

= VR Class Sm3 =

The Sm3 Pendolino (originally branded as Pendolino S220 , and usually referred to simply as the Pendolino) is a class of high @-@ speed body @-@ tilting trains operated by VR Group . It is a member of the Pendolino train family ; its design is based on the ETR 460 . The first two trainsets were assembled in Finland by Rautaruukki @-@ Transtech in the mid @-@ 1990s . The rest of the series of eighteen EMUs were built by FIAT Ferroviaria (later Alstom) between 2000 and 2006 . The trains serve most of Finland 's major cities such as Helsinki , Turku , Oulu and Joensuu with a maximum speed of 220 km / h (140 mph) , although this speed is only attained between Kerava and Lahti . The train has a power output of 4 @,@ 000 kW (5 @,@ 400 hp) and weighs 328 tonnes (323 long tons ; 362 short tons) .

The Sm3 had a long prototype phase before the main series was ordered , with reliability issues being brought up by the press from time to time . Negative reporting continues to haunt the series ' reputation . Reliability problems cannot be proven , as no statistics of specific train types are available . The train has not managed to cope with harsh Finnish weather conditions , and the time benefit of the tilting mechanism will not be taken into account in timetables of winter 2011 ? 2012 . Nevertheless , the Sm3 has also received positive feedback from passengers and has led to increased operating speeds on the Finnish rail network .

= = History = =

= = = 1992 : Ordering = = =

VR announced its 2 billion Finnish Mark Pendolino order on 7 February 1992 , consisting of two firm orders and twenty @-@ three options . ABB 's X 2000 was considered in addition of the Italian train ; the latter was chosen due to its lower price (70 million FIM per unit) and because it was already running . Only these two tilting trains were considered due to the twisting nature Finland 's railway network . Thanks to its tilting mechanism , the Pendolino ? unlike such other European high @-@ speed trains like the TGV , Thalys , and AVE ? does not need to run on specialised high @-@ speed lines , which was important to VR ; instead , it runs on existing lines , and was expected to surpass the speed attained by traditional trains by 35 % . This has both beneficial and negative consequences . The trains cannot run at as high a speed as , for example , the TGV , due to the lines . However , the Pendolino can also run alongside normal non @-@ tilting trains , allowing for greater use of the railway . Building trains that could ensure passenger comfort at high speed on these routes by tilting through the curves was seen as a much cheaper solution than reconstructing the railway network itself due to Finland 's low population and long distances . The train was originally called the Sm200 , but in May 1995 it was officially named Sm3 according to VR 's nomenclature for multiple units .

It was expected that the train would , as in Italy , run at a maximum speed of 250 kilometres per hour (160 mph) and significantly shorten the travel times between major cities . As an example , the 2 hour and 7 minute travel time between Helsinki and Turku was expected to drop to 1 : 28 by 2010 ; however , the top speed of the train was limited to 220 km / h (140 mph) and the advertised times were never achieved . As of July 2011 , 1 : 44 is the fastest train link between the two cities (on the S 126) .

= = = 1993 ? 1997 : Testing the prototypes = = =

A test carriage from an ETR 460 arrived by boat into Finland from Italy in March 1993 . It was used to test how the Pendolino would cope with Finland 's winter and rail network by running it in Northern Carelia between Nurmes and Viekki . The carriage had to be fitted with new bogies over night at Hanko as it was designed for standard gauge instead of the broader Finnish 1 @,@ 524 mm (5 ft) gauge . Another carriage was built by Transtech according to the specifications of the new train (

nomenclature KOEV from koevaunu , test carriage) . It was later included in the first completed unit as the fourth car , TT 7401 . Before a full trainset was finished , some test runs were made with only the first three carriages of the train in late 1994 .

