



A WELL-KEPT *Secret*

CUMMINS RECONDITIONING PROGRAM GIVES
DIESEL ENGINES A SECOND LEASE ON LIFE

I sat comfortably in a conference room at the world headquarters and marinization facility of Cummins MerCruiser Diesel (CMD) in Charleston, South Carolina, on a sunny April afternoon. With me were Rob Dorfmeier and John Wooldridge, *PMM's* publisher and editor-in-chief, respectively, as we discussed the facility's capabilities and CMD's strategic outlook with several company officials, including President Alex Savelli.

During our conversation, a passing reference was made to CMD's remanufactured engines.

"Stop the presses," I exclaimed. "Did you say that Cummins has a dedicated remanufacturing program for marine diesel engines?"

A hush fell over the room, and I'm sure the CMD folks were thinking, "You've got to be kidding. *PMM's* gearhead extraordinaire doesn't know about this segment of our business?"

The fact is, I didn't. Nor, I suspect, do many of my colleagues in the marine industry. Remanufactured engines—often called "recons" (for "reconditioned engines")—are not usually considered for repowers or direct replacements.

"This is a well-kept secret in the trade, gentlemen," I said. "Tell me more."

With that, we were given a brief overview of the remanufacturing program that CMD has had in place since 1999 for its over-the-road, industrial, and B and C Series marine diesel engines (and some Q Series marine engines). It's worth noting that the bulk of the marine engines available through this program are mechanically fuel injected—a holy grail of sorts for cruisers who are looking to keep things simple.

The more I learned about CMD's recon program, the more I wanted to tour the factory where the engines are remanufactured and share the story with *PMM* readers. Clay Gaillard, CMD's public relations manager and my inside man at the company, said he would be happy to show me around the facility.







Engines destined for reconditioning arrive daily by the truckload at the CMD recon plant in San Luis Potosi, Mexico.

Almost as soon as I agreed to take Clay up on his offer, I began to have second thoughts.

Perfect—I just wrangled my way into a tour of a factory that does nothing but take old engines apart and rebuild them en masse. How interesting can that be?

Plenty, I would soon find out.

CMD VS. CUMMINS MARINE

Before delving into the story of CMD's recon program, it's worth spending a moment explaining the seemingly many names of Cummins. The Cummins parent company is well known for its automotive and over-the-road truck engines. Twenty years ago, Cummins made itself a household name in the consumer market unlike any other diesel engine manufacturer by striking a brilliant deal with Chrysler to supply all of the diesel engines for Dodge Ram pickups. That program remains strong today, utilizing the Cummins B Series engine.

When I worked as a marine mechanic in the 1990s, I installed Cummins marine engines in recreational and commercial craft on a routine basis. These engines had an excellent reputation for reliability and robustness. Cummins' marine products were simply referred to as "Cummins Marine."

In 2002, Cummins and Mercury Marine entered a 50-50 joint venture. (For details on the fascinating history of Mercury Marine, MerCruiser's parent company, see *PMM* May/June '07.) The joint venture created a separate entity called Cummins MerCruiser Diesel Marine LLC, allying the two companies' long histories in engine development and marine drivetrain systems.

Jointly, Cummins and Mercury Marine have more than 160 years of experience in these fields. The goal was to offer consumers a prop-to-helm range of products from trusted manufacturers under a single brand.

Today when I sea-trial a new vessel equipped with a CMD power plant package, the instrumentation is provided by Mercury (in the form of its outstanding SmartCraft product), while the engine is a tried and true Cummins—a win-win situation and a clear case of the whole being greater than the sum of its parts. At first this seemed a bit unusual, but I've grown accustomed to seeing products from these manufacturers being used in a unified manner.

Just to keep things interesting, Cummins Marine still exists, providing diesel engines in the 19- to 60-liter-displacement, over-715hp range. CMD's product line remains in the 115-715hp range but will soon be expanded with the recently announced CMD-Volkswagen joint project to include engines from 40 to 350hp (these engines are referred to as the CMD TDI and SDI Series). All new CMD midrange (4B, 6B, QSB, and QSC) and heavy-duty (QSM) engines, spanning 150-715hp, are marinized at the Charleston facility I visited last spring. The "high-speed" engines, below 5 liters in displacement, including the QSD Series and the new TDI products (from Volkswagen), are marinized elsewhere.

