Transportation Technology Center, Inc.
Subsidiary of the Association of American Railroads

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Date: June 21, 2010

Subject; Holden Gravity Outlet Gates # CC-264-17-16

To: Mr. Dave Cackovic
Chief of Technical Standards
TTCI / AAR

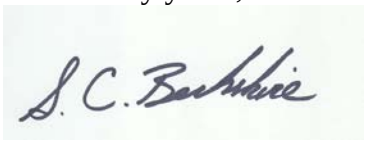
Mr. Cackovic;

Specification testing of Gravity Outlet Gates for covered hoppers Holden International's 42 X 42 Gate Model number FDU4242FB1NV has been completed. Testing was done in Montreal, Canada and in Chicago, IL, for outlet gates produced by Holden International Inc. Dates of the Test Observations in Montreal, were November 3'rd and 4'th, 2009. The Dates of the Test Observations in Chicago were December 2'nd through the 4'th and December 8'th through 10'th, 2009 and completed on April 13, 2010.

All portions of the requisite testing were observed by Mr. Dan Healy or by myself. Applicable requirements of AAR Specification S-233-92 appear to have been successfully completed. As a note the ½" markings of month and year, per section 5, were not on the gate tested. Holden International stated they would be on the production gates. Results of testing are presented in the attached report prepared by Holden America Inc. for Holden International Inc. in support of approval application.

Should you need any additional information, please do not hesitate to call.

Sincerely yours,



Stephen Berkshire
Field Inspector --- Mechanical
Transportation Technology Center, Inc

CC:
A.E. Ciccarelli, Director Mechanical Inspections
K.T. Strout, Chief Inspector – MID
V. Khatchadourian, Holden America Inc.

AAR S-233-92 TESTING OF THE HOLDEN INTERNATIONAL INC. 42 x 42 GRAVITY DISCHARGE OUTLET GATE (MODEL FDU4242FB1NV)

INTRODUCTION

In accordance with the Holden International application submitted in August 2008, for approval of the 42 x 42 Gravity Discharge Outlet Gate, we are hereby documenting the test results as required by AAR S-233-92 specification.

3.1 CYCLE TEST

Cycle tests were conducted in Montreal, Canada on Tuesday, November 3 and Wednesday, November 4, 2009. Present were Varouj Khatchadourian and Diego Pino representing Holden and Mr. Steven Berkshire who observed the 1000 Cycle Test on behalf of the Association of American Railroads (AAR).

The test gate flange flatness was measured and found to be within the +/- 1/16 inch at the bolt centerline as required by S-233-92. Mr. Berkshire inscribed his initials and date on the test gate as SCB 11-09.

The automated cycle test rig houses 6 lb vertical bars each having a cross-sectional area of 1 square inch which apply 6 psi pressure on the gate plate surface. (See Picture 1 in Appendix D). When the gate plate was closed the bars were lowered automatically to apply the required 6 psi load on the gate plate. As the gate plate was driven open, rows of bars dropped past the edge of the gate plate in successive rows until the gate plate was completely opened and unloaded. The bars were then raised automatically so the gate plate could be driven automatically back to a closed position and the cycle could repeat itself. On Tuesday November 3, 2009, 500 cycles were completed and on Wednesday November 4, 2009, another 500 cycles were completed for a total of 1000 cycles.

After 1000 cycles, the test gate was operated without becoming loose or binding. The breakaway torque was measured with a calibrated torque measuring device and the recorded value of the torque was 550 ft lbs. Consequently, the outlet gate met the AAR Cycle Test requirement, as per S-233-92, Sec 3.1.

Mr. Berkshire requested that we prove that the operating mechanism is capable of withstanding a static torque of 2000 ft lb per S-233, item 2.7. He advised that this could be shown by calculations. Please refer to Appendix A showing that stress levels are well below the yield strength of the material of each component in the system. Consequently, the operating mechanism meets the AAR design requirement, as per S-233-92, Sec. 2.7.

