ACCUCRAFT TRAINS
MUSEUM QUALITY BRASS MODELS

D&RGW C-25 2-8-0
CERAMIC BUTANE FIRED
INSTRUCTION MANUAL

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History of the D&RGW C-25 Class Locomotive

This Baldwin-built locomotive, a 2-8-0 or Consolidation type, was originally numbered #103 of the Crystal River Railroad, a narrow gauge line located in the Elk Mountains of central Colorado. It was built and delivered in 1903 as construction number 21757 of the Baldwin Locomotive Works, had 33" drivers, 18x20" cylinders, and a tractive effort just short of 25,000 pounds. It was a standard Baldwin design, and other narrow gauge locos of this size and type were built for railroads in the Western Hemisphere. The D&RG purchased this locomotive from the Crystal River in 1916 and numbered it #432. It was renumbered in 1924 to #375. Originally the locomotive was a class 112, this number reflecting the total weight of the locomotive, but eventually the D&RGW changed the classification numbers of their locomotives to reflect their tractive effort, and thus the classification of C-25. Interestingly, for a while the cab of this loco carried "C-25-112" as its classification. The C-25 was affectionately known as the "Baby Mudhen" because its pulling power was close to that of the K-27 class, those engines being known as "Mudhens." When the engine was put into service in 1916, it was the best steamer on the railroad at that time. Sadly, on June 21, 1949 the one and only C-25 on the D&RGW was scrapped at Alamosa, Colorado.

Safety

For your safety, there are certain rules that should be observed, as follows:

1. The safety valve is under the steam dome (the dome nearest the cab). It has been set at the factory to release at 60 pounds per square inch of pressure. Never tamper with the safety valve.

2. The firing system has been designed to use butane gas only. Never use any other gas (including propane or butane/propane mix), as the storage pressures can reach unsafe levels.

3. Always refuel the engine away from other working live-steam locomotives. The fuel filling system allows a small amount of the gas to bleed off as the fuel tank is being filled. A passing engine can ignite this bleed-off gas, causing a potentially hazardous situation.

4. When lighting up, light your match first, then turn on the gas.

5. A steam engine gets hot. Be careful. The following parts are packaged separately

About Your Boiler

A good place to begin the firing process is to have a thorough understanding of your locomotives boiler and how it behaves. The boiler in your locomotive duplicates a full size boiler in all aspects, including significant areas of flat surface. Construction includes 8 fire tubes and 1 flue, a water legged firebox, 5 bushings for mounting various fittings and a pass through for the blower pipe.

The major flat surfaces are the firebox front, sides and top, the boiler front sheet and the flat outside portions of the boiler wrapper surrounding the firebox. The firebox is surrounded by water legs on 3 sides, the back being dry. These flat surface water legs are supported against the internal pressures by copper rods or stays tying them to each other. The top of the firebox, or crown sheet, also basically flat, is supported from collapsing by vertical plates that connect it to the outer shell, or wrapper. The front of the firebox, or rear flue sheet, and the front of the boiler, or front flue sheet, are supported against boiler pressure by being connected to each other with the tubes and flue. The barrel of the boiler, being spherical, is self-supporting within the limits of its design strength.

Several of these boiler plates are flanged and all are assembled using a high strength, high temperature, silver bearing brazing compound. To maintain joint strength, those boiler plates exposed to the combustion process,

and more particularly the crown sheet, must be in direct contact with and covered at all times by the water in the boiler. This means WATER LEVEL IS CRITICAL. To this end, the locomotive is equipped with an axle pump and hand pump and can also be optionally fitted with an injector or Goodall valve. It should be noted that injectors in smaller sizes are notoriously finicky devices, not generally reliable, and should NEVER BE RELIED ON for critical boiler feed .

The C-25 boiler is designed to function at a working pressure between 60 and 75 pounds per square inch. This pressure is continuously trying to collapse the crown sheet and inner firebox sides. The water level must be maintained above a point equivalent to the bottom edge of the blower pass through pipe at all times. The lower working limit for water level is the top of the lower nut on the water gauge. The installed axle pump is sized to pump water in excess to the needs of the engine, and given time, will fill the boiler to its maximum capacity. During those times the locomotive is stopped and the blower is on, makeup water needs to come via the tender pump.

Maximum water level is not critical, but should not exceed the bottom edge of the top nut of the water gauge. Over filling the boiler results in the engine priming, or passing water to the cylinders, and can be noticed by a spray or mist of water coming from the cylinder exhaust or blower stream exiting the smokestack.