Thus, CMD is the name most recreational and small commercial users are familiar with, and this will remain so for the foreseeable future. This division has allowed Cummins to better serve two distinctly different groups of users, and, in my view, the endeavor has been successful.

I'M GOING WHERE?

I'll admit it. When I inquired about visiting the CMD recon plant, it never occurred to me that I would be making an international flight, let alone an international flight to the central high-desert plateau of Mexico. I assumed the plant would be in one of those bastions of U.S. piston technology like Detroit or Columbus, Indiana. (The latter is the location of CMD's all-operations headquarters.) It's a political hot potato, to be sure, but because of the North American Free Trade Agreement and the higher cost of manufacturing in the United States, it's become especially attractive for manufacturers based in the U.S. (and elsewhere) to make the move to Mexico.

Regardless of the reasons for the facility's location, as I began preparing for my passage south, I was painfully aware that logging on to any Internet news site or tuning in to any news channel seems to yield some news about Mexico that's bad. Sadly, shootouts and drug violence



pervade most of what the rest of the world hears about the country. Thus, it was with some trepidation that I boarded a flight in Richmond, Virginia, for San Luis Potosi by way of Dallas. I had arranged to meet up with Clay Gaillard during the layover, after which we would proceed together for the remainder of the trip.

Most of my preconceived notions about Mexico, many of them media-generated, were dispelled during my visit—some at the instant of my arrival. Even though I had done some brief Google research prior to my trip, including a weather check for San Luis Potosi (abbreviated “SLP” by those at CMD), I still found it hard to believe that it was cooler in Mexico in August than it was in my home state of Virginia, nearly a thousand miles north. When I stepped off the plane onto the runway tarmac at dusk, it was cool and raining lightly, with lightning visible in the distance—not what I expected. My mind had not yet accepted the fact that the region’s 6,000-foot elevation has a dramatic effect on

point to the geographic center of the country, it’s likely your finger will land on San Luis Potosi. This is especially beneficial to businesses that are located here, including Cummins, because it affords near equal access to both coasts, and to Mexico City to the south and the U.S. border to the north. SLP is a crossroads for both rail and highway traffic, and it lies within the triangle of Mexico’s three largest cities: Mexico City, Guadalajara, and Monterrey.

CUMMINS RECON & PARTS, SLP

Clay and I were picked up at the hotel by Cummins SLP Product Engineering Manager Alejandro Contreras, a Cummins employee for nearly 20 years and our host for the duration of our stay. As is the case at many factories, security for entering the manufacturing facility was tight. Clay and I waited while guards checked our IDs and then issued us visitor passes, after which we passed through the gates. Once inside, the neatly



Left: A heavy-duty truck engine is disassembled in the early stages of the reconditioning process. Right: Each and every engine that is reconditioned at the SLP facility can be tracked on computers on the factory floor to determine details about accessories and other assembly requirements.

the weather. More in line with my image of Mexico was the scrubby desert that stretched as far as I could see.

The drive to the hotel, a Holiday Inn, was a high-speed blur of fast-food restaurants, industrial parks, and storefronts not unlike those seen in any American city. In fact, it looked much like the United States. San Luis Potosi’s skilled workforce and stable economy and politics make it a mecca for many large international businesses, including familiar names like Honeywell, GM, Valeo, Bendix, and Union Carbide, to name a few. Additionally, SLP is centrally located—I mean really centrally located. If you look at a map of Mexico and

manicured grounds gave the impression of a college campus, rather than a diesel engine manufacturing facility—trees, shrubbery, and a soccer field dominated the verdant landscape. Irrigation is provided by recycled factory wastewater that’s treated on-site. The Sierra Madre Oriental mountains loomed in the distance.

