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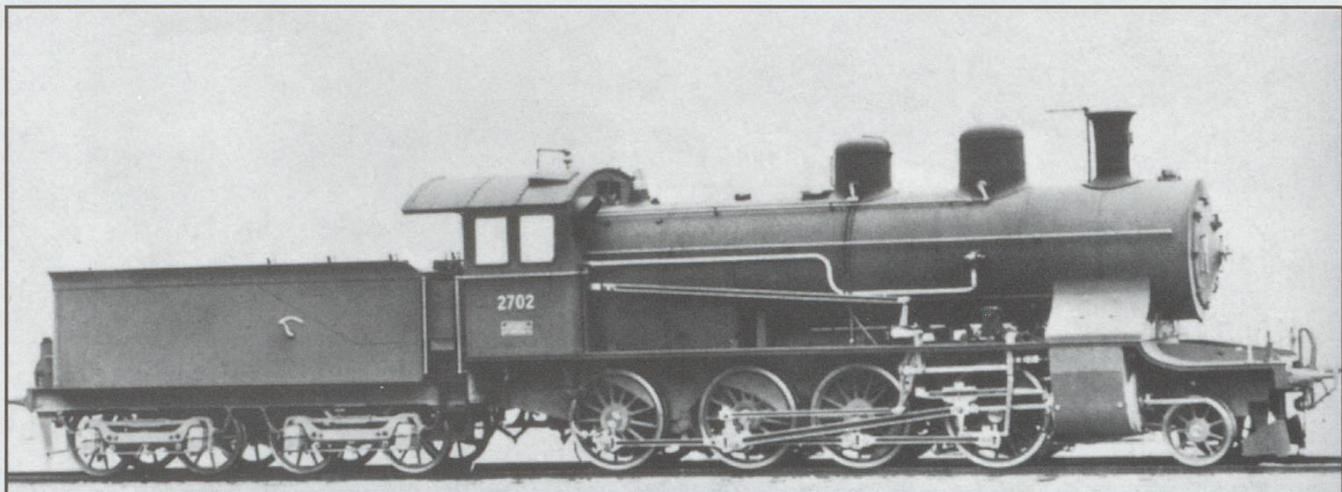
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**PART 9 - SBB HEAVY FREIGHT LOCOMOTIVE
TYPE C 4/5.****FIRST SERIES. NOS: 2701 - 2732.**

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.

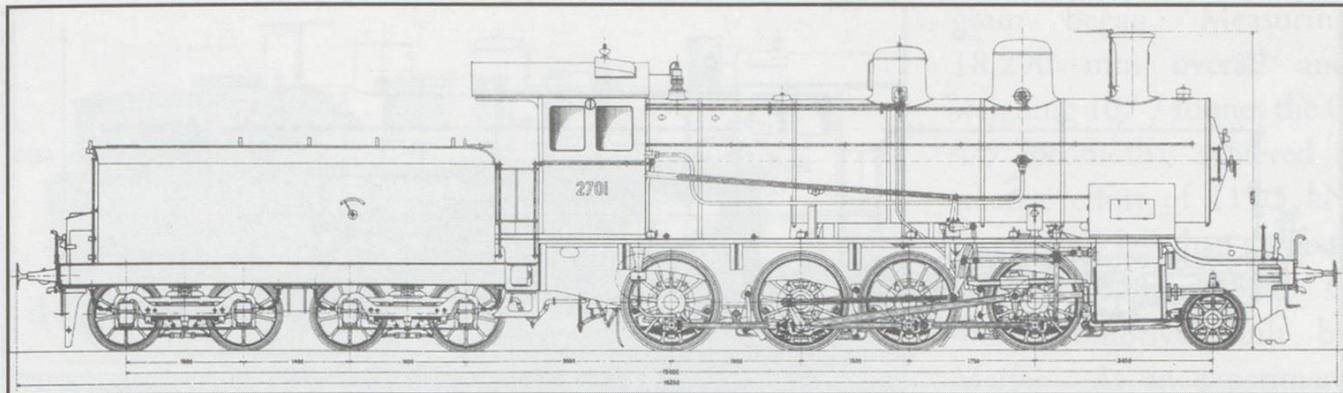
The design offered by SLM was a four-cylinder compound locomotive with driving wheels of 1,330 mm in diameter and an achievable tractive effort of approx. 10,000 kg. The proposed locomotive would have a top speed of approximately 65 km/h on level track and be able to haul a trailing load of slightly 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.

