

= lore =

lore , often stylized IORE , is a class of 26 electric locomotives built by Adtranz and its successor Bombardier Transportation for the Swedish mining company LKAB 's railway division Malmtrafik . The class is a variation of Adtranz 's Octeon modular product platform , thus related to Bombardier 's later TRAXX platform . The locomotives haul iron ore freight trains on the Iron Ore Line and Ofoten Line in Sweden and Norway , respectively . The 8 @, @ 600 @-@ tonne ( 8 @, @ 500 @-@ long @-@ ton ; 9 @, @ 500 @-@ short @-@ ton ) 68 @-@ car trains are hauled by two single @-@ ended Co ? Co ? locomotives , each with a power output of 5 @, @ 400 kW ( 7 @, @ 200 hp ) . Each operates with 600 kilonewtons ( 130 @, @ 000 pounds @-@ force ) tractive effort and has a maximum speed of 80 km / h ( 50 mph ) . Delivery of the first series of 18 locomotives was made from 2000 to 2004 , and they replaced some of the aging Dm3 and EI 15 units . In 2007 , eight more vehicles ( 4 double units ) were ordered , with production to be completed by 2011 , by which time , another four double units were ordered . These units are scheduled to be delivered from 2013 to 2014 .

= = History = =

The Ofoten Line and the Iron Ore Line are two railroad lines which were built to allow iron ore to be hauled from the LKAB 's mines in Kiruna , Svappavaara and Malmberget in Sweden to Luleå on the Baltic Sea in Sweden and to Narvik on the Norwegian Sea in Norway . Historically , these lines were operated by the Norwegian State Railways ( NSB ) in Norway and the Swedish State Railways ( SJ ) in Sweden , but in 1996 the operations , but not the infrastructure , were transferred to the new company Malmtrafik i Kiruna ( MTAB ) , a joint venture between LKAB , NSB and SJ , and its Norwegian subsidiary Malmtrafikk ( MTAS ) . At the time , the line was using EI 15 and Dm3 locomotives .

In 1998 , LKAB estimated a steady 35 % increase in iron ore production until 2005 , and requested that the governments grant sufficient funding to upgrade the lines from 25 @-@ tonne ( 25 @-@ long @-@ ton ; 28 @-@ short @-@ ton ) to 30 @-@ tonne ( 30 @-@ long @-@ ton ; 33 @-@ short @-@ ton ) maximum permitted axle load . Combined with new locomotives , this would give increased efficiency in hauling the ore from the mines . The upgrade was estimated to cost 180 million Norwegian krone ( NOK ) for the Ofoten Line alone .

In March 1998 , LKAB awarded the contract to build 750 new 100 @-@ tonne hopper cars to Transnet of South Africa . In August , an agreement was reached whereby LKAB would pay NOK 100 million of the NOK 130 million needed to upgrade the Ofoten Line . The contract to deliver 18 locomotives was signed with Adtranz Switzerland on 15 September 1998 . In 1999 , LKAB bought SJ 's and NSB 's share in MTAB .

The first two sections were delivered by Adtranz in August 2000 , and was subjected to intensive tests before the manufacture of the rest of the series . Commissioning concluded in December 2000 , the locomotive started regular service on 10 January 2001 , and started operation with the new hopper cars and 30 @-@ tonne ( 30 @-@ long @-@ ton ; 33 @-@ short @-@ ton ) axle load on 7 March 2001 . In May 2001 , Bombardier Transportation took over Adtranz . Bombardier delivered the rest of the lore series from 2002 to 2005 . In March 2004 , LKAB decided not to purchase additional hopper cars from Transnet , and instead purchased 750 heavier cars from K @-@ Industrier . Since 1969 , the ore trains have been using the Soviet SA3 coupler . However , LKAB wanted to also try Janney couplers ( also known as AAR coupler , used in much heavier trains in USA and South Africa ) , as the SA3 couplers were not much tested with the new weights . While the first pair of locomotives had Janney couplers , the rest of the first batch were equipped with SA3 couplers to handle the existing hopper cars , and later retrofitted with Janney couplers . In 2004 , the EI 15 locomotives were sold to Hector Rail .

On 23 August 2007 , LKAB ordered another four twin units , with delivery in 2010 and 2011 , and costing ? 52 million . These will replace all remaining Dm3 locomotives by 2011 , and LKAB convert all the ore trains to 68 cars . This will increase the capacity from 28 to 33 million tonnes per year ,

and at the same time reduce the number of departures per day from 21 to 15 .

The name lore is a mixture between the term Iron ore , and the fictional character Eeyore from Winnie @-@ the @-@ Pooh , spelled I @-@ or in Swedish .

= = Specifications = =

The lore class was a cold @-@ adapted and heavy @-@ haul derivation from Adtranz 's Octeon modular electric locomotive platform , which was launched in 1998 on the basis of Adtranz 's latest models for Deutsche Bahn at the time . Adtranz and later Bombardier Transportation conducted the final assembly of the locomotives at Kassel , Germany . When Bombardier Transportation introduced the brand name TRAXX for its updated modular locomotive platform , the type designation TRAXX H80 AC was applicable to the lore class , however , it was excluded from the TRAXX family by the time of the second batch order in 2007 . The manufacturer has also referred to the locomotive type as the Bombardier Kiruna .