After a short briefing and discussion of the plant layout and procedures, we made our way to the shop floor. Now I was in my element. The sights, sounds, and smells were familiar and welcome—the din of machinery, sparks flying from cutting and grinding tools, the scent of warm lubricating fluids and hot metal.



As one might expect, the facility is organized into an assembly line of sorts. Since this is a recon factory, however, assembly is preceded by disassembly. Used engines, referred to as “cores,” are accepted at loading docks. Cores from the U.S. typically arrive by the truckload; those from Europe and other overseas locations are packed in shipping containers (10 to 15 cores in a 40-foot container), delivered by ship to a Mexican port, and then delivered over the road to SLP. On average, roughly 300 cores arrive each week.

Once at the plant, the used engines are assessed and then pressure-washed with hot water to remove grime, road dirt, and oil. (SLP’s on-site wastewater treatment plant ensures that all water that leaves the facility is free of oil, metal, and other contaminants.) Generally, in order for an engine that arrives at the plant to be considered re-buildable, the block—that is, the body of the engine—must be intact. Most are, but I did see at least one engine arrive with a large hole in its side, exposing the mangled connecting rods and crankshaft. While this engine was not re-buildable per se, certain components, such as the crankshaft and camshaft, manifolds, turbos, and fuel injection components, could be salvaged for refurbishment. Very little goes to waste or is thrown away.

After the cores are washed, they are inspected again for damage before moving to a disassembly area. Here, the used engines are literally taken down to the last nut and bolt; no two components that are capable of being separated remain attached. At each step, inspections are carried out to identify incipient damage or wear that is beyond acceptable rebuilding parameters. After disassembly, most cast-iron and aluminum parts are bead-blasted, scouring and exposing metal that hasn’t seen the light of day since the engine was assembled many operating hours or over-the-road miles ago. It was clear by looking at the engines that the vast majority of those arriving at SLP had been used in over-the-road vehicles. Some, however, were from boats, both large and small. The over-the-road engines usually are encased in dirt or suffer from road-salt corrosion. The marine engines look cleaner, although some suffer from many years of exposure to high humidity and salty sea air. In the end, an engine’s past is irrelevant—washing, disassembly, and blasting turn back the clock on all of the parts.

In an effort to minimize the possibility of an engine that suffers from an insidious flaw—hairline cracks, in particular—making its way to the reassembly line, all blocks and cylinder heads are checked using a procedure called “magnafluxing.” During this process, each freshly blasted part is sprayed with a fluorescent dye and

then scanned with a light that causes the dye, which congregates in cracks and other defects, to glow. All of this takes place under a darkening hood to assist the operator in identifying irregularities.

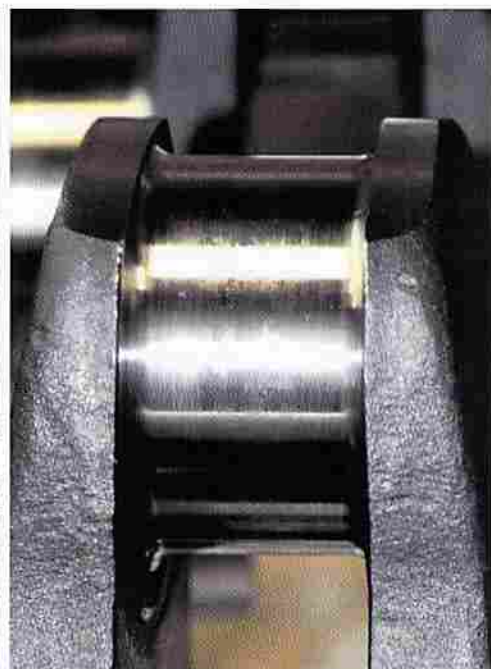
Once the engine components have passed the cleaning and inspection phase, they move to the assembly line. Here, engines are built in much the same way they would be if they were new. Because the main components—including the block, cylinder heads, and fuel system—have been reconditioned, extra care is taken to confirm the proper fit and assembly of these items. As I toured the facility, it seemed that at every turn someone was using a caliper, feeler gauge, or dial indicator to confirm that all was as it should be during assembly. While much of the same activity goes on at conventional engine factories, the watchwords at SLP seem to be “double-check” and “make sure” to ensure that the finished product performs as well as new Cummins engines.

