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Advanced Component Testing: Kaskasia Handbrake Test

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The evaluation of a prototype remote operation handbrake showed that it can be installed on a car with only minor modifications to connect the air. This prototype did not set the emergency during any of the testing performed. The operation of the prototype worked as specified by the manufacturer.

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METRIC/ENGLISH CONVERSION FACTORS

ENGLISH TO METRIC			METRIC TO ENGLISH		
LENGTH (APPROXIMATE)			**LENGTH** (APPROXIMATE)		
1 inch (in)	=	2.5 centimeters (cm)	1 millimeter (mm)	=	0.04 inch (in)
1 foot (ft)	=	30 centimeters (cm)	1 centimeter (cm)	=	0.4 inch (in)
1 yard (yd)	=	0.9 meter (m)	1 meter (m)	=	3.3 feet (ft)
1 mile (mi)	=	1.6 kilometers (km)	1 meter (m)	=	1.1 yards (yd)
			1 kilometer (km)	=	0.6 mile (mi)
AREA (APPROXIMATE)			**AREA** (APPROXIMATE)		
1 square inch (sq in, in^2)	=	6.5 square centimeters (cm^2)	1 square centimeter (cm^2)	=	0.16 square inch (sq in, in^2)
1 square foot (sq ft, ft^2)	=	0.09 square meter (m^2)	1 square meter (m^2)	=	1.2 square yards (sq yd, yd^2)
1 square yard (sq yd, yd^2)	=	0.8 square meter (m^2)	1 square kilometer (km^2)	=	0.4 square mile (sq mi, mi^2)
1 square mile (sq mi, mi^2)	=	2.6 square kilometers (km^2)	10,000 square meters (m^2)	=	1 hectare (ha) = 2.5 acres
1 acre = 0.4 hectare (he)	=	4,000 square meters (m^2)			
MASS - WEIGHT (APPROXIMATE)			**MASS - WEIGHT** (APPROXIMATE)		
1 ounce (oz)	=	28 grams (gm)	1 gram (gm)	=	0.036 ounce (oz)
1 pound (lb)	=	0.45 kilogram (kg)	1 kilogram (kg)	=	2.2 pounds (lb)
1 short ton = 2,000 pounds (lb)	=	0.9 tonne (t)	1 tonne (t)	=	1,000 kilograms (kg)
				=	1.1 short tons
VOLUME (APPROXIMATE)			**VOLUME** (APPROXIMATE)		
1 teaspoon (tsp)	=	5 milliliters (ml)	1 milliliter (ml)	=	0.03 fluid ounce (fl oz)
1 tablespoon (tbsp)	=	15 milliliters (ml)	1 liter (l)	=	2.1 pints (pt)
1 fluid ounce (fl oz)	=	30 milliliters (ml)	1 liter (l)	=	1.06 quarts (qt)
1 cup (c)	=	0.24 liter (l)	1 liter (l)	=	0.26 gallon (gal)
1 pint (pt)	=	0.47 liter (l)			
1 quart (qt)	=	0.96 liter (l)			
1 gallon (gal)	=	3.8 liters (l)			
1 cubic foot (cu ft, ft^3)	=	0.03 cubic meter (m^3)	1 cubic meter (m^3)	=	36 cubic feet (cu ft, ft^3)
1 cubic yard (cu yd, yd^3)	=	0.76 cubic meter (m^3)	1 cubic meter (m^3)	=	1.3 cubic yards (cu yd, yd^3)
TEMPERATURE (EXACT)			**TEMPERATURE** (EXACT)		
[(x-32)(5/9)] °F	=	y °C	[(9/5) y + 32] °C	=	x °F

QUICK INCH - CENTIMETER LENGTH CONVERSION

Inches	0			1			2			3			4			5		

Centimeters	0	1	2	3	4	5	6	7	8	9	10	11	12	13

QUICK FAHRENHEIT - CELSIUS TEMPERATURE CONVERSIO

°F	-40°	-22°	-4°	14°	32°	50°	68°	86°	104°	122°	140°	158°	176°	194°	212°
°C	-40°	-30°	-20°	-10°	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°

For more exact and or other conversion factors, see NIST Miscellaneous Publication 286, Units of Weights and Measures. Price $2.50 SD Catalog No. C13 10286

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Executive Summary

The Federal Railroad Administration (FRA), under Task Order 255, tasked Transportation Technology Center, Inc. (TTCI), to evaluate a prototype of an automatic handbrake designed and manufactured by Kaskasia Tool & Machine (New Athens, IL). The evaluation included installation on a rail car, performance evaluation, and impact testing.

The evaluation of the prototype automatic handbrake showed that it can be installed on a car with only minor modifications to connect the air. This prototype did not set the emergency during any of the testing performed. The operation of the prototype worked as specified by the manufacturer.

1. Introduction

FRA, under Task Order 255, tasked TTCI to evaluate a prototype of an automatic handbrake from Kaskasia. The evaluation included installation on a rail car, performance evaluation, and impact testing.

1.1 Objectives

This project was performed to test advanced rail car components developed or under development for functionality.

