

One of the Six New 4-6-4 Type Locomotives Has Been Streamlined

Santa Fe Installs High-Speed Passenger Locomotives

Baldwin delivers six 4-6-4 type with 84-in. driving wheels and 300 lb. boiler pressure—Total engine weight 412,380 lb.

THE Atchison, Topeka & Santa Fe has received from the Baldwin Locomotive Works six 4-6-4 type locomotives designed for high-speed passenger service. These locomotives are all equipped as oil burners and are assigned to service on the main line between Chicago and La Junta, Colo. One of them is streamline. The other five are conventional in their exterior finish.

The streamline locomotive is covered with a light steel shrouding which is designed to blend into the contour of the train. The boiler shroud ends in a bullet nose at the front and the skirting below the running board covers the cylinders but does not cover the driving wheels and running gear. The sides of the cabs are fitted with removable sections to provide access to staybolts and there are doors in the boiler shrouding where needed for access to the equipment mounted on the boiler.

The shrouding is painted in two shades of blue with the under portion of the locomotive and tender, including the running gear, in black. An 18-in. stainless-steel strip, on which the words "Santa Fe" and the number "3460" are sand etched and filled in with black, extends from the front end of the locomotive to the rear of the tender on each side at running-board level. Other striping is in silver leaf and the faces of the driving-wheel tires and hubs are finished with aluminum paint, as are also the tires of the engine- and tender-truck wheels. The handrails are of stainless steel. The handrail columns, cab handles and other exposed fittings are chromium plates. Rods and motion work are highly

The new Santa Fe locomotives have a weight of 213,440 lb. on the drivers and the total engine weight is 412,380 lb. The driving wheels are 84 in. in diameter and the locomotives develop a tractive force of 49,300 lb., with a boiler pressure of 300 lb. per sq. in. The combined heating surface is 6,850 sq. ft. and the grate area (area inside the mud ring), 98.5 sq. ft.

The outstanding features of these locomotives are the use of special materials and structural features in the boiler to adapt them to the high steam pressure; the large diameter of the driving wheels, the bed casting, the unique engine-truck design and the fuel-oil tank, which is built into the water tank in such a way as to permit conversion to coal-burning with a minimum of structural change.

The Engine Bed and Running Gear

The foundation of the locomotive is a bed casting with which the cylinders and back cylinder heads are integral. Practically all of the heavy equipment formerly attached to the boiler is provided with brackets for direct attachment to the bed. Provision has also been included for the support of the stoker conveyor and grate shaker cylinders should occasion arise to convert the locomotives to coal-burning in the future. The main reservoirs are not included in the bed and the front bumper is a separate casting.

The driving wheels are Baldwin disc type cast-steel centers with the main wheels cross-counterbalanced. The

journals are fitted with SKF roller-bearing boxes and all driving boxes have $\frac{1}{8}$ -in. lateral play in the pedestals. The driving axles, as well as those on the engine truck, trailer truck and tender trucks are carbon steel. The driving axles are hollow bored.

The front trucks on these locomotives have inside journal bearings and are of the Batz four-wheel design. In this truck the entire weight on each side is carried on eight single-coil springs which are seated in a long pocket in the double type cast-steel equalizer. The truck frame is carried directly by the spring cap over the top of the eight coil springs on a rocker pin located on the transverse center line of the truck. Circular pads at the ends of the equalizers rest on rocking plates on the tops of the journal boxes. The bolster is carried on constant lateral resistance rockers which are supported directly from the transoms of the truck frame.

The truck journals are fitted with SKF pedestal-type roller-bearing boxes. These boxes have $\frac{1}{16}$ -in. lateral play in the pedestals. The wheels are 37 in. in diameter.

The trailer truck is a General Steel Castings four-wheel Delta type, all wheels being 40 in. in diameter. The outside journals are fitted with SKF roller-bearing boxes. On the front axle the boxes have $\frac{1}{8}$ in. and on the rear axle, $\frac{5}{16}$ in. lateral in the pedestals.

The main driving springs have reverse camber. The front hanger is solidly connected to the bed casting, while the hanger at the rear of the trailer truck is connected through a double-coil snubber spring.

The main and side rods are of chrome-nickel-molybdenum steel with floating bushings at the back end of the main rod and both ends of the main connection side rod. Pressed bushings are used in the front side rods. The front end of the front side rod is set with $\frac{1}{16}$ in. lateral on the crank pin. The main crank pin is of nickel-chrome steel hollow bored to $3\frac{1}{2}$ in. diameter, the cavity being used as a grease cup. The front and rear pins are of carbon steel.

The piston heads are of special heat-treated alloy cast steel, with the Locomotive Finished Material combined Universal sectional type bull rings and packing rings of bronze and are carried on quenched and tempered carbon-steel piston rods. The cross-heads and guides are of the Laird type, the latter fitted with the Slide-Guide attachment. T-Z packing is applied on the piston rods and valve stems.

