7219 WHEEL MOVEMENT INVESTIGATION

Revision: 2

July 27TH, 2023

HATCH LTK

Positive Change for the Next Century

Revisions

Revision	Date	Change Description
Rev 1	2023-07-21	Initial Release
Rev 2	2023-07-27	Updated wording from #2 Journal Bearing to Gear Side Journal Bearing. Included graph for Journal Bearing Gap measurement

1. Background

During the routine back-to-back inspection on June 28th, 2023, of married pair 7218/19, it was found that Axle 1 on 7219 failed the measurement criteria. Axle 1, MDZ-1423, had exceeded the back-to-back baseline tolerance, as well as the Gear Side Journal Bearing gap measurement. This wheelset assembly is original to car 7219. Table 1 lists the interference fit, and mounting force for both wheels. The Wheelset Assembly Press Sheet for MDZ-1423 can be found in Appendix A.

Press Information	**Gear Side Wheel**	**Motor Side Wheel**
Interference Fit (mils)	5.0	4.8
Mount 55-80 (tons)	67	73

Table 1: MDZ-1423 Wheelset Assembly Press Information

Axle 1 measured 53.390" in both positions 1 and 2. The Gear Side Journal Bearing gap was measured at 0.027" using a feeler gauge. Table 2 below shows the measurement history from the October 2022 baseline to the time of the failure. Figures 1, and 2 are visual representations of the historical axle back-to-back, and journal bearing gap measurements respectively. The car mileage delta from baseline to failure, was 24,016 miles. The delta measurement from failure to baseline is 0.038".

Measuring Period	**Date**	**Back-to-Back Measurement**				**Journal Bearing Gap Measurement**			
		Axle 1	**Axle 2**	**Axle 3**	**Axle 4**	**1**	**2**	**3**	**4**
Baseline	10/5/2022	53.352	53.306	53.31	53.309	0	0	0	0
Periodic	12/1/2022	53.331	53.286	53.297	53.292	0	0	0	0
Periodic	12/22/2022	53.336	53.285	53.302	53.291	0	0	0	0
Periodic	1/5/2023	53.333	53.284	53.293	53.285	0	0	0	0
Periodic	1/17/2023	53.332	53.278	53.292	53.285	0	0	0	0
Periodic	1/25/2023	53.336	53.285	53.3	53.295	0	0	0	0
Periodic	2/2/2023	53.338	53.289	53.304	53.298	0	0	0	0
Periodic	2/10/2023	53.336	53.292	53.296	53.295	0	0	0	0
Periodic	2/17/2023	53.336	53.282	53.298	53.291	0	0	0	0
Periodic	2/23/2023	53.346	53.311	53.302	53.309	0	0	0	0
Periodic	3/2/2023	53.327	53.293	53.288	53.29	0	0	0	0
Periodic	3/9/2023	53.327	53.277	53.294	53.284	0	0	0	0
Periodic	3/17/2023	53.336	53.286	53.293	53.288	0	0	0	0
Periodic	3/25/2023	53.34	53.289	53.301	53.295	0	0	0	0
Periodic	4/2/2023	53.35	53.314	53.316	53.318	0	0	0	0
Periodic	4/9/2023	53.336	53.291	53.298	53.296	0	0	0	0
Periodic	4/18/2023	53.353	53.3	53.312	53.303	0	0	0	0
Periodic	5/4/2023	53.358	53.305	53.317	53.311	0	0	0	0
Periodic	5/12/2023	53.356	53.303	53.315	53.31	0	0	0	0
Periodic	5/28/2023	53.366	53.3	53.306	53.302	0	0.015	0	0
Periodic	6/28/2023	53.39	53.311	53.316	53.317	0	0.027	0	0