1.2 Overall Approach

FRA furnished the prototype automatic handbrake for evaluation and testing. Typical tasks were performed with onsite FRA locomotives and freight cars at the Transportation Technology Center (TTC) in Pueblo, CO. FRA locomotives and freight cars were used for demonstrations and testing as needed. Tests were performed with either single cars or cars in trains to evaluate performance and to obtain user feedback.

1.3 Scope

Current freight car components can be improved in terms of ease of operation, inspection, and functionality. For example, handbrakes require a brakeman to climb a ladder and set the brake by applying force at the brake wheel rim, sometimes in inclement weather. Advanced components have been developed in recent years that can be operated from the side of the car or remotely from the locomotive. Handbrake systems need to be made durable, reliable, and optimized for functionality and ease of operation.

In the course of this work, alternatives to current operating practices are suggested, tested, and/or evaluated with demonstrations.

1.4 Organization of the Report

This report covers the installation of the prototype, operation, impact testing, and comments made from the locomotive engineers and carmen involved in the test.

2. Procedure

TTCI personnel installed the prototype automatic handbrake on a 100-ton rail car, per manufacturer specifications. The air tank was filled after installation of the prototype to verify that its operation did not put the car into emergency. The next test phase was carried out to determine whether the prototype operated according to the manufacturer's specifications. The final phase of testing involved three low-speed impacts to verify that the prototype operated properly under impact forces and that the brakes did not release.

2.1 Installation

The initial hopper car selected for testing did not allow the prototype to be properly installed because of a incompatible support beam. The handbrake mounting plate on this hopper car was recessed from the support beam. Figure 1 shows the support beam on this car, which did not allow the proper installation of the prototype.

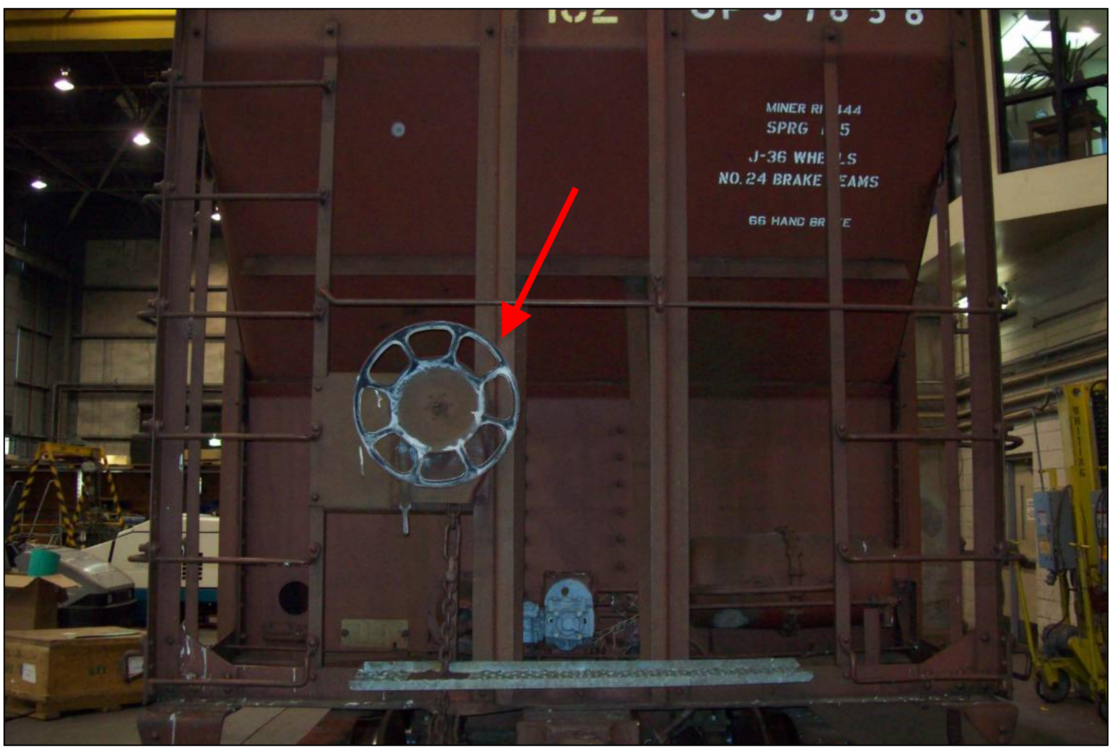

Figure 1. Initial Car with Standard Handbrake

The prototype was successfully installed on a second coal hopper car, as per manufacturer specifications. The installation was easily completed because the prototype was mounted at the same location using the same hardware as a standard handbrake. Figure 2 shows the car with the prototype installed. The only required car modification was the addition of the air interface component into the air system. An air hose connected the prototype to the air interface component. Figure 3 shows the interface component that was added between the air line and the air brake reservoir.

Figure 2. Prototype Installed on a Car

Figure 3. Air Interface Component

2.2 Operation

The operation of the prototype was tested in both the manual and automatic mode. This was done to verify that the prototype operated as described by the manufacturer without causing the car to go into emergency.

In the manual mode, the prototype operated in the same way as a standard, manual handbrake, using the wheel to set the brake and a lever to release the brake.

