

Steam around Switzerland. Part 9, SBB heavy freight locomotive type C 4/5

Autor(en): **Hardy-Randall, Malcolm**

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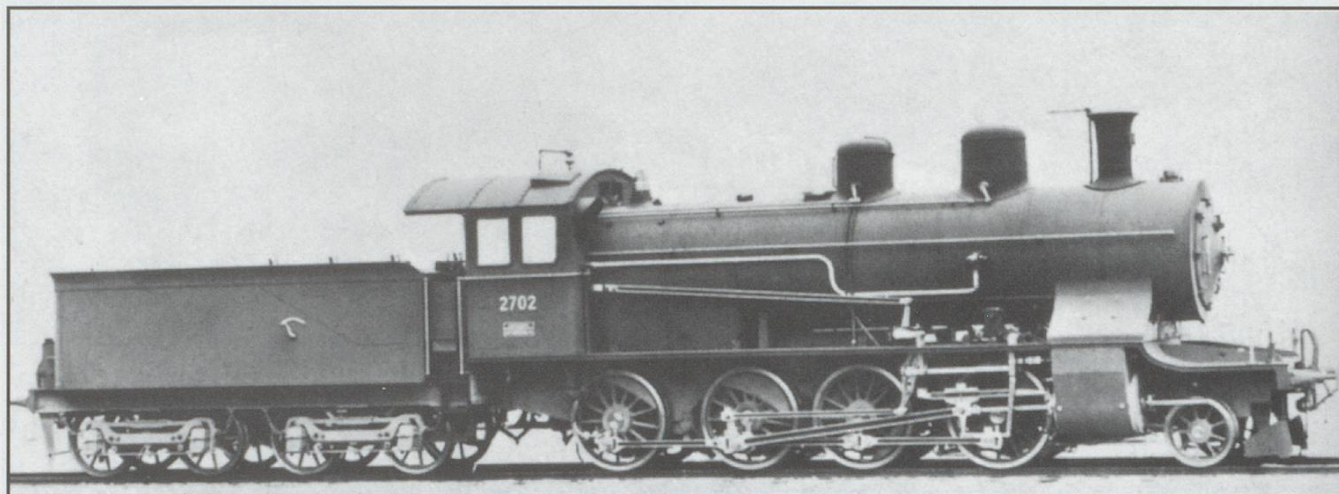
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**PART 9 - SBB HEAVY FREIGHT LOCOMOTIVE
TYPE C 4/5.**



FIRST SERIES. NOS: 2701 - 2732.

When the railway companies North East, Swiss Central, United Swiss and Jura Simplon were nationalised to form the Swiss Federal Railway in 1902, the resulting freight locomotive stock was clearly not up to the demands of the new company. To rectify this shortage the SBB placed an order with the locomotive manufacturer SLM in Winterthur for a locomotive more able to handle the heavy freight trains that were now needed.

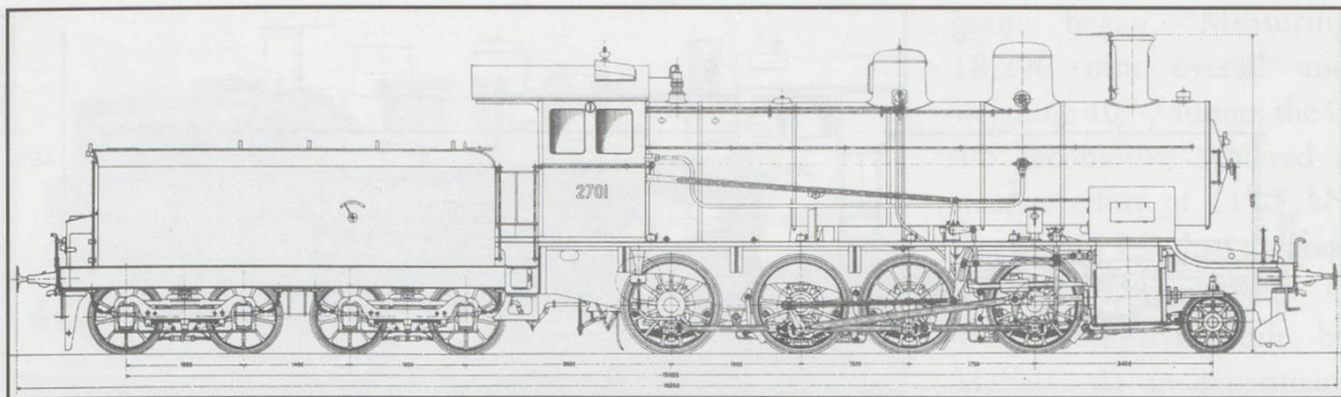
The design offered by SLM was a four-cylinder compound locomotive with driving wheels of 1,330 mm in diameter and an achievable tractive effort of approx. 10,000 kg. The proposed locomotive would have a top speed of approximately 65 km/h on level track and be able to haul a trailing load of slightly more than 200 tons at nearly 30 km/h on the 27 per mille sections of the national route such as that over the Hauenstein between Basel and Olten.