The first finished train was unveiled to the press on 14 October 1994 , and the first two trainsets started their regular test traffic on 27 November 1995 between Helsinki and Turku on the coastal track . Test traffic was stopped only after three months , at the end of February 1996 , due to technical difficulties with the trains . Testing later resumed , and VR announced in 1997 that it would start normal operations with the Pendolino despite electrical problems . The ability of the train to cope with the Finnish winter was put into question , but VR denied that coldness had been a factor in the electrical failures .

= = = 1997 ? 2006 : The main series = = =

Testing ended in August 1997 , after the two trainsets had covered a total of 815 @, @ 000 kilometres (506 @, @ 000 mi) during 3 @, @ 870 trips between Helsinki and Turku . Only six of three thousand journeys were terminated due to technical issues . VR 's CEO Henri Kuitunen was positive about the new train in 1998 , stating that passengers feel it has been a good purchase . Passenger numbers rose by 17 % between Helsinki and Turku in 1997 .

Eight additional Pendolinos were ordered at the end 1997 at the price of FIM 77 million per train (? 13 million) . They were delivered between 2000 and 2002 . The main series trains differed in various ways from the prototypes . The new trains allowed Pendolino traffic to extend : they started running between Helsinki and Jyväskylä on 22 October 2001 . In June 2002 , the network was expanded further , and routes were continued from Tampere onwards to Oulu and from Jyväskylä to Kuopio . One of the main series trains (number 7x08) was damaged during maritime transport in October 2001 . The badly secured train had come loose during a storm on the Atlantic , almost causing the loss of M / S Traden , the ship carrying it . Thanks to good actions of the ship 's crew , it was able to reach Le Havre and the train was sent back to Italy to be repaired .

Not all passengers were happy with the new train . In 2005 , a delegation of commuters between Helsinki and Tampere collected criticism from fellow passengers on the Internet and delivered it to VR 's head of passenger transport Antti Jaatinen . The delegation 's leader , Kaj @-@ Erik Fohlin , had made 30 trips between the two cities in January 2005 using the Pendolino , 12 of which had been on schedule .

The last eight trains were ordered in 2002 and delivered in 2004 ? 2006 , finalising the fleet of 18 trains . At that point it had become clear that the speed limits on the rail network were mostly too low for the trains to run at their maximum operating speed , even though they were chosen specifically to prevent the costly work of straightening existing lines . Work on lines has continued , and , on modernised lines , the speed difference between the Pendolino and non @-@ tilting trains has become minimal . The Sm3 was able to attain its maximum operating speed in regular traffic only in 2006 , when a new rail line was opened between Kerava and Lahti and the full Pendolino fleet was available . Seven of the original 23 options never came to be .

= = = 2006 onwards : The New Train Era = = =

VR advertised the arrival of the full Pendolino fleet with the slogan " New Train Era " (Finnish : Uusi juna @-@ aika) . It started on 3 September 2006 , when the line between Kerava and Lahti was officially opened and timetables changed to take the full potential of the Sm3 into account . Travel times between Helsinki and eastern Finland were cut by up to an hour .

The Pendolino has received bad publicity since the first units were taken in service for its serious reliability issues , mostly caused by technical problems with the tilting system and the couplers . The coupling problems grew particularly important with the expansion of the Pendolino network in 2006 , requiring rapid on @-@ the @-@ fly coupling of two trains at intersection stations . Because the units often could not be coupled the train units had to be run as two separate trains running one after another . This consumed one extra train slot on the heavily used rail sections causing

cascading timetable delays . Sometimes two trains would not separate after coupling them , caused by moisture in the couplers . Due to the problems VR ended the practice of coupling Pendolino trains on @-@ the @-@ fly at the two intersection stations ; in Tampere in late 2007 and in Kouvola during autumn 2008 .

