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Off Air Time Limits

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Summary

In support of the Association of American Railroads' Strategic Research Initiative on brake system performance, Transportation Technology Center, Inc. personnel conducted Class I brake tests 10 times over the course of 5 days on a block of 20 coal gondola and hopper cars to understand the stability of a railcar's brake system at a variety of air temperatures and time off air. Air temperature at the time of the tests ranged from 17°F to 57°F. There was no change in the brake system performance of any of the cars throughout the course of the testing regardless of the air temperature, amount of time off air prior to the test, or cumulative time elapsed after the initial test.

In 2001, the Federal Railroad Administration established the 4-hour off air time limit for Class I and Class II brake tests. In 2008, this limit was increased for trains equipped with electronically controlled pneumatic brake systems to between 24 and 80 hours depending on where the train is parked. The Canadian regulator allows a 24-hour off air limit.

Since 2001, the industry has increased its use of information technology systems to track the time off air and its use of wayside wheel temperature detectors to monitor brake system health.

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INTRODUCTION

Transportation Technology Center, Inc. (TTCI) conducted 10 Class I brake tests on a consist of 20 coal hopper and gondola cars after different intervals of off air time during winter weather conditions to illustrate the independence of brake system performance from off air time. This digest describes the current North American regulations for off air time limits, provides details about the TTCI testing, and provides an update on the current state of affairs in North American freight railroading that have relevance to the issue.

BACKGROUND

For railroad operations in the United States, the Code of Federal Regulations stipulates that the "Class I brake test-initial terminal inspection"[1] or "Class II brake tests-intermediate inspection"[2] be conducted on cars that have been disconnected from a source of pressurized air ("off air") for more than 4 hours before they are moved in a train. This 4-hour off air time limit was codified in 2001, providing an increase from an "administrative interpretation" that allowed a maximum of 2 hours off air.[3] In describing its justification for the 4-hour time limit, the Federal Railroad Administration (FRA) stated the following:[3]

"FRA tends to agree that the amount of time equipment is left off a source of compressed air is not directly related to the operation of the brake system on that equipment. However, FRA does believe that in certain circumstances the length of time that equipment is removed from a source of compressed air can impact the integrity and operation of the brake system on a vehicle or train. Particularly in cold weather situations where freeze-ups in train brake systems can occur…"

"…if equipment were allowed to be off-air for an excessive amount of time, it would be virtually impossible for FRA to ensure that equipment is being properly retested as it would be extremely difficult for FRA to determine how long a particular piece of equipment was disconnected from a source of compressed air."

In 2008, the FRA allowed 24-hour off air limit for trains operating electronically controlled pneumatic (ECP) brake systems.[4] If such a train is left at an "extended off air facility" such as a fenced-in power plant, FRA allows up to 80 hours off air without requiring a retest.

Transport Canada requires brake testing applicable to railroad operations in Canada. The No. 1 and No. 1A brake tests required by Transport Canada are similar in procedure to the Class I and Class II tests, respectively. The No. 1 and No. 1A tests also establish off air time limits, but the maximum allowable time off air without retesting is 24 hours rather than 4 hours.[5]

BRAKE PERFORMANCE TESTING

TTCI conducted testing to evaluate the effects on freight car brake system performance after being disconnected from a source of pressurized air for different periods of time during winter weather. Using a block of 20 coal gondola and hopper cars, TTCI personnel conducted Class I brake tests 10 times over the course of 5 days. Both the air flow and leakage rate tests were used to evaluate the brake pipe pressure leakage. Brake cylinder pistons and brake shoes were checked on each car to ensure that the brakes applied in response to a 20 psi brake pipe service reduction and again to ensure that the brakes released when the brake pipe pressure was increased. After each test, the glad hands were uncoupled between the locomotive and the first car to allow ambient air to infiltrate the train line as it would in a revenue service situation.

Air temperature at the time of the tests ranged from 17°F to 57°F. There was no change in the brake system performance of any of the 20 cars throughout the course of the testing regardless of the air temperature or time off air prior to the test. On all the cars, the brakes were applied in response to a 20 psi brake pipe service reduction and released when and only when the brake pipe pressure was restored. A variety of brake pipe pressure leakage rates were recorded, and all of the values met the Class I test criteria. The brake pipe pressure flow rate and gradient values likewise met the Class I test criteria. Due to the measurable leakage in the brake pipe, the flow rate and gradient values must have been slightly greater than 0 cubic feet per minute and 0 psi, respectively, as shown in the table. However, on a short consist of 20 cars using typically available measurement devices (flow meter on locomotive, pressure transducers on locomotive and end-of-train device), these values were too small to quantify.

Table 1 shows results of the testing.

Table 1: Test Results

Date	Time	Hours Off Air Prior to Test	Air Temperature	Flow Rate (Cubic Feet/Minute)	Brake Pipe Pressure Gradient (psi)	Brake Pipe Pressure Leakage Rate (psi/min)	Cars With Brakes that Failed to Apply or Release
1/12/15	9:35	N/A	21°F	0	0	4	None
1/12/15	14:42	5	23°F	0	0	4	None
1/13/15	8:02	17	17°F	0	0	4	None
1/13/15	14:05	6	25°F	0	0	4	None
1/14/15	8:10	18	26°F	0	0	5	None
1/14/15	14:40	6	39°F	0	0	3	None
1/15/15	7:20	16	18°F	0	0	3	None
1/15/15	15:40	8	50°F	0	0	3	None
1/16/15	7:50	16	28°F	0	0	3	None
1/16/15	13:15	5	57°F	0	0	2	None

This testing was intended to understand the stability of a car's brake system at a variety of air temperatures rather than to comprehensively evaluate the relationship between brake system performance and time off air. If quantitatively establishing this relationship would be useful, a larger test effort involving many more cars tested at a wider variety of weather conditions and time off air could be conducted.