Water

Your locomotive's boiler is an assembly of many components that have been joined using a silver brazing compound. These brazing compounds are atomically different enough from the copper in the boiler plates to be subject to electrolytic decomposition in the presence of an electrically active fluid. The water used in your boiler needs to be as pure as possible, and within a relatively narrow range of pH. pH is the measure of the ionic properties of a liquid material which classify it as an acid or a base. This is measured on a scale from 0 to 14 where 7 is neutral: below 7 is an acid, above 7 is basic. Acidic solutions have an abundance of H+ (hydrogen) ions while basic solutions are strong in OH (hydroxide ions.) It is the presence of these ions that makes the fluid electrically conductive. Freshly "STEAM DISTILLED" water will measure approximately 7. and is ionicly neutral, but with long term exposure to carbon dioxide in the air slowly will become slightly acidic with pH of around 6.

We often think of some natural waters as being very pure; for instance rain water, or "Pure Spring Water." It is true they may not have significant dissolved solids in them, but their pH can vary from acceptable to miserable. Just as we use acids and bases as electrolytes in batteries to pull electrons out of the metal battery plates, the pH of your water can cause electrolytic effects to take place in your boiler, which can cause the brazed joints to break down over time.

Distilled water that has been 'DEIONIZED" is extremely active electrically and should NEVER be used in your boiler. Often water Will be OZONATED to kill bacteria. Water that has been ozonated is acceptable as long as it has also been steam distilled.

****** We recommend only the use of STEAM DISTILLED water in your boiler ******

Oil

Since the beginning of the steam age there has been a heated discussion of which oils are best for cylinder lubrication. The development in recent years of a plethora of synthetic oils has only exacerbated this discussion. All the major oil companies now produce innumerable synthetics; yet they all still recommend similar, non-synthetic, oil and tallow blends for the use in saturated steam cylinders. Although these may carry individualized brand names, they are all a compounded ISO 460 heavy oil for use in steam cylinder environments. They have all been developed to resist being washed off the metallic surfaces by the action of water and hot steam, and all are designed to be carried to the necessary lubrication points by being entrained in the stream of steam. The oil companies also occasionally reference these oils as " AGAMA 7 Compounded" oils, and they also come in weights other than ISO ratings of 460.

Oil that meets this specific criteria is available from your Accucraft as well as from the bulk distributors of the various oil companies.

****** We recommend only the use of the ISO 460 oils ******

Excess oil beyond that necessary to lubricate the valves and cylinders is detrimental to the locomotive.

Unlike a butane fired boiler, your C-25 does not have any holes or drain in the bottom of the smoke box. This means that excess oil delivery to the cylinders will become mixed with cinder and ash to form a sludge in the smoke box, besides forming this sludge, oil soaked cinder and ash can be carried out the stack to be deposited as an abrasive on the running gear.

Preparing the engine

A steam-locomotive engineer goes through a lighting-up ritual every time the engine is to be run. It is good to follow the same routine each time so that nothing is overlooked.

1. Oil all external moving parts of the engine, including wheel bearings, with a high grade, lightweight machine oil like 3-in-1. Be sure to oil all parts of the drive train. A little oil is all that's necessary.

2. Place the engine on track.

3. The lubricator located in the cab ensures the cylinders and valves are properly lubricated inside. As the steam passes through it, a small amount will condense into water. This water will sink to the bottom of the lubricator, forcing a similar quantity of oil into the steam line and thus to the cylinders.

Remove the lubricator cap and draw out any water from previous run with a syringe. Use only proper steam cylinder oil. Fill the lubricator, but leave a small air space between the oil and the cap.

4. Unscrew the filler plug and fill the boiler to the top with water then pull out 30 ml with large syringe. Use only distilled water in your engine's boiler. Tap water contains minerals that will leach out and ultimately affect the performance of the engine. You can also close the bypass valve and pump water from the tender.

5. Finally, add fuel. Your C-25 burns butane gas. The gas tank is located in the tender beneath the cover. Butane gas can be purchased at the grocery store or at a tobacconist's as cigarette-lighter refills. These come with a nipple suitable for the filler valve on the C-25's gas tank. (Butane can also be purchased in larger containers at camping-supply stores, but these cans will require a special adapter for filling the engine's tank.) Simply press the nozzle of the butane canister hard onto the filler valve atop the tank, making sure that the control valve is closed. You will hear the gas transferring and will see a little gas bleeding out of the valve. When the tank is full, the gas will begin to splutter and much more gas will escape the valve. When the gas tank is full you are ready to fi re up the engine. Add water to the rear tank. This will keep the tank warm and the gas pressure up.

