

= OS MX3000 =

MX3000 is an electric train used on Oslo Metro in Oslo , Norway . The multiple units are produced by Siemens , who started serial delivery in 2007 . Seventy @-@ eight three @-@ car units have been ordered by Kollektivtransportproduksjon , and five by Akershus County Municipality . They replaced the older T1000 and T1300 stock that was used on the Oslo Metro since 1966 . By 2010 , the last T1000 and T1300 trains have been retired and replaced by 83 three @-@ car units . 32 additional sets were ordered , and the final train set was delivered in 2014 , increasing the fleet to 115 units .

The trains are built as units of three cars , though they are often operated as double units . Empty 12 wagons ( four unit ) trains are seen every night , going from the main service area at Ryen to Stortinget metro station , where they are ready to be decoupled into shorter trains for the next day . The units are 54 @.@ 14 meters ( 177 ft 7 in ) long , and weigh 98 tonnes ( 96 long tons ; 108 short tons ) empty . They have a power output of 1 @, @ 680 kilowatts ( 2 @, @ 250 hp ) , allowing speeds of 70 km / h ( 43 mph ) . Seated capacity is 138 seats , and total capacity is 493 passengers . New features for the Oslo Metro introduced with the MX3000 include air conditioning ( only in the driver 's cab ) , air suspension , regenerative brakes and batteries for operating at the depot . The first series of 33 units were ordered in 2003 , followed by an additional order for 30 in 2005 , 15 in 2008 , and 32 in December 2010 . The trains have been financed by Oslo Package 2 , and each unit costs about NOK 45 million .

= = History = =

In 1966 , the Oslo Metro opened as an upgrade of two existing suburban tramways , the Østensjø- and Lambertseter Lines . By 1970 , the system was supplemented by the Grorud- and Furuset Lines . They only operated to the eastern suburbs . In 1987 , the system was expanded to connect to the western network , that remained a suburban tramway with overhead wires , two @-@ car platforms and an inferior signaling system . In 1993 , the Sognsvann Line was converted to metro standard , with the Røa Line following two years later . When the order for the MX3000 trains was placed , the Kolsås- and Holmenkoll Lines still used overhead wires , and would not be able to use the new stock . Both systems were at the time being considered for conversion to light rail systems , that would connect to the Lilleaker- and Ullevål Hageby Line , respectively .

The old fleet of T1000 and T1300 consisted of 195 cars in eight series . The T1000 was the original series delivered between 1966 and 1978 , while the T1300 was a later adoption built until 1987 . The T1000 series has only a third rail shoe , while the T1300 also has a pantograph , and could be used on the Kolsås- and Holmenkoll Lines . In 1995 , six two @-@ car T2000 units were delivered for the Holmenkoll Line . They were , at the time , proposed as a possible replacement for all the T1000 and T1300 stock , but were prone to technical problems . They featured both third rail shoes and pantographs .

In 1996 , the work to establish a financing package for new investments in public transport in Akershus and Oslo started . It was passed , in 2001 , by the city and county councils , as well as the Norwegian Parliament . Oslo Package 2 allowed municipal and state grants to be supplemented by increased fare and toll road revenue to finance , among other things , new trains for the metro . The initial order by Oslo Sporveier was for 33 units ( or 99 cars ) , and was approved by the board on 28 June 2003 . The initial order cost NOK 1 @.@ 6 billion , and included options for further orders . Five other manufactures had been rejected during the procurement process . Combined with other investments in the network , the new trains will allow faster travel times on the metro .

In 2005 , the city council voted to replace all existing T1000 and T1300 stock with the MX3000 , increasing the quantity by another 30 units . With the second order , the price had increased to NOK 2 @.@ 5 billion . Two test units were delivered in October 2005 , and the serial production started in April 2006 , with the first deliveries in April 2007 . With the delivery of the new trains , Oslo Sporveier received criticism that they had been disloyal to the old red color of the metro , and that they did not follow up on their former design concept from the 1960s through the 80s . During the first 30 days ,

there occurred two errors : one in the closing mechanism of the doors , and one with a switch in the cab that was not water tight . However , it turned out that Oslo Sporveier had not been accurate enough in specifying the energy consumption of the trains , and the rectifiers on parts of the line needed to be upgraded to supply sufficient power to the trains . During 2007 , there were four incidents where the trains were not able to brake at stations . The worst incident occurred when a train slid the 1 @. @ 3 kilometers ( 0 @. @ 81 mi ) from Blindern to Majorstuen .