3.2 VIBRATION TEST

The test gate was applied on test hopper car FURX 863424. Empty Car Vibration Test was conducted on December 2, 2009 at the Belt Railway of Chicago (BRC) yard in Bedford Park, Illinois. Present were Varouj Khatchadourian from Holden and Mr. Steve Berkshire on behalf of the AAR. Please see setup in Picture 2 in Appendix D

The portable vibrator selected had a 3 inch diameter cylinder, 80 psi operating pressure and it imparted over 15,000,000 ft-lb of energy during the 222 minutes (3 hours and 42 minutes) that it operated per the calculation in Appendix B.

As the test ran continuously for 222 minutes (3 hours and 42 minutes), the vibrator energy output was 15,549,122 ft-lb which is well over the 15,000,000 ft-lb minimum AAR requirement. Consequently and since no damage on the gate or hopper structure was observed, the outlet gate met the AAR Empty Hopper Vibration Test requirement of S-233-92, Sec 3.2.

3.3 TIGHTNESS TEST

The tightness test was conducted on December 3, 2009 on the test gate on test hopper car FURX 863424. Present at this test were Varouj Khatchadourian from Holden and Mr. Dan Healy of the AAR.

The test hopper was filled with 90 cubic feet of fine, dry silica sand with a depth of 30 inches from the gate plate. Then, 20,160 lbs of additional dead weight (concrete blocks over steel footings) were added to achieve the required 6 psi loading on the gate plate surface. Please refer to Appendix C for calculation details of additional dead weight required to achieve 6 psi loading on the gate plate surface, and see Pictures 3 and 4 in Appendix D for photos of the test setup.

The same vibrator used for the Empty Hopper Vibration Test was continuously operated under the same operating conditions for one hour, as required by S-233-92, Sec. 3.3.

A receptacle which was applied on the test gate prior to commencement of the Tightness Test was removed after the test was completed and it showed that no silica sand leakage (0 ounces after 1 hour of testing) occurred during the test versus 8 oz. allowable by the specification. Consequently, the outlet gate met the AAR Tightness Test requirement of S-233-92, Sec 3.3.

3.4. IMPACT TEST

On completion of the Tightness Test the test hopper car was fully loaded to maximum gross weight on rails of 286,000 lbs composed of 217,000 lbs of sand lading and 69,000 lbs of car light weight. Impact Tests were conducted at the Belt Railway of Chicago yard in Chicago. The Impact Test consist was a locomotive and the test hopper car FURX 863424.

The test hopper car was impacted into a series of anvil cars coupled together and stationed with the hand brakes applied. The three anvil cars were ballast cars of 70-ton nominal capacity i.e. each was loaded to 220,000 lbs gross rail load.

Present at the Loaded Car Impact Test were Varouj Khatchadourian and Diego Pino from Holden and Mr. Steven Berkshire from the AAR. Mr. Roy Gelder and Mr. Craig Mowery from the Belt Railway of Chicago were also present. Impact tests were conducted on December 8, 2009.

Loaded Car Impact Tests were conducted at speeds in 2 mph increments starting at 2 mph and up to 10 mph, in accordance with S-233-92, Sec 3.4. A radar gun was used to record the impact speed of the test hopper car as it impacted the anvil cars. The actual speeds recorded were 1 mph, 2.9 mph, 4.5 mph, 7 mph, 8 mph and 11.3 mph. The test car was then reversed and a reverse impact test was conducted at exactly 10 mph. The blue plastic canvas collector that was tightly applied around the test gate to collect any leaked sand was very carefully removed and taken to the shop for measurement of the amount of sand that leaked. The measured amount of lading loss was 4 ounces after 10 minutes, which is half of the amount allowable by S-233-92, Sec 3.4.4.1. (Please see Picture 5 in Appendix D). The test gate was then inspected and the gate plate was found to be fully closed with the locking mechanism properly engaged. The test hopper was then emptied and the test gate was operated through a complete cycle (opened and closed) and the operating mechanism was shown to function properly. Consequently, the outlet gate met the AAR Loaded Car Impact Test requirement of S-233-92, Sec 3.4.4.

Empty Car Impact Tests were conducted on December 9, 2009 at the BRC. Present were Varouj Khatchadourian from Holden and Mr. Steven Berkshire from the AAR.

The forward impact speed recorded was 12.5 mph. After the impact test, the test gate plate was checked and it was found to be fully closed with the locking mechanism properly engaged. The test hopper car was then reversed in preparation for the reverse impact test. The reverse impact speed recorded was 9.5 mph. The test gate was then checked and it was found to be fully closed with the locking mechanism properly engaged.