The SBB placed an order for 32 locomotives of this type to be produced during the period 1904 to 1906. Delivery took place in three batches with Nos. 2701 - 2703 being delivered in 1904, Nos. 2704 - 2723 delivered

in 1905 and the remaining locomotives in 1906.

The C 4/5 in this series was constructed as a four cylinder locomotive without superheating. The 4,200 mm long boiler controlled by Pop relief valves, located above the firebox, operated at a pressure of 14 bars. With the design of the boiler being based in almost every detail upon that chosen for the Jura Simplon A 3/5. The 28 mm thick main frame of the locomotive was supported on eight leaf springs mounted above the 1,330 mm diameter driving wheels. The four cylinders were mounted in line - according to the von Borries design - providing for short steam passageways between them. The inside high pressure cylinders powered the second driving axle and the outside low pressure cylinders powered the third axle. The balance of the drive mechanism on this locomotive was extremely good. Cylinder control was according to the Walschaerts principle.

The four-axle tender unit was as per the design for the Jura Simplon A 3/5 and was able to carry eight tonnes of coal and 17 m³ of water. Locomotive brakes comprised the standard screw system and the double action Westinghouse brake operating on four brake



shoes on driving axles 1 and 3 as well as on four brake shoes on the tender unit.

After seven years of operation the whole series was sent to the SBB workshops in Biel to have the Schmidt-type superheater fitted. At the same time various changes to the boiler

were made on several of the locomotives, with increases in the heating area up as high as 208 m² on number 2716, and the boiler pressure was increased to 15 bars.

Speed indication was provided by the Hausshälter system but this was changed later to the Hasler indicators. All locomotives were capable of providing steam heating for passenger trains. This series of locomotive was able to haul 660-tonne freight trains or 400-tonne passenger trains over the 10 per mille sections of the route; for the 27 per mille sections the trailing load fell to 180 tonnes for passenger and 200 tonnes for freight traffic.

The home workshop for all locomotives was Biel, but the locomotives themselves were based in Districts 1, 2 & 3. During the period 1942 - 45 a total of thirteen C 4/5 locomotives were transferred to the German Reichsbahn to work the southern sector of the German railways. Later, in 1945, having returned from Germany, some of the locomotives joined others from the series along with 23 of the type C 5/6 as part of the 36 locomotives offered to work on the SNCF to help with the shortage of motive power on that system caused by WWII. No 2721 whilst in Germany in 1943 became a casualty of war. Many of this class of locomotive were withdrawn from service and scrapped in the period 1933 - 1937, the remainder continued into the 50s and early 60s.

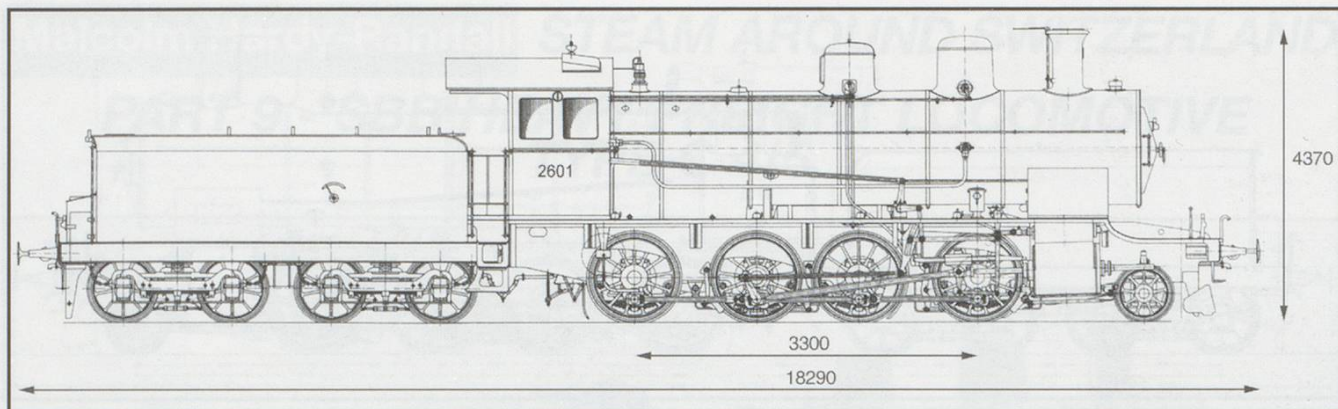
Locomotive Data.