Following the 2006 decision to convert the Kolsås Line to metro standard , Akershus County Council announced they would order five units . In November 2006 , the city government proposed that the maintenance of the new trains be privatized . This resulted in protests from the employees , who campaigned by refusing to work overtime . As a result , after a few weeks , the company lacked 57 trains to provide adequate service . The issue was solved when the socialist opposition parties along with the Liberal Party agreed to postpone the matter until after all the new trains were delivered in 2009 . As part of the agreement , a new limited company , Oslo Vognselskap , wholly owned by Kollektivtransportproduksjon , would take ownership of all metro trains and trams used by the operating companies Oslo T @-@ banedrift and Oslo Sporvognsdrift , the latter being the operator of the tramway . Responsibility for the debt accumulated for buying the trains is to be managed by Oslo Vognselskap , while operation and management of the maintenance contracts was transferred to Oslo T @-@ banedrift .

In January 2008 , an addition 15 units were ordered by Oslo , with an option for further orders later . This will allow all the eastern lines to have a 7 @. @ 5 @-@ minute headway on their services into the city center , instead of the current 15 @-@ minute headway . Trains would start using the balloon loop located at Stortinget , and the western lines will continue to have a 15 @-@ minute headway . At the same time , the trains serving the Ring Line will be extended to six cars . The order cost NOK 675 million . In addition , Akershus finalized their order for five units , costing NOK 240 million . Unlike the Oslo @-@ owned units , Akershus ' five units will be owned by the transit authority Ruter . The same year , the city council in Oslo decided to upgrade the Holmenkoll Line to metro standard , to allow six @-@ car MX3000 trains to be the main mode of transport to Holmenkollen during the FIS Nordic World Ski Championships 2011 . This allowed 9 @, @ 000 people per hour to be transported to the sports venue . In 2009 , the T2000 units were taken out of service , and on 22 April 2010 the last T1300 was taken out of service , making the MX3000 the only units to be used on the Oslo Metro . The city council was considering ordering 15 additional MX3000 to replace the T2000 , as an alternative for a NOK 50 @-@ million renovation .

In November 2010 , the Accident Investigation Board Norway criticized the braking system of the trains . During 2009 , there were 83 incidents where trains with locked wheels slid down steep sections of track . The Accident Investigation Board found that the metro had conducted insufficient testing of the braking system on steep slippery lines , had not adjusted the brakes satisfactorily , and had not maintained the trains and tracks sufficiently . In December 2010 , Oslo Vognselskap ordered another 32 three @-@ car units , bringing the total order up to 115 three @-@ car units . The last trains will be delivered in 2012 . There was political disagreement regarding the final purchase , with the Liberal Party and socialist opposition securing a majority for the purchase , while the right @-@ winged parties voted to order 19 units . The extra trains will make it possible to run all lines except the Holmenkollen Line ( Line 1 ) with six @-@ car lines , compared to a situation with only three @-@ car trains on the Lambertseter Line , the Ring Line and the Kolsås Line ( lines 4 and 6 ) would only use three @-@ car trains .

= = Specifications = =

The MX3000 is a three @-@ car electric multiple unit built exclusively for the Oslo Metro by Siemens in Vienna , Austria . It is a modification of trains used on the Vienna U @-@ Bahn . The units are designed by Porsche Design Studio . Unlike the red predecessors , the trains are painted white with black and grey detailing . The chassis is in aluminum . A three @-@ car train is 54 @. @ 14 meters ( 177 @. @ 6 ft ) long ; the end cars are 18 @. @ 11 meters ( 59 @. @ 4 ft ) long each , while the center car is 17 @. @ 92 meters ( 58 @. @ 8 ft ) long . The cars are 3 @. @ 16 meters ( 10

@. @ 4 ft ) wide and 3 @. @ 68 meters ( 12 @. @ 1 ft ) tall . An empty three @- @ car unit weighs 98 tonnes ( 96 long tons ; 108 short tons ) , while it with full payload weighs 147 tonnes ( 145 long tons ; 162 short tons ) . This gives a maximum axle load of 12 @. @ 5 tonnes ( 12 @. @ 3 long tons ; 13 @. @ 8 short tons ) .

