

= NSB EI 9 =

NSB EI 9 is a retired class of three electric locomotives built by Thune for the Norwegian State Railways (NSB), with electrical equipment from Norsk Elektrisk & Brown Boveri (NEBB) and Per Kure . The locomotives were delivered in 1947 after a three @-@ year delay caused by wartime sabotage in response to the German occupation of Norway . They were used nearly exclusively on the Flåm Line and Hardanger Line , two steep branch lines . The units were used on the Flåm Line until 1983 , when they were replaced by EI 11 . They were then used as shunters until being retired in 1988 . Two of the locomotives have been preserved .

The class was custom @-@ made for steep hills and slow speeds ; it featured a low 48 tonnes (47 long tons ; 53 short tons) weight which , with a Bo 'Bo ' wheel arrangement , allows for a 12 @-@ tonne (12 @-@ long @-@ ton ; 13 @-@ short @-@ ton) axle load . This made the locomotives only 10 @. 2 meters (33 ft) long . They had a power output of 712 kilowatts (955 hp) , a tractive effort of 108 kilonewtons (24 @, 000 lbf) and a maximum speed of 60 kilometres per hour (37 mph) . They were given road numbers 2062 though 2064 .

= = History = =

With the construction of the Bergen Line , which was completed in 1909 , it was decided that there would be built branch lines to two fjords , the Hardanger Line to Hardangerfjord and the Flåm Line to Sognefjord . Both branches were steep and curvy , which set high demands on the locomotives . The Hardanger Line was 27 @. 45 kilometers (17 @. 06 mi) long , had a maximum gradient of 4 @. 5 percent , a minimum curve radius of 180 meters (590 ft) , and a maximum speed of 40 km / h (25 mph) . The Flåm Line is 20 @. 20 kilometers (12 @. 55 mi) long , had a maximum gradient of 5 @. 5 @. percent , a minimum curve radius of 130 meters (430 ft) and a maximum speed of 40 km / h (25 mph) uphill and 30 km / h (19 mph) downhill . Both lines had a maximum permitted axle load of 12 tonnes (12 long tons ; 13 short tons) , standard gauge and a 15 kV 16 2 ? 3 Hz AC electrification system . The Hardanger Line opened in 1935 and the Flåm Line in 1940 , although the latter did not receive electric traction until 1944 .

Originally , the Hardanger Line used Class 64 electric multiple units . On 28 March 1940 , NSB sent an invitation to tender for two multiple units which would be similar to Class 64 . The company asked both for aluminum and steel bids . However , NSB abandoned the plans and instead signed an agreement on 4 October 1940 for delivery of three electric locomotives . The units were intended to be delivered in 1942 . The mechanical components and assembly was done by Thune , and electrical parts were delivered by NEBB , except the transformer and electric controllers , which were built by Per Kure .

By 1944 , by which time Norway was occupied by Germany as part of the Second World War , overhead wire had been installed on the Flåm Line . The locomotives at Thune and nearly completed , except for the transformers , which were at Per Kure . This was during the height of resistance sabotage , and workers at Per Kure had joined the communist resistance group Osvald . Because of the Allied bombing of Germany , Per Kure was thought to become part of a decentralized production chain and would be set to assemble aircraft engines . Osvald considered the plant a legitimate target and on 30 May 1944 , the factory was blown up and the transformers severely damaged . Reconstruction of them took considerable time , in part because of the general lack of materials , and in part because the head engineer for the project disappeared during late 1944 . In 1945 , all three locomotives were sent to Myrdal Station for storage until the transformers were finished .

The locomotives received transformers in 1947 , which were installed in Oslo , and 2064 was delivered on 24 May . The cost of the three locomotives was 1 @, 297 @, 905 million Norwegian krone . At first , only one unit was transferred to Flåm . The other two remained in Eastern Norway ; one was stationed as a shunter at Oslo West Station , the other in Skien . The units operating in Oslo and Skien had problems with the rheostatic brake operating differently depending on the direction the train was running , something which was not observed in Flåm . The

issue was fixed by marginally changing the excitation voltage . The unit stationed in Flåm was periodically sent for service in Oslo , and when this happened , a new unit would be stationed in Flåm . From 21 January 1949 , 2064 was returned to Flåm without the other unit being sent back . From 17 February 1955 , all three were stationed in Flåm . During the late 1950s , one of the units was stationed as Voss Station for shunting duty . Starting in the late 1950s , the class was also used on the Hardanger Line .

In the 1970s , NSB started to consider replacement of the class . In 1971 and 1973 , EI 11 and EI 13 were test @-@ run on the line , and it was concluded that EI 11 would be suitable with minor adjustments . However , the 1960s replacement of steam locomotives had caused a shortage of electric locomotives . Not until 1980 did NSB start the upgrade process of two EI 11s . From 1980s , only a single EI 9 was stationed on the Flåm Line during winter , and the other two were used for local trains on the Bergen Line in Hallingdal . If the unit stationed in Flåm was out of order , it was replaced by a Class 64 unit . Lack of spare parts and limited reliability accelerated the need to replace the units in scheduled trains . The first unit was taken into use on the Flåm Line in 1983 and the second in 1984 . Two EI 9s were transferred to Ål Station and Voss Station where they hauled work trains . Unit 2062 was taken out of service in 1983 . The other two remained in regular service until 1988 . Unit 2063 has been painted green and is on display at Flåm Station , while 2064 has retained the red color scheme and is stored at Tinnoset Station , belonging to the Norwegian Railway Museum .

= = Specifications = =

The locomotives each have four NEBB EDTM423 motors , giving a combined power output of 712 kilowatts (955 hp) . The main transformer is capable of feeding each motor with 765 kilovolt @-@ ampere (kVA) , 115 kVA to heating and 40 kVA for axillary equipment . The power output is regulated with through 28 steps in the voltage regulator which is integrated with the main transformer . The locomotives have a maximum speed of 60 km / h (37 mph) and a tractive effort of 108 kilonewtons (24 @,@ 000 lbf) . Because of the limited roof space , only one pantograph was installed .

The limit on axle load makes the locomotives small and compact . They weigh 48 tonnes (47 long tons ; 53 short tons) , and the total train weight is limited to 85 tonnes (84 long tons ; 94 short tons) . This also gives the trains a short length of 10 @.@ 2 meters (33 ft) . The trains had a Bo 'Bo ' wheel arrangement . In addition to air brakes for the whole train , the locomotives are equipped with rheostatic brakes which is sufficiently powerful to allow for the 5 @.@ 5 percent gradient . When braking , three of the motors are connected to the air @-@ cooled resistance on the roof , while the last motor is connected to deliver magnetization current to the other three motors . The braking is regulated with 22 steps . As a backup , the units are equipped with a carborundum track brake on each side of the bogies .