I’ve rebuilt a few engines in my time and thus can attest to the skill, patience, attention to detail, and commitment required to get everything right. So much effort goes into the rebuilding process that the thought of a failure is, well, unthinkable. Of course, on a mass-production scale such as this, accuracy and reliability are critical. As I walked through the recon facility, often losing my escort as I stopped to take photos or walk deeper into an assembly area, that all-important sense of commitment was clear to see in the actions and on the faces of the folks on the shop floor. Having worked in marine service and repair for many years and having inspected countless manufacturing facilities, I know the look when I see it—the intense gaze of a worker fitting bushings in connecting rods or measuring runout on a crankshaft. It’s obvious that the folks at SLP are proud of what they do and are determined to produce a high quality product.

A TRULY GREEN OPTION

During the recon assembly process, both factory-reconditioned and brand-new parts are used. Reconditioned turbos (rebuilt at a Cummins facility in Memphis, Tennessee), as well as remanufactured fuel injection pumps, starters, and alternators, are utilized wherever possible. During my visit to CMD SLP, a new assembly line was being set up for remanufacturing air compressors, power take-offs, and water pumps. That line is now operational and supplies reconditioned components for the recon engines.

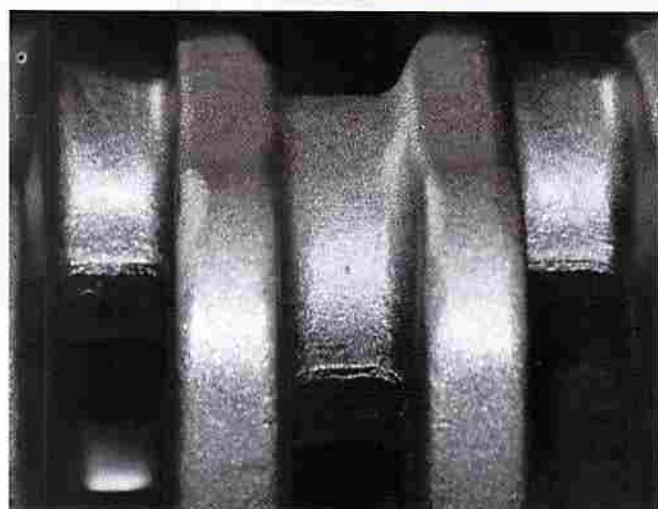
Ultracritical and wear-prone items such as pistons, rings, bearings, bushings, valves, and seats are always replaced with brand-new parts. Crankshafts, on the



other hand, are considered highly durable and are fully capable of being reconditioned and reused. At the SLP facility, used cranks are cleaned and measured for wear, and the journals are "cut" and then fitted with matching bearings. Because the facility has all of the machining abilities for reconditioning, it makes sense for CMD SLP also to manufacture new crankshafts. (The raw castings for the new crankshafts are made elsewhere; SLP does the precision machining and induction hardening.) In fact, the facility produces more new crankshafts than reconditioned ones, turning out 75,000 a year, along with about 12,000 reconditioned crankshafts.

While we're on the subject of numbers, in 2010 SLP produced approximately 20,000 reconditioned units. (A "unit" is defined as a complete engine, a short block, or a long block; the latter two are engines that are rebuilt but do not include all of the bolt-on accessories.) This figure included 60,000 reconditioned cylinder heads. Between 500 and 1,000 of the reconditioned engines were marine engines.