Table 2: 7219 Front Truck Back-to-Back Measurement

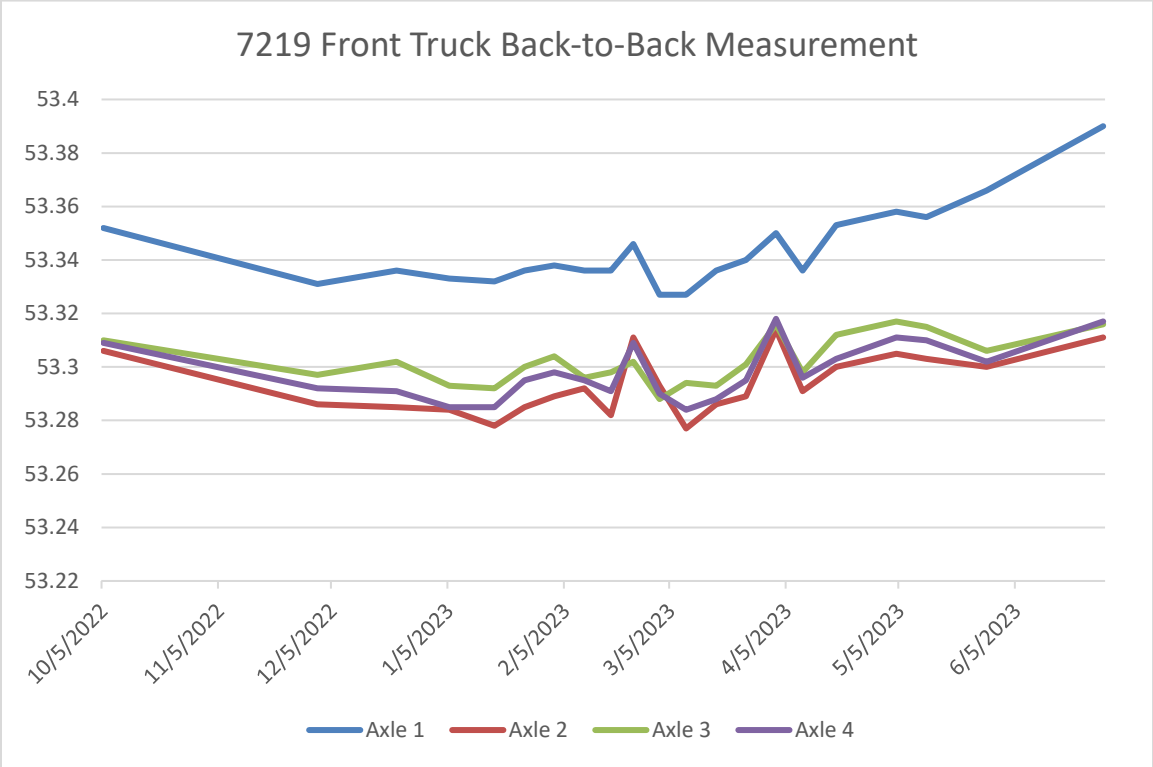


Figure 1: 7219 Front Truck Back-to-Back Measurement History

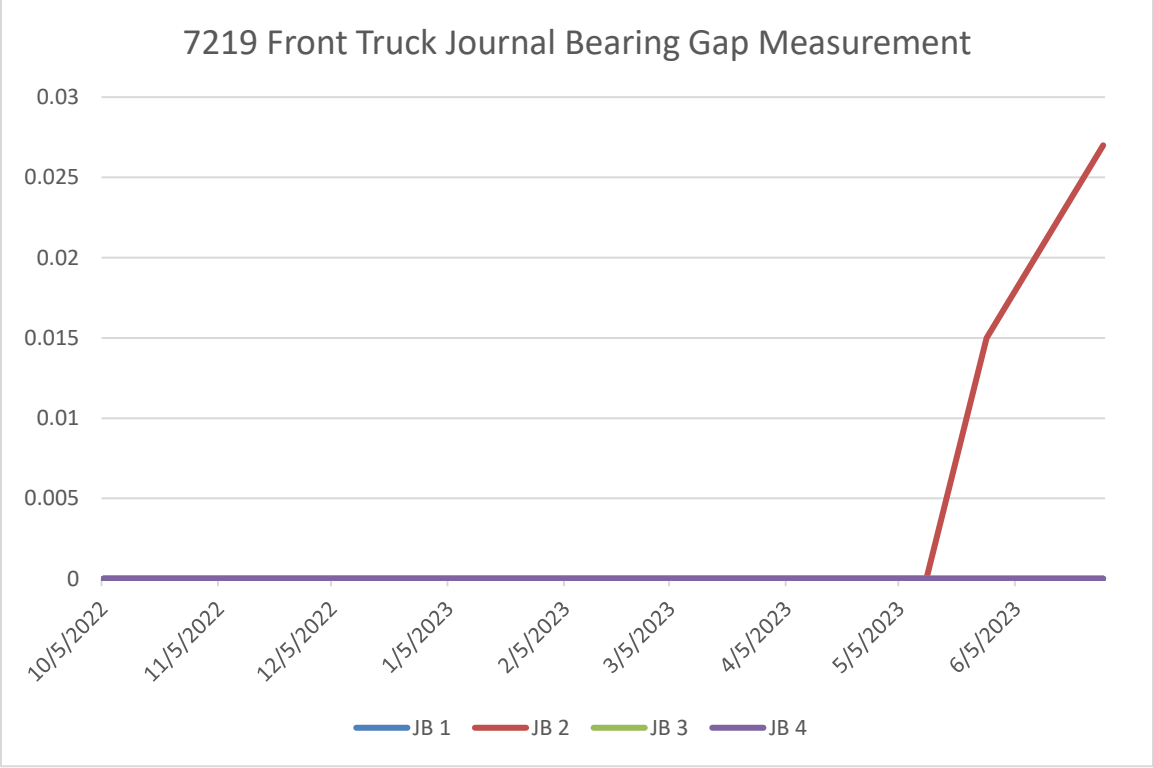


Figure 2: 7219 Front Truck Journal Bearing Gap Measurement History

2. Investigation

2.1. Front Truck C-Inspection

WMATA conducted a complete truck C-Inspection on the front truck of 7219 on July 7th, 2023. During the C-Inspection, it was verified that the back-to-back and Gear Side Journal Bearing Gap measurements of Axle 1 did exceed the allowable limit. Table 3 below shows the measurements taken at the time of the C-Inspection in comparison with the Baseline and failed Periodic measurement. Prior to the inspection, the wheels of Axle 1 were painted red in accordance with Service Bulletin 110 (SBF-110), the back-to-back out of compliant wheelset procedure, as shown in Figure 3.

Measure Period	Date	Back-to-Back Measurement		Journal Bearing Gap Measurement	
		Axle 1 (inch)	Axle 2 (inch)	# 1 (inch)	# 2 (inch)
Baseline	10/5/2022	53.352	53.306	0	0
Periodic	6/28/2023	53.39	53.311	0	0.027
C-Inspection	7/7/2023	53.387	53.308	0	0.027

Table 3: C-Inspection Measurements

The red circle in Figure 4 shows the gap at the Gear Side Journal Bearing. The C-Inspection did not identify any other anomalies with the truck or wheelset assembly. The truck C-Inspection for SN 70442 can be found in Appendix B.

Figure 3: Axle 1 Painted Red to be Removed