The actual speed achieved for the forward impact test was 15 mph and the reverse impact test was 11.4 mph, when the radar gun vantage point (45 degree angle to the track) was taken into consideration. The vantage point was from inside a rented vehicle because of the severe weather condition (-30 C with the wind factor on that day). The rented vehicle could not be moved closer to the tracks, for a more head on measurement, because of the condition of the road next to the track. Because a more head-on impact speed could not be recorded and also because the Water Spray Test (Sec 3.5) could not be performed, both because of the severe cold weather, Mr. Berkshire requested that we repeat the 10 mph Empty Car Impact Test at the time of the Water Spray Test, at a later date.

The Empty Car Impact Test was therefore repeated on April 14, 2010 when warmer weather permitted conducting the Water Spray Test. Present at this test were Varouj Khatchadourian and Diego Pino from Holden and Mr. Dan Healy from the AAR. The impact speed recorded for the 10 mph reverse impact test was 10.4 mph. After the reverse impact test, the test gate was

inspected and the gate plate was found to be fully closed with the locking mechanism properly engaged. The test gate was then operated through a complete cycle (opened and closed) and the operating mechanism was shown to function properly. Please see Picture 6 in Appendix D. Consequently, the outlet gate met the AAR Empty Car Impact Test requirement of S-233-92, Sec 3.4.4.

3.5 WATER SPRAY TEST

An attempt was made on December 10, 2009 to conduct the Water Spray Test but because of the very severe cold temperatures at the BRC yard (-30 degrees C with the wind factor) the water pump that was being used and the flexible hoses full of water froze and the test could not be conducted.

The Water Spray Test was therefore performed on April 13, 2010 at the BRC yard in the presence of Mr. Dan Healy of the AAR. Present from Holden were Varouj Khatchadourian and Diego Pino. Please see Picture 7 in Appendix D for test setup.

The stream of water from a nozzle verified to comply with the requirements of Sec 3.5 was applied to the seals and the joints of the test gate in accordance with the requirements. Upon completion of this test, the interior of the test gate was checked and found to be completely free from water penetration. Consequently, the gate outlet met the AAR Water Spray Test requirement.

CONCLUSION

Based on the above test results the Holden International Inc 42 x 42 Gravity Discharge Outlet Gate (Model FDU4242FB1NV) met all AAR S-233-92 test and design requirements.

May 31, 2010
Montreal, Quebec CANADA

APPENDIX A

APPENDIX B

VIBRATOR ENERGY OUTPUT CALCULATIONS

Pneumatic pressure of vibrator	80 psi
Piston area	3.14*(3 in diameter/2)^2 = 7.069 sq in
Piston weight	10.75 lbs
Piston stroke	(0.75 in/(12 in/ft)) = 0.0625 ft
Operating rate (frequency)	2880 CPM

Work per cycle:

W/cycle = [(0.7071*80 psi)*(7.069 sq in) – 10.75 lbs]*(0.0625 ft)
W/cycle = [(56.568 psi)*(7.069 sq in) – 10.75 lbs]*(0.0625 ft)
W/cycle = [(399.88 lbs) – 10.75 lbs]*(0.0625 ft)
W/cycle = [(399.88 lbs) – 10.75 lbs]*(0.0625 ft)
W/cycle = [389.13 lbs]*(0.0625 ft) = 24.32 ft-lb

Total cycles:

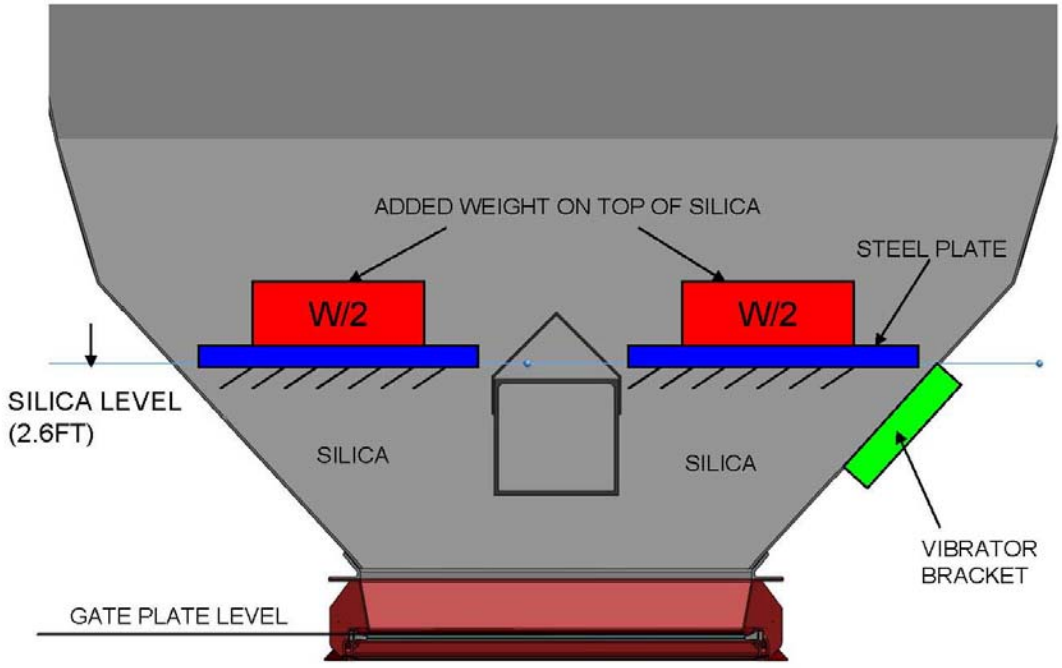
N (required) = 15,000,000 ft-lb/(W/cycle)
N (required) = 15,000,000 ft-lb/24.32 ft-lb
N (required) = 616,776 cycles

Total time:

T (required) = N (required) /Operating rate
T (required) = 616,776 cycles/2880 CPM
T (required) = 214.2 minutes (3 hours and 34 minutes)

APPENDIX C

42x42 Gate Vibration Test Setup



HOPPER CAR CROSS SECTION

Calculation of Static Pressure of Silica on Top of Gate Plate:

$$P_{silica} := g \cdot \rho_{silica} \cdot h_{silica.total}$$

g : gravity constant

$\rho_{silica} := 120\left(\frac{lb}{ft^3}\right)$ Density of silica.

$h_{silica.total} = 2.6 \cdot ft$ Total height of silica above gate plate. This corresponds to a volume of 90 cu-ft.

$$P_{silica} = 2.1 \cdot psi$$

Calculation of Required Weight (W) to Reach Test Pressure:

$P_{req} := (6)psi$ Required Test Pressure on Top of Gate Plate

$w_{steel.plate} := 30in$ Width of Steel Plate (≈ to width of silica surface on each side of center sill)

$len_{steel.plate} := 84in$ Length of Steel Plate (≈ to length of silica surface on each side of center sill)

$A_{steel.plate} := w_{steel.plate} \cdot len_{steel.plate}$ Surface Area of Steel Plate (≈ surface area of silica on each side of center sill)

$W_{extra} := (P_{req} - P_{silica}) \cdot 2 \cdot A_{steel.plate} = 19434\,lbf$ Total Weight Required
(Distributed on Both Sides of Center Sill)

Plate Dimensions and Weight:

Width = 30 in

Length = 84 in

Thickness = ½ in

Weight = 357 lbs

Material = SA36 or equivalent

Qty = 2

Amount of Silica Required:

Volume Silica = 90 cu-ft

APPENDIX D

PICTURE 1: CYCLE TEST RIG AND TEST GATE

PICTURE 2: EMPTY CAR VIBRATION TEST

PICTURE 3: HOPPER BEING LOADED FOR TIGHTNESS TEST

PICTURE 4: HOPPER LOADED WITH CONCRETE BLOCKS FOR TIGHTNESS TEST

PICTURE 5: LOADED CAR IMPACT TEST RESULT SHOWING 4 OZ. LEAKAGE AFTER 10 MINUTES

PICTURE 6: TEST GATE FULLY CLOSED AFTER 10.4 MPH EMPTY CAR IMPACT TEST

PICTURE 7: WATER SPRAY TEST RIG