Watching the resurrection of crankshafts and other subassemblies within the walls of this facility, I couldn't help but be struck by the green side of this approach. "Green" is a buzzword that, in my opinion, is sorely abused in the marine industry and elsewhere. As a result, I use the term carefully and deliberately. In this case, I believe it's an apt description. Keeping old engine blocks, cylinder heads, and crankshafts out of landfills is good for the environment and has positive economic side effects for Cummins, for the consumer, and for the folks working at SLP. Among the benefits



Top left: After a thorough cleaning, critical castings such as cylinder heads undergo a process called magnafluxing, which reveals cracks that otherwise would be unnoticeable. Top right and above: A new crankshaft bearing journal before (above) and after (top right) precision machining. The castings are made in Brazil and then shipped to Cummins SLP for machining.

for the consumer is the fact that the cost of a CMD recon is 20–30 percent below that of a new engine.

While CMD strongly encourages the return of cores, it's not mandatory. If you are considering a repower with a CMD recon engine and the clunker you're removing isn't a CMD, you'll be charged a core fee of \$2,000 to \$4,000, depending on the engine model you're purchasing. Turn in a CMD core, and you'll be issued a "core credit"—a waiving of the core fee. It's worth noting that cores need not be like models; you can turn in a



Cummins 6BTA as a core and purchase a fully electronic QSB engine and receive full core credit. If a core is externally damaged or is missing components, the core credit you receive may be reduced accordingly.

At the final recon assembly line, accessories are bolted on to match the engine's specific intended application, whether it's truck or automotive, industrial, power generation, or marine. Each engine has a specific computerized order that follows it through its life at SLP, from the moment it's accepted as "rebuildable" until it leaves the factory. This information can be accessed at multiple locations on the shop floor at industrialized computer workstations. Once the mechanical work is

There is simply no need to paint hoses. While it may look nice when the engine is new, flexing, expansion, and contraction will cause the paint to flake off, at which point the hoses will look worse than if they hadn't been painted at all, and paint flakes will litter the bilge. At CMD's recon facility, I watched intently as the woman who was operating the paint test cell dutifully masked and wrapped all of the hoses on the newly remanufactured engines that she painted. Aside from the commission plate, which identified the engine as "remanufactured Cummins ReCon," the finished product looked superb and was indistinguishable from a brand-new engine.



Left: A newly reconditioned Cummins MerCruiser Diesel C Series engine awaits shipment from the remanufacturing facility. Right: The "old city" section of San Luis Potosi, accented by squares, churches, and shops featuring Spanish colonial architecture, is reminiscent of cities in Spain and elsewhere in Europe.

complete, every engine is run in a computer-controlled test cell to ensure it will be reliable when it's installed in a truck, remote power-generation station, or seagoing vessel. All recon engines are "hot tested" on a dynamometer, which not only records power output but also loads the engine, making it more likely that any flaws will reveal themselves. The results of the test are recorded and are available to dealers on demand.

How reliable are CMD's recon engines? The proof is in Cummins' recon product warranty, which is similar to, and in many cases exceeds, the warranty provided with its new engines: 2,000 hours or two years, whichever comes first. This warranty applies whether the engine is mechanical or electronically controlled, recreational or commercial.

Once an engine completes its test cell run-up, it is moved via an overhead trolley mechanism to a painting cell. A pet peeve of mine is engine manufacturers painting their engines—hoses and all.

A SHIPSHAPE SHOP

Cleanliness is important in any manufacturing process, especially when the work involves the innards of finely machined gear like diesel engines. A bit of dust, cardboard, or wood from a packing crate reaching the wrong place can bring oil flow to a halt, which nearly always leads to rapid and catastrophic failure. Therefore, any time I walk into a shop or repair or manufacturing facility, I can't help but scrutinize the "neatness factor." Clean shops are often well-run shops where good attention is paid to detail; these attributes are complementary. Toward this end, the CMD SLP staff includes a cleaning crew that, at least during my visit, seemed to be constantly mopping, sweeping, or sponging down machinery, floors, walls, and anything else that didn't move—and some things that did. The factory design incorporates natural lighting and opening skylights in many locations, making for a bright, work- and cleaning-friendly atmosphere.



