Early days at La Grange

An EMD electrical engineer helps create the F3

By Milo M. Schalla, as told to Robert Schalla • Photos by Milo M. Schalla

When a new locomotive design is introduced, a critical period of road testing always follows, to determine how well the product will perform under operating conditions. In the early 1940s when Electro-Motive FTs were beginning to displace steam across the country, it became apparent that although the FT design was revolutionary, it was a long way from perfect.

As more and more FTs entered service, problems came to light, and they ranged from trivial to critical. I worked as an engineer for EMD during those early years and had the opportunity to tackle some of those problems, and in so doing I helped make the F-series locomotives some of the most successful and reliable freight-haulers ever built.

I grew up in the Chicago area during the Great Depression and graduated from the Illinois Institute of Technology (formerly the Armour Institute) in 1941 with a degree in electrical engineering. My first job out of college was with Chicago utility Commonwealth Edison, where I worked the night shift at a power plant monitoring gauges and occasionally flipping a switch or two.

I was glad to have a job, but I quickly determined it was not the type of engineering work I'd hoped to do. So in fall 1941, with war production ramping up, I interviewed with General Motors at its Electro-Motive Division locomotive plant, not far from my hometown of Oak Lawn. (The plant was in tiny McCook, but its mailing address was in the larger and better-known adjacent suburb of La Grange.) I was hired in November as an

These rare color slides in 1945 of F3 "demo" quartet "291" are not labeled for site or month but are believed to have been taken on the Rock Island, possibly near its shops at Silvis, Ill. The road numbers on each cab unit, though, are a mystery, as one reads 290 (above) and the other 102 (left). The latter could have been intended for TP&W, which later bought two of the units.

entry level engineer, and the next six and a half years would prove to be some of the most memorable and technically challenging of my career.

F2 vs. F3

The FT had been in production for two years when I hired on, and EMD still was working to solve technical issues with the design and incorporate the improvements into its successor. EMD intended the successor locomotive to be rated at 1,500 h.p., and was to be designated model F2, but when the first units were completed in May 1945, it became evident there were serious design problems with the D12 main generator.

According to author Preston Cook [pages 20–35], correcting these issues required designing and manufacturing new stamping dies for the laminations in pole pieces in the generator that would take several months to complete. All other logistics were in place to produce the new locomotive, so in order to allow manufacturing to proceed, EMD quickly modified the D4 main generator of the FT, adding a companion alternator to allow its use in the F2.

This resulted in a locomotive rated at 1,350 h.p., the maximum the D4 generator could accept. Eventually the problems with the D12 were solved, allowing 1,500 h.p. units to be built, and they first appeared in July 1945 as model F3 in the four-unit demonstrator set pictured above. F2 production, which followed the F3 demo quartet, would total 74 in the U.S. and 28 in Mexico, all delivered in the second half of '46. Both the F2 and F3 introduced the D17 traction motor, replacing the D7 motors used in the FT.

When the F3 demonstrators came out, I was among the crew who rode them across the country, showing sometimes-reluctant railroad executives the advantages our diesel-electrics had over even their newest steam locomotives. It was exciting and fun to be on the cutting edge of technology and to be part of the team that was revolutionizing the railroad industry.

Load-testing the 567

My first job at EMD was in the test plant, where we load-tested new 567 model V16 diesel engines. We would run them at full load for an hour and then remove all the panels and covers and perform a complete inspection. If all was well, the engines were subjected to progressively longer test runs until they were finally released for installation.

In the early test facility we could run only three or four engines at a time. The facility was equipped with two D.C./A.C. converters, so two of the test engines usually were hooked up to sell power to Commonwealth Edison. If more than two were on the test stand, they were tied into a series of rooftop resistor grids.

Besides monitoring engine readings during the test runs, I was also responsible for getting the A.C. power coming out of the converters in sync with Edison's line current. This was a process that helped me learn patience, for if our output was not in perfect harmony with Edison when the switch was closed, a sudden jolt would hit the generators, causing the entire building to shake. This was

disconcerting not only to the person closing the switch but to everyone else in the structure. The worst part was that everyone knew who was responsible.

In the early war years, most of the engines we tested did not end up in locomotives because the needs of the U.S. Navy took precedence. Many of those new engines went to sea in submarines and destroyer escorts, both of which utilized the same diesel-electric drive as a four-unit FT, namely four V16 567s.

Fixing flushing and fans

After a few months in the test plant, I was offered a move to the Engineering Department and jumped at the chance. This was what I'd been waiting for — I was finally going to put my education to use. The department was divided into four groups: Engines, Electrical, Carbody and Running Gear, and a group that handled everything that did not fit into one of those three. This fourth group, called Auxiliaries, was where I was assigned. As if to put emphasis on "auxiliaries," the first project I was given was to redesign the locomotive toilet!

As was the norm in those days, toilets in locomotives were "flushed" by opening a flap valve at the bottom of the bowl, allowing the contents to drop onto the roadbed. On the FTs, however, the toilet, which was located just above the rear truck, sometimes caught an updraft created by the wheels, and that updraft would cause the toilet to flush backwards. You can imagine why this would quickly make the complaint list of our customers. The fix, as I recall, was simple and involved rerouting some ductwork. This must have worked, because the complaints ceased. This was not the kind of engineering I expected to be doing when I got my Double-E degree, but at least I was engineering something!