Figure 4: Gear Side Journal Bearing Gap

After the inspection was completed, and the measurements were verified, truck shop personnel removed and replaced the front truck. The installed truck was original to car 7014 (SN 70027). The truck was removed from 7014 due to a wheel size issue (WO 17960826). Axles 1 and 2 in truck SN 70027 are both original. The axle information can be found in Table 4.

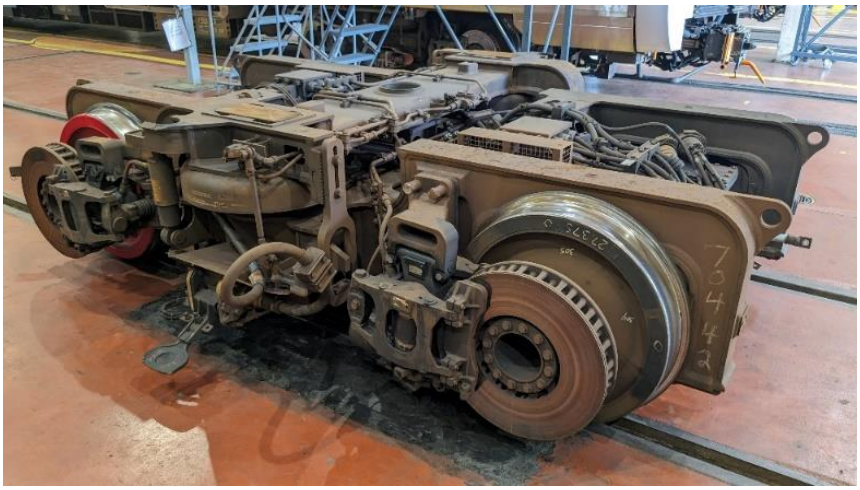


Figure 5: Removed Front Truck SN 70442

Figure 6: Installed Truck SN 70027

Serial Number	70027
Asset Number	682340
Axle 1 Heat Number	LDZ-186
Axle 2 Heat Number	KXZ-141

Table 4: Installed Truck SN 70027 Information

Table 5 lists the wheelset assembly press information for the replacement truck, SN 70027. The complete wheelset assembly press records can be found in Appendix C.

Press Information	Axle 1 – LDZ-186		Axle 2 – KXZ-141	
	Gear Side Wheel	Motor Side Wheel	Gear Side Wheel	Motor Side Wheel
Interference Fit (mils)	4.7	5.0	5.2	5.5
Mount 55-80 (tons)	66	69	70	68

Table 5: SN 70027 Wheelset Assembly Press Information

2.2. Tramming

Truck SN 70442 was trammed at Greenbelt on the BBM Truck Stand on July 14h. Axle 1 which failed for back-to-back, is further away from the operator's stand.

Figure 7: SN 70442

The truck was trammed at a simulated load of AW0 and AW2, and the results of the parallel and diagonal measurements are below in Table 6. The full results can be found in Appendix D.