Figures 1, 2, and 3 graphically show the measured leakage rates as a function of the ambient temperature, time off air, and cumulative time since the initial test, respectively. The leakage rates do not show correlation with any of these parameters.

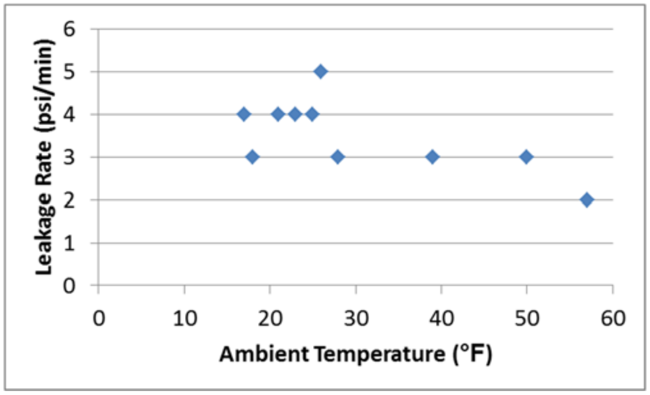

Figure 1: Leakage Rate Vs Ambient Temperature

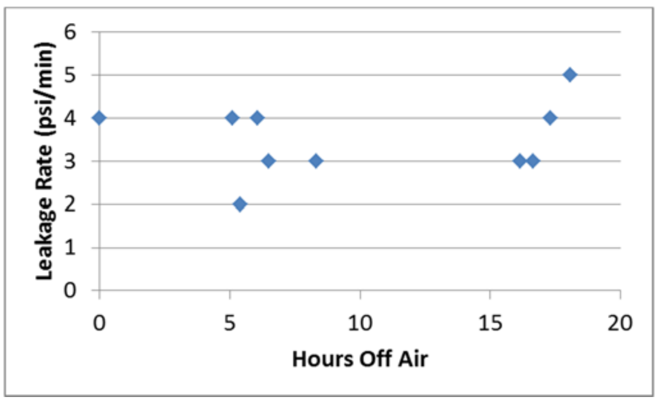

Figure 2: Leakage Rate Vs Hours Off Air

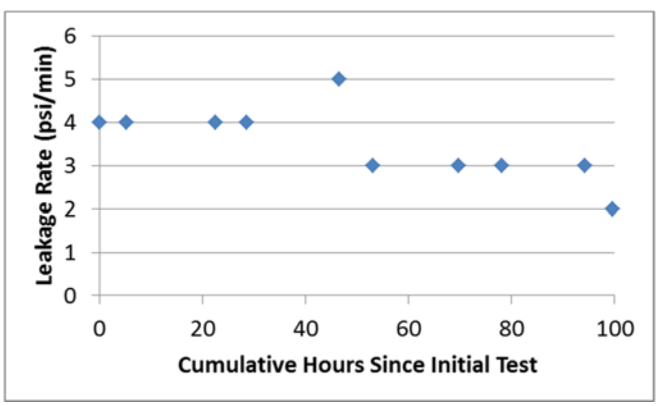

Figure 3: Leakage Rate Vs Cumulative Hours since Initial Test

DISCUSSION

Railroads are proactively pursuing improved brake system health monitoring through the use of wayside wheel temperature detectors. These devices allow an in situ evaluation of the brake system health of every car that passes the detector. Such methods are able to identify not only cars with inoperative brakes, but can also be used to identify cars with chronically under-performing brake systems.[6] For example, while the brake cylinder may look fully pressurized to an inspector, it may only have sufficient air pressure to extend the piston and may not be providing the intended brake shoe force. Wayside wheel temperature detectors are capable of identifying the symptoms of this type (and other types) of poor brake system performance.

Railroads have invested heavily in information technology over the last 20 years. Using commonly held technology, it should be possible to compute an estimate of the time off air for a car or cut of cars by querying the arrival time at the current terminal. Railroads utilizing automatic equipment identification technology have the ability to research the time a car, train, or cut of cars arrived at a location and when it departed, without the need for a physical observation of the event.

CONCLUSIONS

To investigate the stability of a car's brake system at a variety of air temperatures and time off air, TTCI personnel conducted Class I brake tests 10 times over the course of 5 days on a block of 20 coal gondola and hopper cars. Air temperature at the time of the tests ranged from 17°F to 57°F. There was no change in the brake system performance of any of the cars throughout the course of the testing regardless of the air temperature, time off air prior to the test, or cumulative time elapsed after the initial test.

Since FRA last considered the question of changing the off air time limits for non-ECP equipped trains in 2001, a number of changes in the industry have occurred. Railroads have increased the use of information technology systems to track the time off air, which should alleviate the concerns about difficulty in enforcement of the regulations. Increased use of wayside wheel temperature detectors to monitor brake system health allows for the ability to identify cars with poorly performing brake systems without a visual inspection.

REFERENCES

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3. Federal Railroad Administration, DOT. Final Rule. 49 CFR Parts 229, 231, and 232 "Brake System Safety Standards for Freight and Other Non-Passenger Trains and Equipment; End-of-Train Devices," 66 FR 4104, Federal Register, Vol. 66, No. 11, pp 4104-4217, January 17, 2001. http://www.gpo.gov/fdsys/pkg/FR-2001-01-17/pdf/01-606.pdf
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