One of my next projects was a bit more complicated and actually required an electrical engineering background. The V16 engine in the first F3s had four cooling fans, which turned on and off automatically to keep the engine at an optimum temperature. At full throttle in hot weather, three fans were needed; when the engine was idling or in cool weather, it needed only one or two. The fourth fan came on only in extreme circumstances, like when the locomotive was a trailing unit in a tunnel where ambient temperatures could get quite high.

The problem was that the fans always came on in the same sequence, so the No. 1 fan was almost always in use while the No. 4 fan was almost never used. Because of this, maintenance shops complained they were replacing a lot of No. 1 fans but almost never a No. 4. To solve this, I designed a mechanical electrical switching circuit that randomized fan use. This was one of the improvements added to the F3 design, and it greatly extended the time between fan motor failures. For this work, my boss Tom Dilworth and I appplied for a U.S. patent on October 5, 1945, which was granted, as Patent 2423929, in 1947.

As each problem in the FT was identified, the Engineering Department went to work to resolve it and incorporate the changes into the successor model then on the drawing board, which became the F3. Although not involved in the project, I recall discussions with other engineers about cooling fan blades that kept breaking. The original fan blades in the FT were stamped out of sheet steel and then twisted to the appropriate angle. This was a cost-effective approach to making them, but the twisting process caused micro-fractures to develop near the root of each blade, hence blade failures were common. At first they tried grinding and polishing the cracks out, but this

Silvis, Ill., 1945: One trip Milo Schalla made for EMD was on the Rock Island from Blue Island, Ill., west 158 miles to the road's backshops. RI bought 36 FTs (series 70–77 and 88–99), 12 F2s, 48 F7s, and 10 FP7s, but no F3s. Striking red 4055 (Alco, 1927) was second-to-last among RI's 57 class M-50 4-8-2s.

was just partially successful. Finally it was decided that a cast aluminum blade assembly was the answer. It cost a bit more, but the fan blades quit flying off.

Another problem I dealt with on the early F units was the tendency for the fuel filters to get plugged with paraffin when the locomotives were operated in cold climates. As I recall, Great Northern was one of the first roads to experience this problem. The trouble was that the fuel system drew directly from the main tank below the locomotive. Because of the tank's location, the fuel could get quite cold in the winter and when it hit the filters, they would often become plugged with wax and starve the engine.

The solution was a complete redesign of the fuel delivery system. The design I came up with delivered more fuel than was needed to the injectors, while circulating the fuel past the exhaust manifolds. The injectors pulled the fuel they needed from the delivery line, and the

En route from Cheyenne to Green River, Wyo., on a UP demonstration trip, Milo's train waited for a meet, and when he took in his surroundings, he felt like he was really in the Wild West.

In Green River, Milo had time and opportunity to photograph Big Boy 4008. He could not help thinking that the 4-8-8-4s, the epitome of steam, would likely be displaced by EMD's diesels.

excess fuel, which had been heated, was returned to a holding tank where it was mixed with the cold fuel coming from the main tank. Cold-weather shutdowns owing to plugged filters became a thing of the past. The patent for my design was filed in May 1947 and approved in 1952, so I am not sure if the earliest F3s had this improvement.

Riding the demos

In 1945 when the F3 demonstrators began touring the country, I often rode with them. My job was to record data in the dynamometer car behind the locomotives and periodically make my way through the units to collect data on each engine's performance. Most of my trips were on western railroads, including a short one on the Rock Island to its shops in Silvis, Ill. I clearly recall a longer one, for which I flew from Midway Airport in Chicago on a DC-3 to Denver and then on to Cheyenne, Wyo.

The next day I rode in the dynamometer car on a demonstration trip west to Green River, Wyo., on Union Pacific. Somewhere east of Green River in the Red Desert, our freight went into a siding to await an approaching train. While the engines idled I climbed down and walked a short distance into the desert to stretch my legs. When I stopped to take in my surroundings, the sagebrush seemed to go on forever across the dimly lit landscape, and when a distant group of coyotes began to yip and howl, I suddenly felt like I was really in the Wild West. This was quite an experience for a city kid from Chicago.

The following day, while I waited for the return trip to Cheyenne, I took a photo of Big Boy 4008 sitting beneath the coaling tower in Green River. As I marveled at its size and complexity, I could not help thinking that the Big Boy

was the epitome of the machine that we had come to slay. As new and impressive as they were, the Big Boys represented the past, and I was certain that given a chance, our diesel-electrics would prove that the days of steam were numbered.

Union Pacific had been an early owner of EMD passenger locomotives but did not have any FTs. Trips like the one I made across Wyoming with the F3s were meant to give UP management a comparison with their Big Boys and Challengers. The data we complied was an important step in selling UP on the potential of diesel freight-haulers. Needless to say, when the results were in and analyzed, UP was impressed and began ordering F3s, first in December 1946. They were delivered in early '47, and over the next three years UP bought 179, giving it one of the largest F3 fleets in the country. A decade after its last F3 arrived, UP's Big Boys and Challengers were retired.

In 1948, with the F3 in full production, I was transferred to GM's Allison Division in Indianapolis to work on the possible application of Allison's gas turbines to locomotives. As it turned out, EMD and Allison never teamed up to build a gas-turbine locomotive, but the history of that whole project is, as they say, another story.

View ahead from the dynamometer car: Milo's job was to record data in this car, right behind the units, and periodically walk through them to collect performance data from each engine.

This 1945 photo's location is uncertain, but it's probably on the RI-SP Golden State Route, as B&M 2-8-4 4010 (right) was sold to SP and entered service at El Paso on August 21, 1945.