First series.

| Type | C 4/5 | | |
|---------------------------------|------------------------------------|-----------|-----------|
| Nos | 2701-2703 | 2704-2723 | 2724-2732 |
| Built by | S. L. M. Winterthur. | | |
| Works No | 1599-1601 | 1676-1695 | 1698-1706 |
| Date built | 1904 | 1905 | 1906 |
| Power - HP | 1240 | | |
| Power - kW | 911 | | |
| T/E at wheel rim. kN | 112.8 | | |
| Date in Service | 1904 | 1905 | 1906 |
| Date out of service | 1915-20 | 1912-61 | 1933-60 |
| Max. Speed - km/h | 65 | 65 | 65 |
| Speed Indicator | Hausshälter | | |
| Driving wheels | | | |
| Diameter - mm | 1,330 | | |
| Rigid Wheelbase - mm | 3,250 | | |
| Total wheelbase - mm | 7,500 | | |
| Length overall - mm | 18,250 | | |
| Height - mm | 4,370 | | |
| Loco weight. | | | |
| Empty - Tonnes | 76.9 | | |
| Service - Tonnes | 109.0 | | |
| Adhesion - Tonnes | 57.6 | | |
| Water capacity - m ³ | 17.0 | | |
| Coal capacity - Tonnes | 8.0 | | |
| Brakes | Screw, Westinghouse Double action. | | |
| Cylinders | | | |
| Number - Low pressure | 2 | | |
| Bore - mm | 370 | | |
| Stroke - mm | 600 | | |
| Number - High Pressure | 2 | | |
| Bore - mm | 600 | | |
| Stroke - mm | 640 | | |
| Boiler | | | |
| Operating pressure - Bars | 14 | | |
| Length - mm | 4,200 | | |
| Tubes | 242 | 242 | 232 |
| Firebox - m ² | 14.2 | | |
| Grate area - m ² | 2.4 | | |
| Trailing load | | | |
| Gradient 10 ‰ - tonnes @ km/h | 660@45 | | |
| 26 ‰ - tonnes @ km/h | 200@30 | | |
| Construction cost - SFr | 110,000 | | |

SECOND SERIES. NOS: 2601 - 2619

The manufacturer SLM built a total of 19 of the second series of type C 4/5 locomotives



during the period 1907 to 1912. They were originally intended for use on freight and passenger services on the Bözberg line from Basel via Brugg to the Gotthard main line, and to be based at Brugg. However, many of them saw service on the mountain and Tessin valley sections of the Gotthard line, in charge of both passenger and freight trains. The new locomotives were to be built as two cylinder locomotives with superheating.

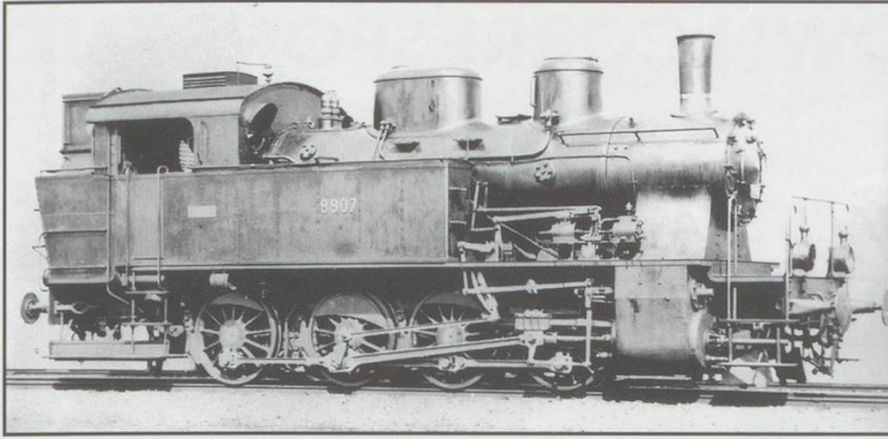
The second series C 4/5 - rated at 938 kW - entered Gotthard line service to haul the freight trains on the valley and mountain lines, and able to haul 660 tonnes at 28 km/h on track with a ruling gradient of 1 per mille and 235 tonnes at the same speed on the mountain section. The delivery of the first 15 of these locomotives was with a boiler operating at 12 bars, except for those fitted to Nos.2611 & 2612 which operated at 13 bars. A large steam dome fed wet steam to the 21-tube Schmidt superheater, and then on to the two outside mounted 570 mm diameter, 640 mm stroke cylinders - the largest on any twin cylinder locomotive in Switzerland - controlled by Walschaerts valve gear.