Each lore consists of twin units with one driver 's cab at each . They normally operate in fixed units of two , making a pair capable of hauling a 8 @,@ 600 @-@ tonne ( 8 @,@ 500 @-@ long @-@ ton ; 9 @,@ 500 @-@ short @-@ ton ) ore train . Technically an lore section is also capable to operate as single locomotive , an option that is seldom used in operation . The units are fed with 15 kV 16 2 ? 3 Hz AC via a pantograph . The power is transformed and then converted via a single water @-@ cooled gate turn @-@ off ( GTO ) thyristor based converter per bogie . The converters belong to the Camilla family , which was developed by ABB 's Swiss branch as successor for its oil @-@ cooled converters , and found previous use in the FS Class E464 . The converters operate independently , with their own cooling and control systems and are shut down automatically in case of failure . The converters consist of seven line @-@ replaceable unit modules to minimize maintenance costs . Each locomotive has six three @-@ phase asynchronous alternating current traction motors , each rated at 918 kW ( 1 @,@ 231 hp ) and each powering a single axle . This gives a Co ? Co ? wheel arrangement . The tractive effort of each locomotive is 600 kN ( 130 @,@ 000 lbf ) and the maximum dynamic braking effort is 375 kN ( 84 @,@ 000 lbf ) . There is also a boost function , allowing a temporary traction effort of 700 kN ( 160 @,@ 000 lbf ) . The units are capable of 80 km / h ( 50 mph ) in single runs , 70 km / h ( 43 mph ) with empty trains and 60 km / h ( 37 mph ) with loaded trains .

The locomotives are 22 @.@ 905 m ( 75 ft 1 @.@ 8 in ) long , 4 @.@ 465 m ( 14 ft 7 @.@ 8 in ) tall and 2 @.@ 950 m ( 9 ft 8 @.@ 1 in ) wide . The distance between the bogie centers is 12 @.@ 890 m ( 42 ft 3 @.@ 5 in ) and the bogie wheel @-@ base is 1 @.@ 920 m ( 6 ft 3 @.@ 6 in ) . The wheel diameter is 1 @.@ 250 m ( 4 ft 1 @.@ 2 in ) when new and 1 @.@ 150 m ( 3 ft 9 @.@ 3 in ) when worn . Each locomotive weighs 180 tonnes ( 180 long tons ; 200 short tons ) , of which 38 tonnes ( 37 long tons ; 42 short tons ) is electrical equipment . Each locomotive has 30 tonnes ( 30 long tons ; 33 short tons ) of dead weight to increase the locomotive 's weight to the maximum axle weight , and further weight increase has been achieved by making the walls 4 centimetres ( 1 @.@ 6 in ) wide with armored steel . The extra wall thickness also provides for increased structural strength , to withstand collisions with snowdrifts and elk . The sides of the walls were built as flat as possible to reduce the sticking of blowing snow and ice formation .

The auxiliary system is powered via a separate transformer winding feeding three independent insulated gate bipolar transistor ( IGBT ) converters each providing a three @-@ phase 400 volt system . The locomotive is designed with an open system architecture that can be adapted later . Diagnostic information is available to the driver and can be sent to the control center via GSM @-@ R . The locomotive has a large and bright cab with space for up to three people . The second series of locomotives have an improved driver 's chair , which has been retrofitted on the older trains . The machine room has a center hallway . All high @-@ current equipment is located behind a door which can only be opened with a special key . This key is locked in such a way that it cannot be accessed without grounding the locomotive , and similarly the locomotive cannot be ungrounded again until the key is back in place .

= = Operation = =

LKAB operates iron ore mines in Kiruna , Svappavaara and Malmberget in Norrbotten County , Sweden . Most of the output is transported by rail to the ice @-@ free Port of Narvik , a route named the Northern Circuit . A minority of the ore is transported to Luleå on the Southern Circuit . Located on the Baltic Sea , ore is shipped to Baltic customers , or delivered to furnaces operated by SSAB in Luleå and Oxelösund . The Iron Ore and Ofoten Lines are 536 km ( 333 mi ) long , including the branch to Svappavaara , with the route from Kiruna to Narvik being 170 km ( 110 mi ) , and from Malmberget to Luleå being 220 km ( 140 mi ) . Operations are handled by LKAB 's subsidiary Malmtrafik i Kiruna ( MTAB ) in Sweden , and Malmtrafikk ( MTAS ) in Norway . As of 2010 , six pairs of the first batch lore locomotives operate 11 to 13 trains daily in each direction on the Northern Circuit , and the remaining three pairs of the first batch operate five to six trains on the Southern Circuit . The four pairs of second @-@ batch locomotives will replace Dm3 locomotives on the Northern Circuit by 2011 .

The trains hauled by lore are 68 cars long and weigh 8 @,@ 600 tonnes ( 8 @,@ 500 long tons ; 9 @,@ 500 short tons ) . From Riksgränsen on the national border to the Port of Narvik , the trains use only a fifth of the power they regenerate . The regenerated energy is sufficient to power the empty trains back up to the national border . Although the trains and hopper cars are all owned by LKAB , the line is owned by the Swedish Transport Administration and the Norwegian National Rail Administration . The Iron Ore and Ofoten Lines are also used by passenger and container trains .