VR has given mixed statements about the fault @-@ sensitivity of the train . Pentti Kuokkanen , project coordinator of VR Engineering downplayed the problems when questioned about the reliability of another Fiat Ferroviaria multiple unit , the Sm4 , in 1999 . According to him , the Pendolino had been VR 's most reliable passenger train during winter 1998 ? 1999 . In 2006 , VR 's CEO Henri Kuitunen affirmed that the Pendolino was causing serious image problems to VR Group . In 2010 , the company 's head of traffic control Mauno Haapala stated that the Sm3 was not more fault @-@ sensitive than their other trains . However during winter 2011 , VR Group 's head of service and production department Pertti Saarela gave a totally different answer , saying that Pendolinos are more prone to failures especially during winter . It is impossible to know if the train has more problems than VR 's other rolling stock , as the company does not give out punctuality statistics for specific train types .

In the 2010s , the novelty of the Pendolino has worn off and VR has even used the train in regional traffic between Oulu and Rovaniemi due to rail works in summer 2011 . The problematic tilting mechanism was not used during winter 2010 ? 2011 and the time benefit of the tilting was not taken into account in timetables of winter 2011 ? 2012 .

On 19 August 2011 , VR announced it would start a refurbishment of all its Sm3 units to improve the operating conditions during winter . The work will be done between 2012 and 2014 and will cost 10 million Euros . Alstom will cover half of the expenses . The problematic couplers will be changed to allow trains to be coupled on @-@ the @-@ fly again at intermediate stations . Heaters will be installed in the trains ' undercarriages to prevent the formation of ice during the winter . In addition to these modifications , the tilt angle of the bogies will be lowered from the current eight degrees . The operating speed of the train will remain the same . As of January 2013 , new couplers have been installed in at least Sm3 units 7x12 and 7x18 .

Pendolino traffic on the coastal track ended in December 2012 . The two remaining services were replaced with InterCity trains , which run at similar speeds .

= = Technical information = =

With its eight asynchronous three @-@ phase AC motors delivering 4 @, @ 000 kW (5 @, @ 400 hp) to move its weight of 328 tonnes (323 long tons ; 362 short tons) , the Sm3 does not accelerate particularly fast , reaching 200 km / h (120 mph) from a standstill only after 3 minutes and 13 seconds and a distance of 6 @. @ 8 km (4 @. @ 2 mi) . The tilting mechanism lets the body tilt up to 8 ° at speeds of over 70 km / h (43 mph) , which helps to lessen the G @-@ forces in the corners and allows the train to achieve its maximum speed of 220 kilometres per hour (140 mph) . According to VR , the tilting system enables a 30 to 40 % higher speed compared to traditional trains . The highest speed ever reached by the class has been 242 km / h (150 mph) during testing .

Each train consists of six cars , from front to back : IM , CM , TTC , TT , CM and IM . The IM class carriages at each end of the train are powered and fitted with a driver 's compartment . The CM class is a powered passenger car . Class TTC is unpowered , it is equipped with a pantograph and a restaurant . The TT class is an unpowered passenger car which has also a pantograph on its roof . Each of the powered carriages is fitted with one motor on each of the two bogies . If needed , two trains can be coupled together .

The prototype and series trains have various differences . The number of seats was increased from 264 to 309 by changing the seat configuration in second class from 2 + 1 to 2 + 2 . The information screens on the outside of the carriages were moved from the center of the carriages to next to the doors . There are also differences with the light switch logic , which often leads to the trains running with both front and tail lights on at the same end . The prototypes differed also originally by their restaurant car and Extra class features . They were modified in the mid @-@ 2000s to be similar to

the series trains .

The doors of the two prototype trains were changed in 1999 as they were not working properly .

VR does the maintenance work of the trains itself , getting expert advice from Alstom as needed . The work is done in Helsinki and Turku .

= = Services = =

The Pendolino is designed as a premium facility train . The seats are fitted with audio sockets for radio and music channels ; however the radio service was dropped in 2010 due to low usage . All seats have electricity sockets for laptops and mobile phones . All Sm3 trains offer a free onboard Wi-Fi Internet access since 2010 . The passenger information monitors over the aisle in the carriages show a clock and the train 's current speed in addition to VR 's marketing material and station information . They are also used to convey passenger information for the deaf . The train is accessible for wheelchairs , contains pet spaces and seats for allergic passengers .

