coolant level sensor.)
12. Steam clean engine and catalyst compartment, and move bus to installation bay.



06-0109 97 Cummins ISL-G Near Zero Repower -DRAFT - PRODUCTION SCHEDULE - 10/2/2017 to 9/24/2018

Week #	Bus Count	Date	Model	Week #	Bus Count	Date	Model
1	7576	10/2/2017	7576-S	49	5150	8/2/2018	5150-I
2	5676	10/9/2017	5676-A	50	7573	8/9/2018	7573-A
3	5677	10/16/2017	5677-A				
4	5675	10/23/2017	5675-A				
5	5128	10/30/2017	5128-G				
6	5121	11/6/2017	5121-G				
7	5678	11/13/2017	5678-A				
8	7529	11/20/2017	7529-A				
9	7530	11/27/2017	7530-A				
10	7575	12/4/2017	7575-S				
11	5129	12/11/2017	5134-I				
12	5127	12/18/2017	5127-G				
13	7531	12/25/2017	7531-A				
14	7532	1/1/2018	7532-A				
15	7533	1/8/2018	7533-A				
16	7577	1/15/2018	7577-S				
17	5130	1/22/2018	5139-I				
18	5123	1/29/2018	5123-G				
19	7534	2/5/2018	7534-A				
20	7535	2/12/2018	7535-A				
21	7536	2/19/2018	7536-A				
22	7578	2/26/2018	7578-S				
23	5131	3/5/2018	5131-I				
24	5124	3/12/2018	5124-G				
25	7537	3/19/2018	7537-A				
26	7538	3/26/2018	7538-A				
27	7539	4/2/2018	7539-A				
28	7579	4/9/2018	7579-S				
29	5132	4/16/2018	5132-I				
30	5125	4/23/2018	5125-G				
31	7540	4/30/2018	7540-A				
32	7541	5/7/2018	7541-A				
33	7542	5/14/2018	7542-A				
34	7580	5/21/2018	7580-S				
35	5133	5/28/2018	5133-I				
36	5126	6/4/2018	5126-G				
37	7543	6/11/2018	7543-A				
38	7544	6/18/2018	7544-A				
39	7545	6/25/2018	7545-A				
40	7581	7/2/2018	7581-S				
41	7582	7/9/2018	7582-S				
42	5134	7/16/2018	5129-I				
43	7546	7/23/2018	7546-A				
44	7547	7/30/2018	7547-A				
45	7548	8/6/2018	7548-A				
46	7583	8/13/2018	7583-S				
47	5135	8/20/2018	5135-I				
48	5136	8/27/2018	5136-I				
49	7549	9/3/2018	7549-A				
50	7550	9/10/2018	7550-A				
51	7551	9/17/2018	7551-A				
52	7584	9/24/2018	7584-S				
53	7585		7585-S				
54	5137		5137-I				
55	7552		7552-A				
56	7553		7553-A				
57	7554		7554-A				
58	7586		7586-S				
59	5138		5138-I				
60	5139		5139-I				
61	7555		7555-A				
62	7556		7556-A				
63	7557		7557-A				
64	7587		7587-S				
65	5140		5140-I				
66	5141		5141-I				
67	7558		7559-A				
68	7559		7559-A				
69	7560		7560-A				
70	7588		7588-S				
71	5142		5142-I				
72	5143		5143-I				
73	7561		7561-A				
74	7562		7562-A				
75	7563		7563-A				
76	7589		7589-S				
77	5144		5144-I				
78	5145		5145-I				
79	7564		7564-A				
80	7565		7565-A				
81	7566		7566-A				
82	7590		7590-S				
83	5146		5146-I				
84	5147		5147-I				
85	7567		7567-A				
86	7568		7568-A				
87	7569		7569-A				
88	7591		7591-S				
89	5148		5148-I				
90	5149		5149-I				
91	7570		7570-A				
92	7571		7571-A				
93	7572		7572-A				
94	7592		7592-S				
95	5150		5150-I				
96	7573		7573-A				