Measurement	Simulated AW0 (inches)	Simulated AW2 (inches)	Allowable Difference (inches)
Axle Difference AD.13 (Wheelbase P1)	87.993 (2235.022 mm)	87.994 (2235.048 mm)	
Axle Difference AD.24 (Wheelbase P2)	87.990 (2234.946 mm)	87.993 (2235.022 mm)	
Parallel Difference	0.003 (0.076 mm)	0.001 (0.025 mm)	+/- 0.063 (+/- 1.6 mm)
Wheel Diagonal W.Diag.14 (D1)	102.883 (2613.228 mm)	102.888 (2613.355 mm)	
Wheel Diagonal W.Diag.23 (D2)	102.932 (2614.473 mm)	102.935 (2614.549 mm)	
Diagonal Difference	0.049 (1.245 mm)	0.047 (1.194 mm)	+/- 0.100 (+/-2.5 mm)

Table 6: SN 70442 Tram Results

Measurement	Simulated AW0 (inches)
Journal Box to Frame W1 (Motor Side)	1.540
Journal Box to Frame W2 (Gear Side)	1.520

Table 7: Journal Box-to-Frame Measurements

The results of the tramming conclude that the truck is within specification both in parallel and diagonal.

Axle 1's Journal Box-to-Frame measurements for both the Motor Side and Gear Side in Table 7, are in compliance per WMATA's on-car C-Inspection minimum height of 1.26"

The BBM Truck Stand was able to measure the back-to-back distance of Axle 1 and confirmed the exceeded limit.

2.3. Wheelset Assembly Teardown

The teardown was performed at Brentwood on July 19th. During the teardown, only the Gearbox and Motor Side wheels were removed. No other components of the wheelset assembly were pressed off at the time of this investigation. Both wheels on the axle were fitted with hydraulic assist ports. However, hydraulic assist was not used to press the wheels off.

Figure 8: MDZ-1423

In order to properly conduct the inspection, a procedure was followed to document findings, and record data. The inspection and results can be found in Appendix E, and F.

After a visual inspection of the wheelset assembly was performed, the following steps were completed:

1. Measure the gearbox lateral play
2. Dismount the wheels
3. Visually inspect each wheel and wheel bore
4. Measure the inside diameter of the wheel bore
5. Visually inspect the wheelseats on the axle
6. Measure the wheelseat diameters
7. Measure the journal bearing lateral play

2.3.1. Gearbox Lateral Play

The gearbox lateral movement was measured using a dial gauge. The measurement was performed against the Gearbox, and Motor Side Wheels, and both times the readings were 0.002". This can be found in the Appendix F.

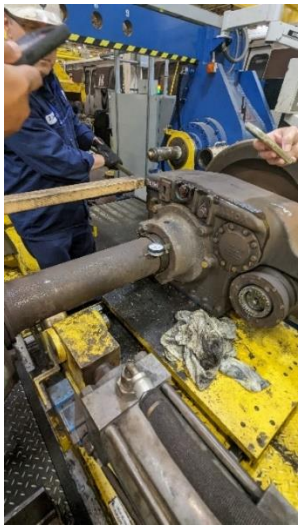


Figure 9: Gearbox Lateral Movement

2.3.2. Wheel Dismount

The results of the dismount tonnage can be found in Table 8.

Figure 10: MDZ-1423

Wheel	**Dismount Force** (tons)
Left Wheel (GBX End)	110
Right Wheel (Free/Motor End)	128

Table 8: Dismount Tonnage

The Motor Side Wheel tonnage value was observed on the computer during the dismount, and extrapolated from the *Dismount – Right Wheel (Free End)* chart found in Appendix G. The BBM Press Machine does not supply this value on the dismount charts. The Gearbox Wheel chart is found in Appendix G as well.

There were no issues when removing either wheel.

2.3.3. Wheel Inspection

2.3.3.1. Gearbox Side Wheel

The visual inspection of the Gearbox Side Wheel showed a larger rust band along the inboard side of the wheel bore compared to the Motor Side Wheel seen in Figures 11 through 13 below. After the bore was cleaned, black bands indicating fretting and wheel movement remained on the inboard side of the wheel bore in Figure 14. This fretting is consistent with other wheelset assemblies which have failed for out-of-tolerance back-to-back measurements.

