

= NSB EI 18 =

NSB EI 18 is a class of 22 electric locomotives built by Adtranz and Swiss Locomotive and Machine Works ( SLM ) for the Norwegian State Railways ( NSB ) . The class is a modification of the Swiss Federal Railways Re 460 locomotive and built at Adtranz Strømmen in 1996 and 1997 . The class remains the only mainline electric locomotive used by NSB , and is predominantly used on some intercity services and all night trains on the Bergen Line , Dovre Line and Sørland Line , as well as some regional trains .

The locomotives are 18 @. @ 5 metres ( 61 ft ) long and weigh 83 tonnes ( 82 long tons ; 91 short tons ) . They have three @- @ phase asynchronous motors with a maximum power output of 5 @, @ 880 kilowatts ( 7 @, @ 890 hp ) , giving a tractive effort of 275 kilonewtons ( 62 @, @ 000 lbf ) and a maximum speed of 200 km / h ( 120 mph ) . They have a Bo 'Bo ' wheel arrangement and regenerative brakes . The exterior was designed by Pininfarina and the cabs have pressurization . The units are numbered 2241 through 2262 .

= = History = =

During the early 1990s , NSB was in need of new electric haulage for their passenger trains , as both classes EI 11 and EI 13 were in need of replacement . EI 17 , the latest purchase , had proved unreliable , and NSB wanted to remove them from mainline service . In 1993 , Re 460 and EuroSprinter locomotives were tested in Norway , with the Re 460 being tested from 28 August through 8 October . NSB was satisfied with both units , and stated that it would be possible to increase the train weight on the intercity services from 700 to 800 t ( 690 to 790 long tons ; 770 to 880 short tons ) . During the first half of 1994 , NSB leased two Re 460s to have sufficient locomotives for operation during the 1994 Winter Olympics .

When the deadline for bids for the units was reached on 8 May 1994 , five bids had been received . GEC Alsthom offered a modification of the French SNCF Class BB 36000 and AEG offered a variation of the German prototype 12X . Siemens offered two models , the EuroSprinter and an adaptation of the Austrian ÖBB Class 1014 . Siemens ' proposal for the former was branded Dovresprinter and was a cooperation between Kværner and NSB 's workshop at Sundland in Drammen . Siemens would deliver the overall design and electrical components , Kværner would build the mechanical components and the assembly would occur in Drammen . The final offer was from Asea Brown Boveri ( ABB , which by delivery would merge to become Adtranz ) and SLM for " Lok 2000 " , a modification of the Swiss Re 460 .

Prior to the final negotiations , union representatives for the train drivers stated that Lok 2000 was their preference , and that NSB could expect a dispute if they chose a different model . The representatives stated that they were " tired of experimenting with Norwegian solutions " . Another important aspect for NSB was that as much of the production as possible take place in Norway . The final negotiations were made with ABB / SLM and AEG and on 2 September , and NSB approved the agreement with ABB / SLM for a purchase of 22 units . The contract was signed on 27 September , and the 22 units cost approximately 700 million Norwegian krone .

NSB considered ordering the units with support for both the Norwegian and Swedish 15 kV 16 2 ? 3 Hz AC system , and the Danish 25 kV 50 Hz AC system . This would have allowed the trains to operate directly to Denmark via the Øresund Bridge , which was then under construction . The dual @- @ voltage system was dropped during the procurement process , but NSB stated that if they needed such units , compatibility could be provided in future orders of the class . The units were built by Adtranz Strømmen at Strømmen outside Oslo , and delivered between 3 September 1996 and 12 June 1997 . The units are numbered 2241 through 2262 . When entering service , the locomotives replaced NSB 's oldest units , EI 13 , which were then retired . This reduced NSB 's average locomotive age from 31 to 18 1 ? 2 years at the time of the end of the delivery .

During 1997 , there were five incidents where NSB 's Nordic Mobile Telephone equipment interfered with the locomotive 's electronics , causing the emergency brakes to activate . This caused a temporary halt until the motorman had unlocked the brakes . The problem was fixed by

moving NSB 's mobile senders . The units were taken into use on the Bergen Line from 5 January 1997 . Later they entered into use on the Dovre and Sørland Lines , and then on regional trains around Oslo , such as the Vestfold Line . In August 1998 , NSB stated that EI 18 used more power than some of the substation transformers along the line could handle , particularly along the Vestfold Line . Part of the problem was caused by a mechanism in the locomotives whereby the motor was turned off if the wheels spin . The result was that the full power output of the EI 18 along parts of the railway network could not be utilized .

= = Specifications = =

The locomotives have a maximum power output of 5 @, @ 880 kW ( 7 @, @ 890 hp ) , and are capable of a continual power output of 5 @, @ 400 kW ( 7 @, @ 200 hp ) . This gives a maximum speed of 200 km / h ( 120 mph ) and a tractive effort of 275 kN ( 62 @, @ 000 lbf ) . The locomotive is fed 15 kV 16 2 ? 3 Hz AC power from the pantograph . This is then converted to direct current before being converted to three @-@ phase electricity through one of three gate turn @-@ off thyristors . Each bogie has three rectifiers , each connected to a transformer that is again connected to two inverters . The motors are three @-@ phase asynchronous motors located in the bogie frame and equipped with regenerative brakes . There is also an auxiliary three @-@ phase power supply which powers the compressor , pumps , ventilators and other auxiliary equipment , operated by four separate inverters . The controller is a 16 @-@ bit microprocessor that communicates using optical fibre cables . The rectifier , auxiliary rectifiers , controllers and the error and diagnostic system is of the same type as used on the NSB Class 70 multiple units .

Each unit weighs 83 t ( 82 long tons ; 91 short tons ) . The body is 18 @, @ 500 millimeters ( 60 ft 8 in ) long , 3 @, @ 000 mm ( 9 ft 10 in ) wide and 4 @, @ 322 mm ( 14 ft 2 @. @ 2 in ) tall . The center distance between the bogies is 11 @, @ 000 mm ( 36 ft 1 in ) and the center wheel distance in the bogies is 2 @, @ 800 mm ( 9 ft 2 in ) . The wheel diameter is 1 @, @ 125 mm ( 3 ft 8 @. @ 3 in ) ? this is 25 mm ( 0 @. @ 98 in ) larger than the Re 460 . The EI 18 has a Knorr HSM mechanical braking system , but unlike the Swiss versions does not have a rail brake . The design of the locomotive was by the Italian company Pininfarina . The machine room is designed with a center aisle , the driver 's cabs have pressurization applied to avoid air pressure dropping when running through tunnels , and the cabs are equipped with air conditioning .

EI 18 is a modification of the Swiss Re 460 . The class was originally built in 119 units from 1992 to 1995 for the Swiss State Railways , where it was given the brand Lok 2000 . It was part of a project to create a series of new intercity locomotives and cars . Bern ? Lötschberg ? Simplon @-@ Bahn received eight units in 1994 ( as Re 465 ) , the Finnish State Railways received 46 units between the years 1995 @-@ 2003 ( as Sr2 ) and the Kowloon ? Canton Railway Corporation received 2 units in 1997 . The units are designed to haul heavy passenger trains along existing curved railways at high speeds . It is designed as a universal locomotive , so it is also suitable for freight trains .