Each three @- @ car unit has 138 seats , and a total capacity of 493 passengers . The height of the floor is 1 @. @ 12 meters ( 3 ft 8 in ) above the track , allowing step @- @ free access to the platforms . There are three doors on each side of each car , measuring 1 @, @ 300 millimeters ( 51 in ) wide and 1 @, @ 900 millimeters ( 75 in ) high . Unlike the older T1000 trains , the triple @- @ car configuration allows passengers to walk between the cars . Combined with a better spatial design , it reduces the feeling of crowding . The MX3000 also introduced air conditioning in the driver 's cab . The units run either in single configuration ( with three cars ) or in multiple ( with six cars ) .

Each car is equipped with four three @- @ phase asynchronous 140 @- @ kilowatt ( 190 hp ) motors , giving each three @- @ car unit a power output of 1 @, @ 680 kilowatts ( 2 @, @ 250 hp ) . In each car , the four motors are fed by the car 's own insulated @- @ gate bipolar transistor . They transform the 750 volt direct current collected from the third rail shoe to the three @- @ phase alternating current used in the motors . The frequency and amplitude of the current fed to the engines varies depending on the train 's speed . The MX3000 introduced regenerative brakes , that allow the electromagnetic brakes to feed power back to the power supply when braking . In addition , there is a back @- @ up disc brake on each axle . Acceleration in the range 0 to 40 kilometers per hour ( 0 to 25 mph ) is limited to 1 @. @ 3 meters per second squared ( 4 @. @ 3 ft / s<sup>2</sup> ) . In this phase , the fully loaded train uses 5 @. @ 0 kiloampere . For use in areas without a third rail , such as at depots , the trains are equipped with a 110 V battery . This removes the need for shunting at the depots , and makes maintenance more cost efficient . Energy usage is reduced by 30 % , estimated to save the operating company NOK 13 million per year , compared to using the old stocks .

There are two bogies per car , each with two axles . The wheel diameter is 850 millimeters ( 33 in ) for new wheels , and 770 millimeters ( 30 in ) when fully worn @- @ down . The center distance between the bogies is 11 @. @ 00 meters ( 36 @. @ 09 ft ) . The primary suspension is steel coil spring between the axles and the bogies , with a secondary air suspension between the frame and the bogies . The latter , which the MX3000 was the first to use on the metro , gives reduced noise , better comfort and makes it possible to adjust the height with changed passenger weight .

The units are controlled by a distributed system connected by a double multifunction vehicle bus . It has two vehicle control units , that monitor and control all main functions of the train ; in addition , there are systems for controlling the brakes , traction , doors , ventilation , passenger information system and compressor . Like the older stock , the train 's speed is controlled by an automatic train protection ( ATP ) system . The speed codes are transferred from the ATP points in the infrastructure , using 75 hertz pulses in the tracks . The trains pick up the signals via antennas . The speed codes are 15 km / h ( 9 @. @ 3 mph ) , 30 km / h ( 19 mph ) , 50 km / h ( 31 mph ) and 70 km / h ( 43 mph ) . They are informed to the engineer via signals in the driver 's cab ; in addition , the system will automatically reduce the speed , should the limit be exceeded . The driver can put the trains in an automatic mode , where the train itself adjusts the trains speed to the speed limit . The driver is always responsible for starting and halting the train at stations . The driver 's cabs are more ergonomic than in the T1000 , and the mirrors to monitor the platforms have been replaced with cameras and screens .

= = Numbering = =

The first 99 train sets were numbered 3001 to 3099 . When the 100th set was delivered the numbering continued with 30100 and will continue with 30101 and so on . Many of the train sets have also been given a girls ' name .

The three individual cars that make up a train set are distinguished by the second digit . For example , train set 3001 consists of the cars 3101 , 3201 , and 3301 .