Figure 11: Gear Side Wheel Inboard

Figure 12: Gear Side Wheel Inboard

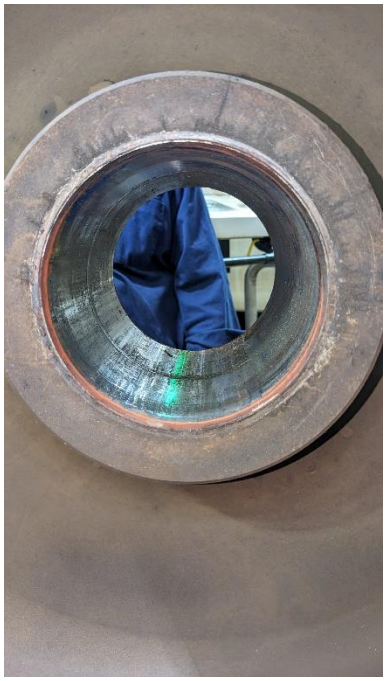


Figure 13: Gear Side Wheel Inboard

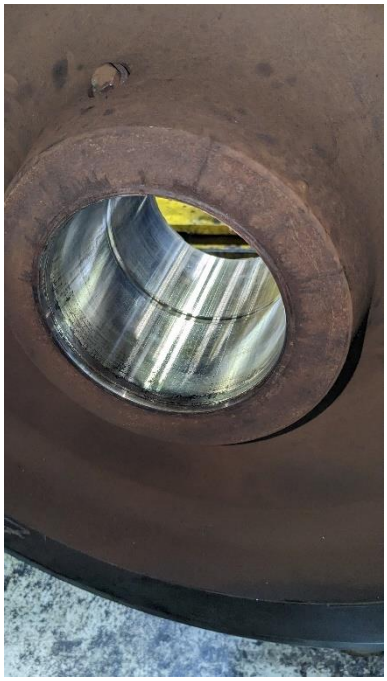


Figure 14: Gear Side Wheel Inboard

2.3.3.2. Motor Side Wheel

The visual inspection of the Motor Side Wheel showed rust on the inboard taper similar to the Gear Side Wheel as seen in Figure 15. This rust is along the circumference of the edge. The lateral lines in the bore are from the residual Molykote used during the wheel press on at ORX. After the bore was cleaned, these lines were not present as seen in Figure 16. Black bands remained at the inboard side of the wheel bore. Similar to the Gearbox Side Wheel.

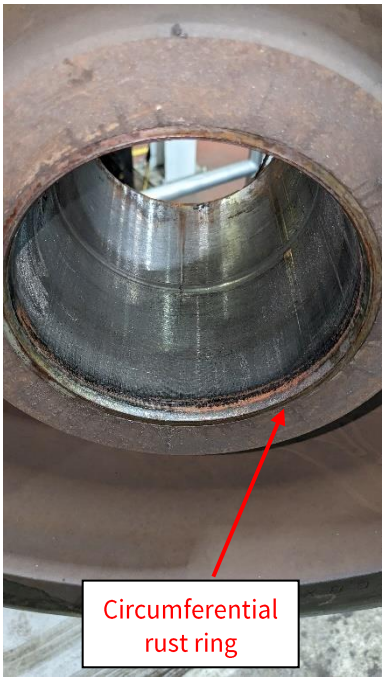


Figure 15: Motor Side Inboard

Figure 16: Motor Side Outboard

Figure 17: Motor Side Wheel Bore Cleaned

2.3.4. Inner Wheel Bore Diameter

The inner diameter was taken at seven points along the bore of each wheel. The measurements were taken with a Tri-Mic Bore Gauge. Figure 18 below shows where the measurements were taken, labeled Points One through Seven.

Table 9 lists the dimensions, along with the referenced measurement points. From the results it is seen that starting at the Inboard Side (Position 1), to the Outboard Side (Position 7) there is an overall decreasing taper through the wheel bore.

Figure 18: Inside Bore Measurement Points

Point	Location	Motor Side Wheel (inches)	Gear Side Wheel (inches)
1	Inboard (IB) Side	5.167	5.169 & 5.167
2	IB Inside 1”	5.163	5.168 & 5.171
3	IB Middle to Groove	5.163	5.163
4	IB at Groove	5.165	5.163
5	Outboard (OB) at Groove	5.160	5.156
6	OB Middle to Groove	5.152	5.157
7	OB Side	5.155	5.158

Table 9: Inner Bore Dimension

2.3.5. Visual Wheelseat Inspection

2.3.5.1. Gearbox Wheelseat

Figures 19 through 21 of the Gearbox Side Wheelseat visual inspection showed no signs of metal tears from the dismount. A consistent pattern of fretting was seen, similar to other wheelseats which have failed due to the axle back-to-back exceeding tolerance. This ring thickness is alike to that of the inner bore of the respective wheel found in Section 2.3.3.1.

A scale was placed at the relief groove to measure the overall length of the fretting band. The band length was 0.400”, as shown in Figure 22 below.

Figure 19: Gear Side Wheelseat

Figure 20: Gear Side Wheelseat

Figure 21: Gear Side Wheelseat

Figure 22: Gear Side Wheel Fretting with Scale

2.3.5.2. Motor Side Wheelseat

Figures 23 through 25 are of the Motor Side Wheelseat. No tears were found during the inspection. It was observed that there was a rust band along the outside circumference of the axle by the relief groove much like the Gearbox Side Wheelseat. This was expected as the inner bore of the Motor Side Wheel had a similar pattern.