The reciprocating parts on each side of this locomotive weigh 1,805 lb., of which 38.8 per cent is balanced. At 84 m.p.h. (diametral speed) the theoretical dynamic augment is 9,457 lb. per wheel in the front and rear pairs and 14,186 lb. per wheel in the main pair of drivers.

The valve motion is of the Walschaert type which drives 13-in. valves with a maximum travel of 7 in. The valves have one-piece bronze bull rings and packing rings. The reverse gear is the Baldwin type C.

In point of boiler proportions these locomotives are

first in total evaporative heating surface, superheating surface and grate area. Their working pressure has not been exceeded by any locomotive boiler built with the staybolt type of firebox.

The Boiler

The boiler shell courses and outside firebox sheets are of nickel steel on all of the locomotives and in the case of the streamline locomotive a nickel firebox steel has been used for the inside firebox sheets. The boiler-seam rivets are also of nickel steel.

The firebox is of unusual width. It is 108 in. inside the side sheets and 132 in. in length, and the crown and side sheets are in one piece. There is no combustion chamber. Two Nicholson Thermic syphons are installed in the firebox. Although not horizontal, the rear of the mud ring is only 7 in. higher than the front. The side water legs of the firebox are vertical for 18 in. above the bottom of the mud ring and the back door sheet is perpendicular 12 in. from the mud ring to facilitate the application of firebrick lining above the cast-steel draft pan. The crown stays are the F. B. C. adjustable type and F. B. C. flexible bolts are also installed in the breaking zone.

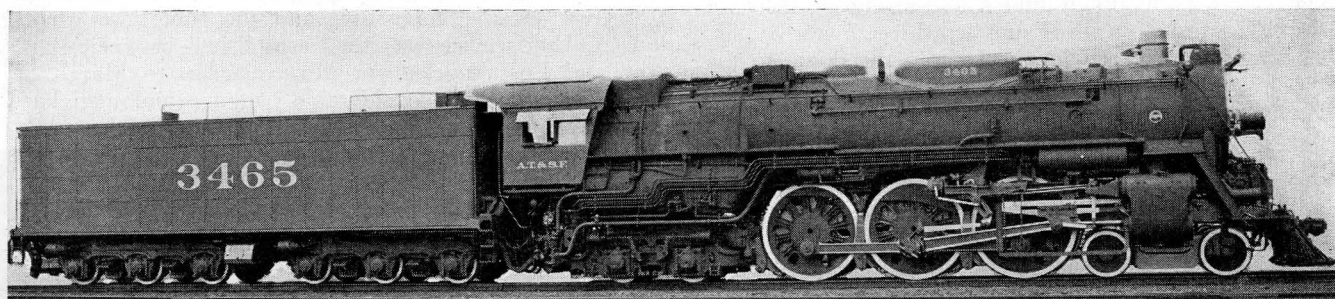
The boiler has a main and an auxiliary dome. The main dome is of cast steel and is solid, without cover. The opening in the auxiliary dome is large enough to permit a man to enter the boiler and on this dome cover are mounted the safety valves.

The boiler is laid out for an Elesco Type E superheater and the American multiple throttle is built into the header. The feedwater heater is the Worthington Type 6Sa. The heater unit is mounted in the top of the smokebox in front of the stack, the hot-water pump on the engine bed under the smokebox and the cold-water pump on the left side of the locomotive near the tender. Other equipment on the boilers includes the Signal Foam-Meter and Electromatic blow-off cock arrangement.

The locomotives are fitted with box type spark arresters which are completely closed at the top, sides and bottom. The bottom rests directly on the exhaust pipe and the stack extension extends down through the top. The sides are curved parallel to the smokebox shell. The front of the arrester is open. A portion of the rear is completely closed with a large rectangular panel of double louvers. The stack has a hinged extension top operated by a pneumatically actuated rack and pinion.

Lubrication

Each locomotive is equipped with three force-feed lubricators. A Nathan type DV-7 36-pint lubricator supplies oil to the pedestal faces of the engine truck, driv-



High-Speed Locomotive for Passenger Service on the Atchison, Topeka & Santa Fe

ing wheels, trailer truck, and main guides. With the exception of the streamline locomotive, two Chicago 40-pint lubricators, one on each side, feed oil to the cylinders, valves and the hot-water feed pump. The cylinder and valve lubrication on the streamline locomotive is provided by two Nathan DV-7 lubricators.

Alemite fittings are provided on all rod cups, on the crosshead pins and on the eccentric crank pin. The flange oilers are the Swanson type.

These locomotives have No. 8ET Westinghouse air brakes with brake shoes on the drivers, trailing truck

left water leg should the locomotives subsequently be converted to coal burning.

The oil tank is integral with the water-tank structure. Conversion for coal can be made by removing the top of the oil tank over the coal space and substituting coal gates for the front oil-tank closure.