Firing Up

Close the throttle and the blower valve. Place the battery powered suction fan in the smoke stack, but do not turn it on yet. Open the hinged smokebox door at the front of the engine and you'll be able to see the ceramic over the burner. To light up, strike a match or use a BBQ lighter and hold it at the open smokebox door while simultaneously opening the gas valve in the tender very slowly until the gas ignites. You should hear the gas coming into the burner. Make sure the burner is lit by looking in the fire door, then immediately turn on the suction fan.

It will take approximately 7 minutes to raise pressure. Once the gauge reaches 20 psi, you can shut off and remove the suction fan from the stack and then open the engines blower valve. At this point steam will rise rapidly! When the gauge reads 50 psi, the engine is ready to run.

Drain Cocks

This locomotive is fitted with working drain cocks on the cylinders. When first starting out, the cocks should be open (levers moved to “outside” positions). This will allow water in the cylinders to drain while the cylinders heat up to working temperature. As steam enters cold cylinders, it condenses, so expect a fair amount of water to come out at the beginning of each run. Once the cylinders have warmed up, you can close the drain cocks. To close them, move the levers to the “up” position.

Running

Move the reversing lever at the right side of the cab to the forward position. With the engine on the track, and without a train, open the throttle. The engine may need to be pushed a little to overcome the steam condensing into water in the cold cylinders, but the open drain cocks will minimize this. After a few moments, the engine should take off on its own, moving away smoothly.

When the engine is running, the blower valve can be turned down but should be open whenever the engine is stopped. A train can be coupled on and the run can proceed. Since all of the locomotive’s functions are controlled from the cab, it can be driven like a full-size engine, meaning that you’ll have to stay with the engine through the run if you want to change its speed or direction. If you have a suitable track, the engine can be left to run on its own at a steady speed.

Keep your eye on the water glass. If the level drops lower than the top of the water gauge nut, close the bypass valve and use the hand pump or let the engine’s axle pump fill the boiler. With practice and good weather, steady runs of an hour or more are not uncommon for this engine.

Axle Pump

This locomotive is equipped with an axle pump and bypass valve. The pump moves water from the tender to a check valve on the locomotive. The bypass valve is located on the back right side of the locomotive under the cab. When the bypass valve is completely shut, water is pumped into the locomotive. When the bypass valve is open, the pump will re-circulate water back into the tender. With careful adjustment of this valve, the engine will always have enough water to keep running for long periods of time until the tender water tank needs to be refilled. The tender is also equipped with the hand pump, which needs to be used to prime the axle pump. Only two or three strokes are necessary to prime the pump.

Shutting down

To shut the engine down, simply close the gas valve . Make sure the fire is completely out before turning off the steam blower if engine is standing still. This will minimize the chance of the paint getting scorched from any fire still burning in the firebox that is not vented! After a day’s operation in the garden, you’ll probably find that your engine has a coating of oil all over it. This is steam-cylinder oil that has been exhausted from the stack. A simple wipe down with a dry cloth is all that’s necessary to restore the engine to pristine condition. This is best done while the engine is still warm. Wipe any grit and excess oil from the wheels and running.

Cold Weather Running

The weather can dramatically affect the performance of your locomotive. Cold and wind can decrease effi ciency to a disappointing level. Butane gas becomes liquid at 32℉ and will not work. As it approaches 32℉, its pressure (and effectiveness) diminishes.

The compartment in the rear tank in which the gas tank resides can be fi lled with warm water in cooler weather. This will warm the gas in the tank and keep its pressure up, which will cause the engine to operate in a much more lively manner, much as it does in warm weather. If the water in the tank cools, just replace it with warmer water. Empty the tender at the end of the day’s run. Note: the temperature of the fuel-supply-can must always be higher than that of the engine’s gas tank. If you have warmed the engine’s gas tank and the supply can is cooler, gas will not transfer. **Never put hot boiling water in the compartment. This could cause dangerous pressure levels in the gas tank. The water should be comfortable enough to put your finger in.**

Control Layout

Control layout is shown below with the cab removed to provide clarity. All controls are readily accessible from the rear of the cab with the tender connected, and the Throttle, Blower Valve and Axle Pump Bypass Valves all project outside of the cab within easy reach.

The door has two small air holes in it that allow the operator to see the intensity of the fire.

The water gauge and pressure gauge are easily visible through the left side window.