A scale was placed at the relief groove to measure the overall length of the fretting band. The band was 0.350”, as shown in Figure 26 below.

Figure 23: Motor Side Wheelseat

Figure 24: Motor Side Wheelseat

Figure 25: Motor Side Wheelseat

Figure 26: Motor Side Wheelseat Fretting with Scale

2.3.6. Wheelseat Diameter

Both wheelseat diameters were measured in three locations using a Large-Diameter Micrometer. Outboard (OB), Center (C), and Inboard (IB) as shown in Figure 27. A second set of measurements were taken at each location by roating the axle 90°. Table 10 below lists results of the measurements.

The wheelseat diameter tolerance for a used axle is 5.618” to 5.621”. All of the measured points were within this specification.

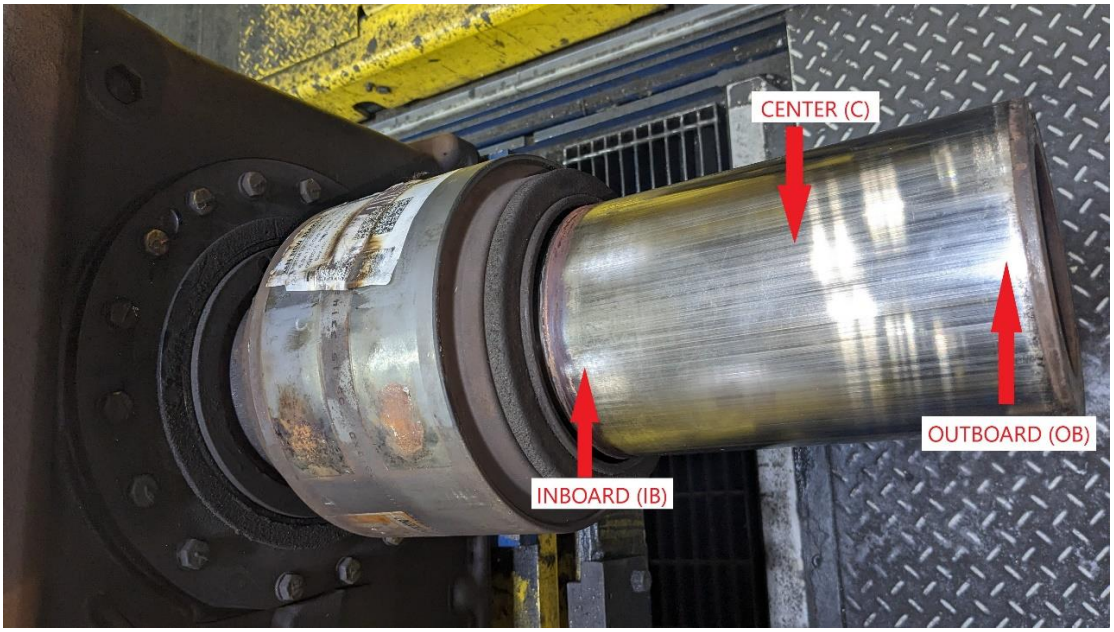


Figure 27: Wheelseat Measurement Points

Wheelseat	**Position**	**OB** (inches)	**C** (inches)	**IB** (inches)	**Average** (inches)
Gearbox Side Diameter	0°	5.6203	5.6207	5.6206	5.6205
	90°	5.6204	5.6206	5.6206	
Motor Side Diameter	0°	5.6202	5.6204	5.6205	5.6202
	90°	5.6198	5.6202	5.6203	

Table 10: Wheelseat Diameters

2.3.7. Journal Bearing Lateral Play

The last inspection was to check the lateral play of the journal bearings using a dial indicator. The lateral movement was measured after the wheels were removed. The results are in Table 11. The acceptable range as stated in MSI 000005 is 0.001” to 0.02”. The gearbox side journal bearing exceeds the allowable tolerance.

Journal Bearing	**Lateral Movement** (inches)
Motor Side	0.0050
Gearbox Side	0.0500

Table 11: Journal Bearing Lateral Play

3. Conclusion

Axle MDZ-1423 was found to be out of tolerance during the routine back-to-back inspections. Further investigation was performed on the truck to identify failure points. The Truck C-Inspection verified the out of compliant measurements taken prior; the visual inspection did not yield any anomalies. The parallel and diagonal tramming results were both in tolerance. The wheelset assembly teardown provided the most evidence of what caused the wheel movement. Both the Gear and Motor Side Wheelseats had signs of fretting, which is consistent with previous failed back-to-back axles due to the micro-ratcheting effect.

MDZ-1423 was original to car 7219 and had wheels pressed to the 55 to 80-ton criteria, with an interference fit of 3.5 to 6.0 mils. Wheels pressed to this standard have been identified as being susceptible to back-to-back failures.