The train has an onboard bistro , named Prego . It has an Italian theme and serves Italian style beverage and food in addition to more common Finnish snack bar dishes . Extra class passengers have access to a self service counter with coffee , tea and the day 's newspapers . Each train has also a closed off conference compartment for business groups .

= = Routes = =

The trains are distinguished in Finnish railway timetables by the letter S. The Pendolino network radiates out from the capital Helsinki . Five main routes serve most of Finland 's big cities :

Regular service

Helsinki ? Oulu (? Rovaniemi)

Helsinki ? Vaasa

Helsinki ? Jyväskylä ? Kuopio

Helsinki ? Kouvola ? Kuopio

Helsinki ? Joensuu

Former routes

Helsinki ? Turku from 27 November 1995 to 8 December 2012

The newest service between Helsinki and Vaasa started on 12 December 2011 , with the completion of the electrification work on the Seinäjoki ? Vaasa line .

The trains can run at speeds up to 200 km / h (120 mph) on routes between Helsinki and Seinäjoki , Helsinki and Turku and Lahti and Luumäki as lines are being upgraded . Only the line between Kerava and Lahti permits operation at the maximum speed of 220 kilometres per hour (140 mph) .

= = Livery = =

At least two livery variants were tested on scale models , which were later exposed at VR 's conference centre at Helsinki central railway station : one has a red strip for the whole length of the train , with the window backgrounds painted grey . The other is more similar to the final result , but the front of the train includes more red and no grey paint at all . VR finally settled to a combination of both of them , which bore resemblance to the company 's InterCity livery . The bottom of the carriages is dark grey , with a red stripe distinguishing it from the white base colour . The top of the carriages is painted grey . Red colouring at the end of each car forms red parallelograms when the carriages are combined . When asked why the trains were not blue and white , VR 's CEO answered that red and white fits the train and its design the best .

The trains were originally marked with only a V instead of the full VR logo to symbolise the company 's high speed transport . The same logo was also used on the Sr2 locomotive . The text " Pendolino S220 " was written on the units according to the train 's original branding . On later units , VR 's logo was fully painted (the same happened with the Sr2) and " S220 " dropped .

Since 2009 , VR has been repainting its fleet in new colours according to its changed visual identity

. Green colour has replaced red , and each car now has two green parallelograms instead of one larger figure between carriages . Artwork showcasing Finnish nature decorates them . As of December 2012 , Sm3 units 7x01 to 7x04 , 7x06 to 7x10 and 7x12 have been repainted in the new livery .

= = Incidents and accidents = =

On 9 January 2003 an improperly locked door came loose in a high speed tunnel at Perniö . No one was injured in the accident . The settings of all Sm3 doors were checked by the operator in the following days .

A Sm3 derailed near Karjaa on 25 July 2003 due to a defect in a turnout . The train derailed at a low speed after mechanics turned the turnout blades manually into the correct position , but forgot to check the turnout frog , which was set to a diverging track . The first three carriages of the train derailed completely , in addition to the first bogie of the fourth car .

= = Sm6 Allegro = =

In December 2010 , Karelian Trains , a joint venture by VR and RZhD , started a new service linking Helsinki to St. Petersburg , Russia using a new model of the Pendolino called the Sm6 Allegro . The Sm6 is technically based on the Pendolino Nuovo , but its looks are similar to the Sm3 . The most significant difference is that an Sm6 unit is composed of seven carriages . The train is capable of dual @-@ voltage running due to differences between the electric systems of the Finnish and Russian rail network and is equipped with four pantographs .

The Sm6 is reserved for international passengers and therefore cannot be used to travel inside of Finland . There are four trains per day in each direction .