Of particular interest was the trial carried out on locomotive

Nos.2611 and 2612. Special cylinders designed by Professor Stumpf of Charlottenburg replaced the standard units, the idea being to simplify the passage of steam through the cylinders by making it flow in a uniform direction. Steam would enter the cylinder via valves built into the cylinder casing and leave via slots in the middle of the

Second Series.

| Type | C 4/5 | | | |
|---------------------------------|--------------------------------------|---------|----------|---------|
| Nos | 2601-10 | 2611-12 | 2613-15 | 2616-19 |
| Built by | S.L.M. Winterthur | | | |
| Works No | 1870-3,1976-2065 | 2066-7 | 2157-59 | 2240-43 |
| Date built | 1907-10 | 1910 | 1911 | 1912 |
| Power - HP | 1279 | | | |
| Power - kW | 938 | | | |
| T/E at wheel rim - kN | 115.7 | | | |
| Date in Service | 1907-10 | 1910 | 1911 | 1912 |
| Date out of service | | | | |
| Rebuilt E 4/4. | 1930-33 | 1926-31 | 1930-33* | 1930-33 |
| Speed maximum - km/h | 65 | | | |
| Speed Indicator | Klöse | | | |
| *=Scrapped | | | | |
| Driving wheels | | | | |
| Diameter- mm | 1,330 | | | |
| Rigid Wheelbase. -mm | 3,050 | | | |
| Total wheelbase - mm | 7,400 | 7,650 | 7,400 | 7,400 |
| Length overall - mm | 18,290 | | | 18,390 |
| Height - mm | 4,370 | | | |
| Loco weight. | | | | |
| Empty - Tonnes | 75.6 | 76.1 | 75.6 | 79.5 |
| Service - Tonnes | 107.7 | 108.3 | 107.7 | 112.7 |
| Adhesion - Tonnes | 58.0 | 58.2 | 58.0 | 60.5 |
| Water capacity - m ³ | 17.8 | 17.8 | 17.8 | 18.0 |
| Coal capacity - Tonnes | 7.0 | | | |
| Brakes - | Westinghouse, Double action - Screw. | | | |
| Cylinders | | | | |
| Number - Low pressure | 2 | 2 | 2 | 2 |
| Bore - mm | 570 | | | |
| Stroke - mm | 640 | | | |
| Boiler | | | | |
| Operating pressure - Bars | 12 | 13 | 12 | 13 |
| Length - mm | 4,200 | 4200 | 4,200 | 4,500 |
| Tubes/Superheater | 142/21 | 142/21 | 142/21 | 152/21 |
| Firebox - m ² | 14.2 | 14.2 | 14.2 | 14.8 |
| Grate area - m ² | 2.4 | 2.4 | 2.4 | 2.5 |
| Trailing load | | | | |
| Gradient 10 % - tonnes @ km/h | 350@50 | | | |
| 26 % - tonnes @ km/h | 175@40 | | | |
| Construction cost - SFr | 106,500 | | | |



SBB Locomotive type E 4/4 No: 8907 ex C4/5 No: 2618

cylinder. One major advantage of this system is that it almost eliminates condensation within the cylinder, but a major disadvantage is the huge increase in the weight of the pistons, up to 281 kg, for this locomotive. The trial was not a success and resulted in the modified locomotives retiring from service earlier than the rest of the class.

The Stumpf Direct flow system or 'Gleichstromsystem' found very little support within Switzerland, resulting in no further conversions to the type C 4/5. The outcome of the trials on these particular locomotives was that they were not considered for rebuilding into type E4/4 as were the remainder of the class, and were scrapped when the rebuild pro-

gram began. Measuring 18,290 mm overall and weighing 107.7 tonnes the C 4/5 locomotive achieved a tractive effort of 115.7 kN just slightly less than the four cylinder Gotthardbahn C 4/5 locomotive built by Maffei. As an experiment the locomotive No.2618 had the Knorr feed water pre-heater system installed to improve boiler efficiency, but the rest of the series did not undergo any trial, due to planned conversion work.

The whole of this series of C 4/5 was withdrawn from SBB service between 1930 and 1933, not because of age but because they were to be rebuilt into Type E 4/4 heavy freight shunting locomotives that were to remain in service in the marshalling yards such as Muttenz and Chiasso up to 1968.

References used:-

Der Dampfbetrieb der Schweizerischen Eisenbahnen. 1847 - 1923. A. Moser.

SBB & SLM Documents.

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Muttenz.
SBB Loco E4/4 (converted C4/5) on marshalling duties