One of the highlights of my tour was a visit to the company cafeteria. In keeping with the facility's general appearance, the cafeteria was neat, clean, and organized and offered food that was simple but very tasty, with ample variety and portions. As I strolled in the cafeteria entrance, a selection of the day's fare was on display under cellophane-covered dishes, as you might see in a restaurant. I couldn't help but compare the selection of food to that which I've encountered in other facilities I've visited. Here, it was healthy and hearty and looked and tasted fresh; very little was packaged, there were very few sweets, and soft drinks consisted mainly of juices. It seems SLP employees know a good thing when they see it—the large room was packed with what appeared to be the entire facility's staff. The fare is not free, but Cummins subsidizes two-thirds of the cost. Meals are served several times a day, at least once per shift.

After the factory tour ended, Alejandro, my SLP host, took Clay and me to the downtown area of San Luis Potosi. This was truly a high point of my short visit to Mexico. The old city area is stunningly beautiful and very reminiscent of Spain and other southern European locales. The architecture, churches, and squares are magnificent and are, should you find yourself in the region, not to be missed. The ornate artwork, frescos, and gilding of the few churches we peeked into rivaled many I've seen in Europe.

When I told my wife I was going to Mexico, her response was, "You have to get me a pair of huarache sandals." My wife has a talent for placing region-specific orders based on my travels. (She arranges all of my travel plans, and I strongly suspect that the shopping aspect plays a big part in her research.) I had no idea what huaraches were, but I agreed to try to find some. When I mentioned my quest to Alejandro, I saw a flash of recognition on his face. He then ushered me (and Clay, poor Clay) to several shops in the old part of town on a mission to locate the elusive huarache. After several shopkeepers shook their heads, we found one in the Calle Hidalgo district who nodded: "Si, we have many."


I sent a few photos to Sandy for approval via BlackBerry. She responded that the first pair I showed her was perfect but, at \$138, much too expensive. I explained via text as the entire party stood anxiously awaiting her decision that the prices attached to the huaraches were in pesos, not dollars. At the exchange rate of the day, this equated to about U.S.\$11. Her reply: "What other colors do they have?" Another remote shopping mission accomplished.

We toured the downtown area, which was filled with

couples and families, many eating ice cream or strolling arm in arm, enjoying the fine weather and fresh air. As I am wont to do, I continually fell behind the others as I attempted to capture the picturesque scenery through the lens of my camera. Eventually, hunger overcame us, and we stopped for dinner at La Parroquia, a restaurant on the main square, Plaza de Armas, a UNESCO World Heritage Site. The square is flanked by several churches, an 18th-century cathedral, and the Government Palace (San Luis Potosi was the seat of the national government for a time in the 19th century, and the city played a role in the 1910 revolution with the "San Luis Plan"). The region is known for its enchiladas potosinas, and with good reason—I tried them, along with a cold cerveza Victoria, and they were spectacular.

While Mexico has its social and economic problems, as do most nations (including the U.S.), as is often the case, the news reports about these issues are significantly out of proportion to their actual presence. Although my visit to Mexico was brief, I felt safe and welcomed throughout my stay, and everyone I encountered was helpful and accommodating. I clearly recall a young man who worked in the hotel dining room approaching me during breakfast and saying, in halting but well-practiced English, "It is my pleasure to serve you." While he no doubt was trained to say this, he didn't look the slightest bit reluctant or impatient with the directive. Either he genuinely meant it, or he was a good actor. Whichever the case, it had the desired effect.

My visit to Cummins Recon SLP was enlightening in many ways. I was able to see the complete, start-to-finish remanufacturing program for a wide variety of engines and subassemblies handled by this plant. In doing so, my notion that these products should be of interest to both boat owners and marine-industry professionals was confirmed. Indeed, recons represent a viable alternative to new engines, particularly in the case of a repower. (And if you're replacing an existing Cummins, it's a no-brainer.)

With a robust warranty that matches or exceeds that of a new product, an attractive price 20–30 percent below that of a new engine, and mechanically fuel injected engines available for those who prefer them, the question is, why *wouldn't* you consider the option of a reconditioned Cummins MerCruiser Diesel engine? 

Steve owns and operates Steve D'Antonio Marine Consulting (www.stevedmarine.com), providing consulting services to boat buyers, owners, and the marine industry.