In the automatic mode, when the prototype was set, the brake was released as the air pressure in the brake system built up. In the automatic mode, when the prototype was not set, there was no effect on the system. With the prototype, once the pressure in the air system reached 20 pounds per square inch (psi), the brake was released. With air pressure in the system, the prototype did not allow the brake to be set manually.

2.3 Impact Test

To further evaluate the prototype, three low-speed impacts were performed. This was done to determine whether the brakes would release if the car was impacted by another car. The prototype was installed on a car loaded to a capacity of 100 tons. The impacting car, or hammer car, is a hopper car loaded to a total gross rail load of 243,050 pounds. Figure 4 shows a diagram of the test consist. The car with the prototype was configured with the B-end leading and positioned at the head end for each test. Figure 5 shows the hammer car and the car with the prototype installed just before the impact, during impact, and after the impact.

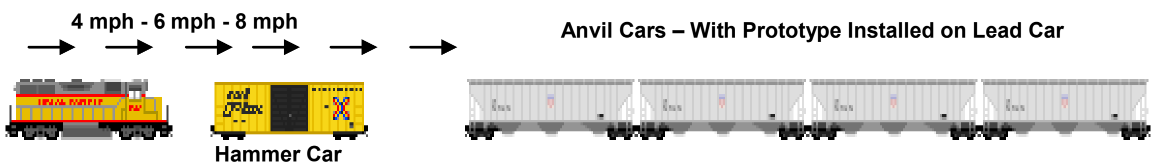

Figure 4. Impact Test Consist Setup

Figure 5. Before, during, and after Impact

The brake did not release at any of the impact speeds tested.

3. Discussion

Throughout the installation, operation, and impact testing of the prototype, several locomotive engineers and carmen were asked to evaluate the prototype.

The general comment from the locomotive engineers was that the prototype handbrake took too much control away from them. They did not like the handbrake releasing the brake as the air pressure was building up in the system. The main concern was the potential of the brake releasing during the Class I initial terminal air brake test. During this brake test, the air is pressurized to operating pressure (90 psi), and then, a brake pipe reduction is performed. The reduction applies the brakes to all of the cars. Each car is then checked for air leaks and brake application. Once all of the cars are checked, the brakes are released. The air is then pressurized back to 90 psi, and the train is then ready for full operation. If the handbrakes release during the initial pressurization of the system and the train is on any incline, there is a potential risk that the train would start rolling because of the lack of brakes.

The carmen did not have any problems installing the components used for the prototype. Their only comment was that the valve to set the brake from manual to automatic was in an unsafe location.

The valve is currently located behind the brake wheel, requiring the carmen to climb up onto the car to set the valve to manual or automatic. Figure 6 shows the location of the valve. The concern is that if the carman were to reach through the spokes of the brake wheel to turn it to automatic and the wheel started to spin when the brakes were released a hand could be injured.

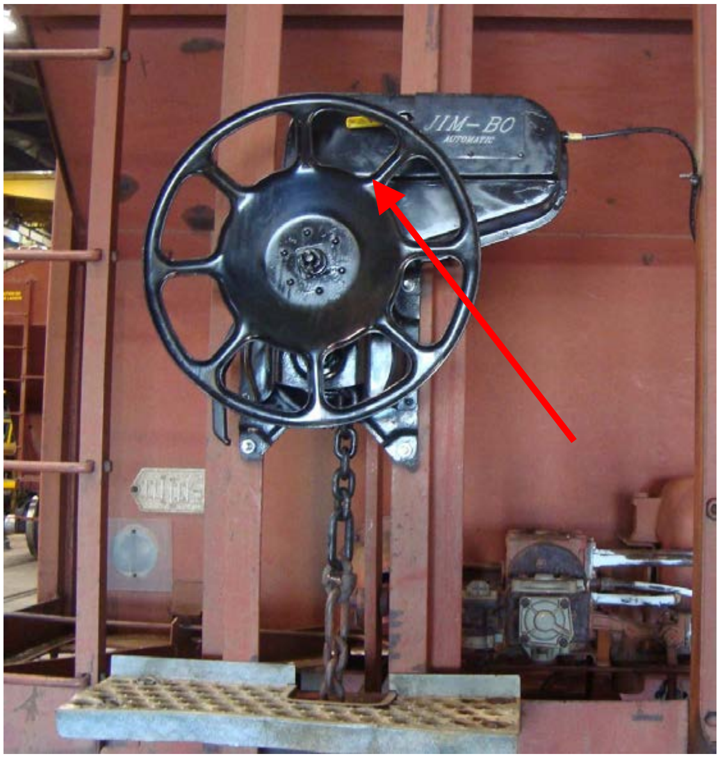

Figure 6. Manual to Automatic Valve Location

4. Conclusion

The evaluation of the automatic prototype handbrake showed that it can be installed on a car with only minor modifications to connect the air. This prototype did not set the emergency during any of the testing performed. The operation of the prototype worked as specified by the manufacturer.

Abbreviations and Acronyms

FRA	Federal Railroad Administration
psi	pounds per square inch
TTCI	Transportation Technology Center, Inc.