Electro-Motive workers install north of 6,000 parts on each diesel they assemble. Here’s how they do it

**Story and photos by David Lustig**

**DEPARTMENT: UNDERFRAME STRUCTURE**
At the first stop in EMD’s London, Ont., plant, workers install several major components onto what will become the locomotive’s underframe. These include:
- Bedplates and all main cross-bearers
- Center sills, with a Strongback press
- Pivot pins
Welding is also completed here using a semi-automated fixture. End plates are applied and welded, along with end piping. Underframe stiffeners and bolsters (the component that carries the weight of the engine to the trucks) are applied and welded in the horizontal position.
All small underside parts (cable brackets, tie bars, tapping pads) are added here, as are side sills (handrail base). Engine/generator pads, and compressor pads are applied to ensure proper alignment further in the assembly process.

The underframe camber (an upward curvature to compensate for the weight of the engine to be installed) is formed.

The underframe can be rotated 360 degrees to create optimal conditions for producing the best welds.

**DEPARTMENT: UNDERFRAME EQUIPPING**
Here, EMD takes the completed underframe structure and adds the bulk of the electrical cabling and piping. Some of the critical items that essentially make up the “nervous system” of the locomotive include:
- Traction motor sensors, cables, and air ducts
- Dynamic brake cables, radar bracket, and cabling
- Air piping and other air-brake plumbing
- Reservoirs and sand piping

Some of the larger items, such as snowplows and fuel tanks, finish off assembly work on the deck.

Finally, operators do a full air test to ensure piping is air-tight and the underframe is ready to move on.

**DEPARTMENT: TRUCKS**
The Truck Assembly Department is shaped like the letter “T.” This arrangement enables the best possible process flow for the marriage of the traction motor combos and the equipped truck assemblies.

From the north end of the department, gears, bearings, and wheels are pressed and assembled onto axles. This subassembly is known as a WAG (wheel, axle, gear). The WAG moves southward by crane to be bolted to the traction motors. Gear cases and seals are added to protect the gears and retain gear oil that will be added later. This assembly now becomes a “combo.”

**TRUCK STRUCTURAL SERIAL LINE**
At the same time the WAGs and combos are being built, from the opposite (south) end of the department, the truck frame is placed on self-moving stands oriented in an inverted fashion (bottom side up). The frame travels down this assembly line inverted as it is equipped. Once complete, it meets in the middle of the department (roll-over station) with the combos. Components such as brake system hardware, steering beams, primary springs and bearing adaptors, and dampers are attached and secured to the bottom side of the truck frame.

**TRUCK ROLLOVER STATION**
This is where three combos will be placed into the still-inverted truck assembly. Once the three combos are secured into the bearing adaptors on the truck frame, the entire truck assembly is rolled end-over-end via a large 35-ton crane. After the rollover move is complete, the truck frame assembly is now positioned to enable the wheel to sit on the rails facing westward. They’re now ready to move on.

**FINAL ASSEMBLY STATION**
At this point, the assembly moves westward, its wheels rolling on the rails, to have all the topside components assembled into the truck frame. Items completed: gear oil to fill the gear case, secondary rubber springs, all the air piping for the brake systems, and any final welding.

**DEPARTMENT: CABS**
EMD begins with a cab shell and adds 90 percent of the mechanical applications in the cab roof, including wiper lines and wiring running. The ceilings and sidewalls are applied, as well as the control stand and the engineer’s and conductor’s desks. The radome assembly (antenna farm) is also applied to the rooftop. From here, the unit moves to the high stands to complete all of the electrical applications. With the unit on the high stands, workers can access both the interior of the cab and the un-
The locomotive is then ready to move outside under its own power for the first time. Once outside the shop, locomotive sales specifications are reviewed to confirm that the correct horsepower is achieved, as well as confirming that no fuel, lube oil, or coolant leaks have developed through vibrations. After the load test, a full locomotive vibration test is conducted to ensure no functional air brake test.

The last step in the initial test process is to perform a dynamic track test. This takes place on London’s dedicated test track, which runs along the south end of the property along the Canadian Pacific main line. During this test, all basic throttle, brake, and control system functions are tested, as well as the operation of the air brake system, if so equipped, and speed indicators.

The locomotive then undergoes a cab sound level test as specified by the engineering department and the locomotive sales specifications. Two locomotives are then coupled together, and the static operation of electrical multiple-unit (EMU) functionality and brake-type functionality are verified.

The two locomotives remain coupled together, and are taken back out to the locomotive test track as an m.u. pair for their final set of dynamic tests. Full dynamic m.u. functionality is checked, including both electrical and pneumatic lead and trail operation. The electrical trainline cable is then disconnected, one unit is put in full power, and the other unit is put in full dynamic brake (if so equipped). This is referred to as a “slag” or “push-pull” test, and requires each locomotive to achieve near full levels of tractive effort. From this standpoint, the “push-pull” m.u. test is the most stringent and true-to-life test each locomotive can undergo at the factory.

In this department, workers finish the locomotive and ship it to the customer. A fully assembled locomotive that has completed initial testing is moved into the preparation department. The first step is to move the entire unit with a chemical degreaser to remove any grease, oil, or contaminants.

The next step is to prepare the unit to ensure the next layer of primer will adhere to the paint. The paint employees pay special attention to ensure any defects like girder marks, scratches in the primer, and rough primer areas are sanded smooth to create a clean smooth surface for the next application.

Workers then mask specified areas and components to protect them. Once the unit is completed in the prep booth, employees are assigned a section of the locomotive to prime. Some workers may paint the interior of the hoods and short noses; others will go in a pit under the locomotive to prime any bare metal on the underside of the locomotive.

The complete exterior of the locomotive will be primed with a high-solids epoxy primer. In some cases, the first color of the topscopes will be applied in this shift. From this point, employees will mask and apply topcoat color to each section of the unit to match the specified layout. Out of all the topscope colors, a product called “girt coat” is applied in designated areas. Girt coat is applied on all flat surfaces that will be walked on to prevent slipping or skidding while working. These areas include the roof of the cab, short nose, and engine hood.

Finally, all exterior decals, letter boards, and nameplates are applied, and all piping is identified.

Manoj Mottee, EMD’s director of operations, confers with a quality control worker at the London plant. Steel cabling is used to properly run the wiring for hook-ups to the rest of the locomotive. Finally, workers are ready to hook the cab to an electronic testing system to test all circuits and wiring. This includes everything from lights to component cables, to ensure no damage occurs when circuits and wiring. This includes everything from lights to component cables, to ensure no damage occurs when