The results of this inspection are consistent with previous findings of the investigation into wheel migration on the 7000-Series fleet. The wheel mitigation investigation found that the 7000-Series wheelsets are susceptible to ratchet extrusion for which the corrective action is to increase the press tonnages and interference fits. It is likely failures will continue to occur until the new press tonnage and higher interference fit are in place. As such, it is recommended that WMATA continue to routinely measure the back-to-back distance of the 7000-Series wheelsets.

4. Appendix

A. MDZ-1423 Press Record
B. SN 70442 Front Truck C-Inspection
C. SN 70027 Wheelset Assembly Press Records
D. SN 70442 Front Truck Tram
E. MDZ-1423 Axle Inspection
F. MDZ-1423 Axle Record Sheet
G. MDZ-1423 Wheel Dismount Charts

APPENDIX A: MDZ-1423 PRESS RECORD

KAWASAKI RAIL CAR WMATA 7000 WHEEL SET ASSEMBLY DATA	Doc No 00452	Rev P6	Dwg D6183-000005	Rev d	Authority	ORX®
	ORX Item No WM7-0000		KRC Part No 6183-000005		PM AG	
PO 37095	QV 1267	By 1242	Asmy Date 2016-04-27		DB 1319	WM7-0894

AXLE	Forge No 1423	Forge Heat MDZ	Forge Mfg OSW	Forge Date (MM-YY) 12-15

BACK TO BACK

Min 53.250 53.375 288	Max 53.250 53.375 292
// (mils) 0 30 3	Tapes w/in ½ ✓ ✗ ✓

GEAR UNIT

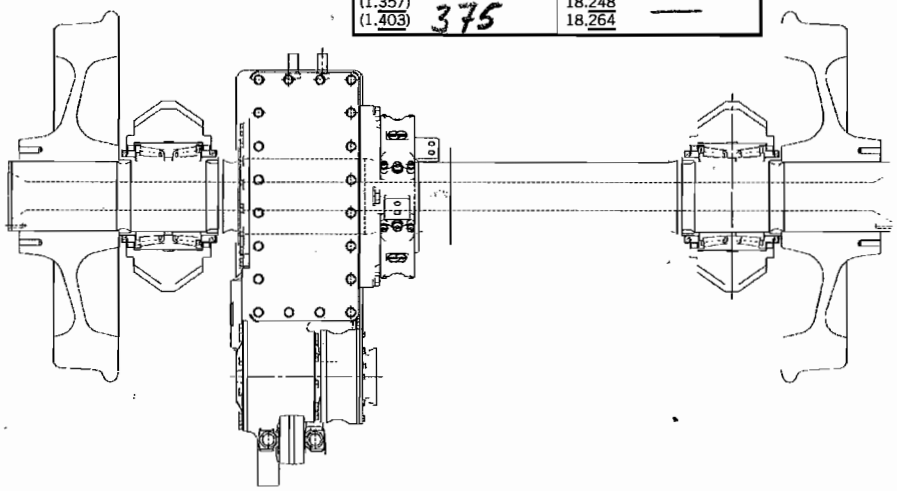
SN 31000383	Size 6.1000
Seat Δ +00 +10 +09	Bore Δ (–40) (–50) –50
Int (mils) 5.9	Mount (tons) 60 101 94
Quill Face–Brg Stop (1.357) (1.403) 375	Quill Face–Axle End, Sample 18.248 18.264 —

GROUND RING

Size 5.9800	Seat Δ +00 +10 +07
Bore Δ –35 –45 –45	Mount Temp (°C) 185 200 195

LEGEND

Δ	delta; the deviation from a reference size
↗	radial runout
⊥	axial runout; perpendicularity
↔	end play; lateral
//	parallelism
( )	reference only



GS WHEEL

SN 2959	Date 15-11
Mfg JW	Heat 68X
Tape 31.5 34.0 32	Size 5.6200
Seat Δ +00 +10 +07	Bore Δ (–35) (–50) –43
Int (mils) 5.0	Mount (tons) 55 80 67
Spike (tons) 25 40 28	↗ (mils) 0 5 3
⊥ (mils) 0 15 2	Reserved

GS BEARING

SN 331422	Date 05-15
Mfg Timken	Size 5.6905
Seat Δ +00 +10 +07	Bore Δ –25 –35 –33
Int (mils) 4.0	Mount (tons) 10
Seat (tons) 25 40 32	↔ (mils) 0 20 2

MS BEARING

SN 331204	Date 05-15
Mfg Timken	Size 5.6905
Seat Δ +00 +10 +06	Bore Δ –25 –35 –35
Int (mils) 4.1	Mount (tons) 10
Seat (tons) 25 40 32	↔ (mils) 0 20 3