The six-wheel tender trucks are of the Pullman type, the castings for which were furnished by the General Steel Castings Corporation. The elliptic bolster springs are of chrome-vanadium steel. The rolled-steel wheels are 37 in. in diameter and are mounted on SKF roller-bearing axles. The tender trucks are fitted with Simplex unit cylinder clasp brakes.

The general dimensions, weights and proportions of these locomotives are shown in the table.

General Dimensions and Weights of the Santa Fe
4-6-4 Type Locomotives

Railroad	A. T. & S. F.
Builder	Baldwin
Type of locomotive	4-6-4
Road class	3460
Road numbers	3460-3465
	(1 streamline)
Date built	1937
Service	Pass.
Rated tractive force, engine, lb.	49,300
Weights in working order, lb.:	
On drivers	213,440
On front truck	83,950
On trailing truck	114,990
Total engine	412,380
Tender	396,340
Wheel bases, ft. and in.:	
Driving	14-6
Engine, total	41-1½
Engine and tender, total	88-8
Driving wheels, diameter outside tires, in.	84
Cylinders, number, diam. and stroke, in.	2-23½×29½
Valve gear, type	Walschaert
Valves, piston type, size, in.	13
Maximum travel, in.	7
Boiler:	
Steam pressure, lb.	300
Diameter, first ring, inside, in.	86½/16
Firebox length, in.	132
Firebox width, in.	108
Thermic syphons, number	2
Tubes, number and diam., in.	46-2¼
Flues, number and diam., in.	200-3½
Length over tube sheets, ft. and in.	21-0
Fuel	Oil
Grate area, sq. ft.	98.5
Heating surfaces, sq. ft.:	
Firebox and comb. chamber	280
Syphons	95
Firebox, total	375
Tubes and flues	4,395
Evaporative, total	4,770
Superheating	2,080
Comb. evap. and superheat.	6,850
Feedwater heater	Worthington
Tender:	
Style	Water bottom
Water capacity, gal.	20,000
Fuel capacity, gal.	7,000
Trucks	6-wheel

and tender. The single 8½-in. cross-compound air compressor is mounted above the front deck of the bed casting at one side. The train-control equipment is the Union Switch & Signal Company's three-speed continuous type. Except for the streamline locomotives these engines are quipped with Pyle-National 1,000-watt, 32-volt turbo generators with dynamotors on the train-control equipment boxes. The streamline locomotive is fitted with a Sunbeam turbo generator with a dual-voltage generator.

The turret is mounted under a housing in front of the cab. Saturated steam is supplied through two 3½-in. extra-heavy pipes extending back from the dome to the turret; one pipe on each side, outside the boiler shell. Weston speed recorders are applied on all of the locomotives. The Unit Safety drawbar and Franklin type E2 radial buffer are applied between engine and tender.

The Tenders

The tender underframe is the General Steel Castings water-bottom type. This is arranged for the application of a submerged stoker trough and stoker engine in the

Floods Interrupt California Service

FLOODS in the vicinity of Los Angeles, Cal., on March 2, caused by the heaviest rainfall in 61 years, washed out tracks and bridges of major railroads and completely cut off railway service to and from that city. While the greatest damage to railroad property occurred in the vicinity of Los Angeles, sections of track and bridges were damaged throughout the storm area, extending from Ventura to San Juan Capistrano along the coast and as far inland as Bakersfield and Cajon.

Rain began to fall in this section on February 27 and by March 2 the precipitation aggregated 10.86 in. at Los Angeles. As a result many normally dry arroyos became raging streams which overran their banks. On March 2 the major rivers, the Santa Clara, the Los Angeles, the San Gabriel and the Santa Ana reached their capacity and flooded large areas of Los Angeles and vicinity with three and four feet of water.

The Atchison, Topeka & Santa Fe line from Cajon to Los Angeles was rendered impassable and because the Union Pacific uses the Santa Fe from Barstow to Riverside the service of both railroads into Los Angeles was cut off. On the Santa Fe line between Cajon and Los Angeles practically every bridge was affected, some being moved out of alignment considerably, and several sections of track aggregating several thousand feet were washed out. Near Cajon a 40 ft. washout and a landslide of considerable proportion occurred. In addition its line from Los Angeles to San Diego was rendered unusable when washouts occurred at Anaheim.

When all Santa Fe entrances to Los Angeles became impassable on March 2 a route was established from Barstow to Mojave and thence over the Southern Pacific to Glendale, from which point passengers were carried by bus to Los Angeles, but after one train had passed over the route the Southern Pacific tunnel at Monrovia became impassable and the route was abandoned. Bus service was then established between Barstow and Los Angeles via Mojave. Up to March 5, 700 passengers and considerable baggage and mail had been transported by bus between Barstow and Los Angeles. The Los Angeles-San Diego line was cleared on March 8 and service resumed on March 9. Service between Los Angeles and San Bernardino via Pasadena was resumed on March 9, while the line between San Bernardino and Barstow was opened on March 10.

While physical damage to Union Pacific lines west of Yermo and between Cresline, Nev., and Caliente was

(Continued on page 467)