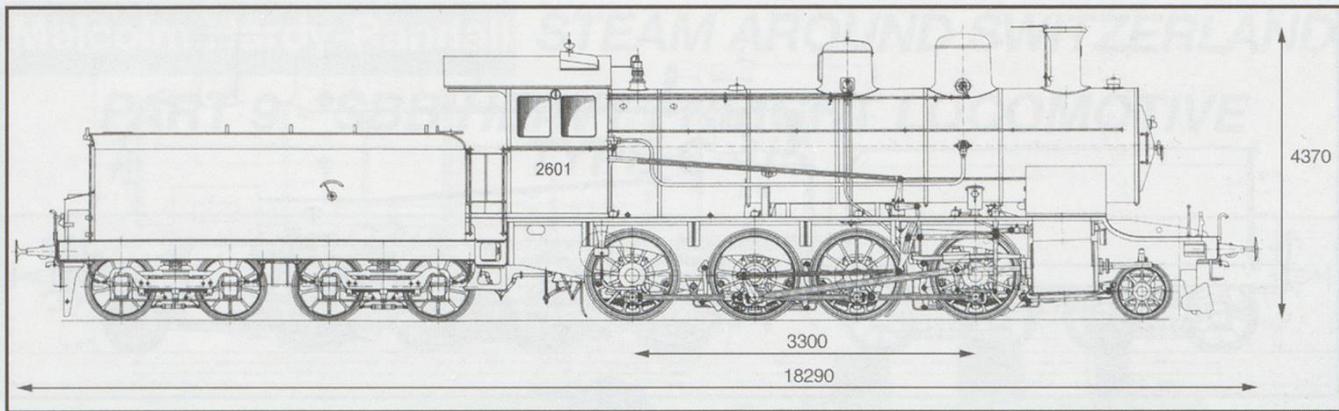
Speed indication was provided by the Hausschälter system but this was changed later to the Hasler indicators. All locomotives were capable of providing steam heating for passenger trains. This series of locomotive was able to haul 660-tonne freight trains or 400-tonne passenger trains over the 10 per 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		Hausschälter	
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 casting 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
Length overall - mm	18,290

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

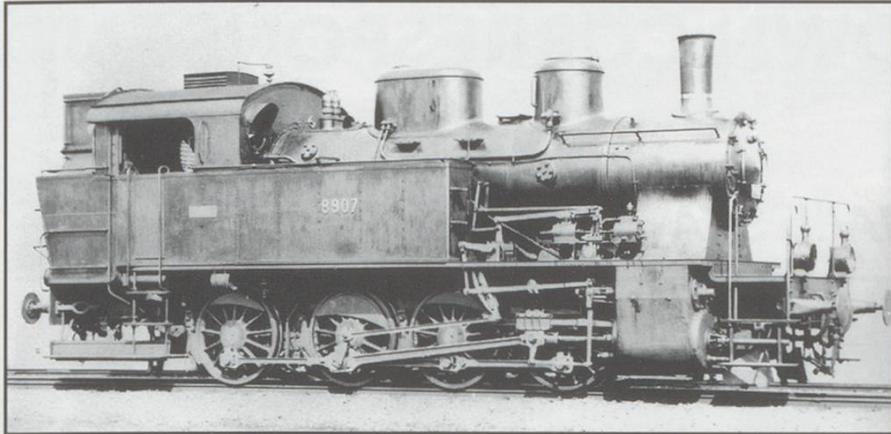
Number - Low pressure	2	2	2	2
Bore - mm		570		
Stroke - mm		640		

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