MS WHEEL

SN 2945	Date 15-11
Mfg JW	Heat 68X
Tape 31.5 34.0 32	Size 5.6200
Seat Δ +00 +10 +05	Bore Δ (–35) (–50) –43
Int (mils) 4.8	Mount (tons) 55 80 73
Spike (tons) 25 40 29	↗ (mils) 0 5 3
⊥ (mils) 0 15 5	Reserved

7K TRUCK INSPECTION WORKSHEET

PRINT NAME:

DATE: 7/7/2023 EMP#

FRONT COUPLER INSPECTION

BUFFING FACE:	PASS	FAIL
HOOK HEIGHT/WIDTH:	PASS	FAIL
THROAT INSPECTION:	PASS	FAIL

DON'T FORGET COUPLERS

COUPLER SPRING TENSION: _____

WHEEL #2				
WHEEL SIZE	27.260			
FLANGE SIZE	0			
DISC SIZE	3.61			
CALIPER BUSHINGS	PASS	X	FAIL	
GROUND BRUSHES WORN?	Y		N	X
GROUND BRUSHES REPLACED?	Y		N	X

WHEEL #1				
WHEEL SIZE	27.30			
FLANGE SIZE	0			
DISC SIZE	3.63			
CALIPER BUSHINGS	PASS	X	FAIL	
GROUND BRUSHES WORN?	Y		N	X
GROUND BRUSHES REPLACED?	Y		N	X

AXLE 1 BACK TO BACK MEASUMENT: 53 1/4 – 53 3/8
53.386 & 53.387
AXLE 1 CLEARANCE JB AND WHEEL HUB
FAIL

NOTES: JB #2 HAD A GAP OF 0.027"

CAR # 7219 | FRONT TRUCK S/N: 70442

WHEEL #4				
WHEEL SIZE	27.345			
FLANGE SIZE	0			
DISC SIZE	3.62			
CALIPER BUSHINGS	PASS	X	FAIL	
GROUND BRUSHES WORN?	Y		N	X
GROUND BRUSHES REPLACED?	Y		N	X

WHEEL #3				
WHEEL SIZE	27.325			
FLANGE SIZE	0			
DISC SIZE	3.65			
CALIPER BUSHINGS	PASS	X	FAIL	
GROUND BRUSHES WORN?	Y		N	X
GROUND BRUSHES REPLACED?	Y		N	X

AXLE 2 BACK TO BACK MEASUMENT: 53 1/4 – 53 3/8
53.307 & 53.308
AXLE 2 CLEARANCE JB AND WHEEL HUB
PASS

NOTES:

COUPLER SPRING TENSION: _____

WHEEL #6				
WHEEL SIZE				
FLANGE SIZE				
DISC SIZE				
CALIPER BUSHINGS	PASS		FAIL	
GROUND BRUSHES WORN?	Y		N	
GROUND BRUSHES REPLACED?	Y		N	

WHEEL #5				
WHEEL SIZE				
FLANGE SIZE				
DISC SIZE				
CALIPER BUSHINGS	PASS		FAIL	
GROUND BRUSHES WORN?	Y		N	
GROUND BRUSHES REPLACED?	Y		N	

AXLE 3 BACK TO BACK MEASUMENT: 53 1/4 – 53 3/8
AXLE 3 CLEARANCE JB AND WHEEL HUB

NOTES:

CAR # | REAR TRUCK S/N:

WHEEL #8				
WHEEL SIZE				
FLANGE SIZE				
DISC SIZE				
CALIPER BUSHINGS	PASS		FAIL	
GROUND BRUSHES WORN?	Y		N	
GROUND BRUSHES REPLACED?	Y		N	

WHEEL #7				
WHEEL SIZE				
FLANGE SIZE				
DISC SIZE				
CALIPER BUSHINGS	PASS		FAIL	
GROUND BRUSHES WORN?	Y		N	
GROUND BRUSHES REPLACED?	Y		N	

AXLE 4 BACK TO BACK MEASUMENT: 53 1/4 – 53 3/8
AXLE 4 CLEARANCE JB AND WHEEL HUB

NOTES:

APPENDIX C: SN 70027 WSA PRESS RECORDS

KAWASAKI RAIL CAR WMATA 7000 WHEEL SET ASSEMBLY DATA	Doc No 00452	Rev P6	Dwg D6183-000005	Rev d	Authority	ORX
	ORX Item No WM7-0000		KRC Part No 6183-000005		PM AL	
PO 28792	QV 1267	By 1242	Asmy Date 8-1-14		DB 1319	WM7-0087

AXLE	Forge No	Forge Heat	Forge Mfg	Forge Date (MM-YY)
	186	LDZ	OSW	03-14

BACK TO BACK

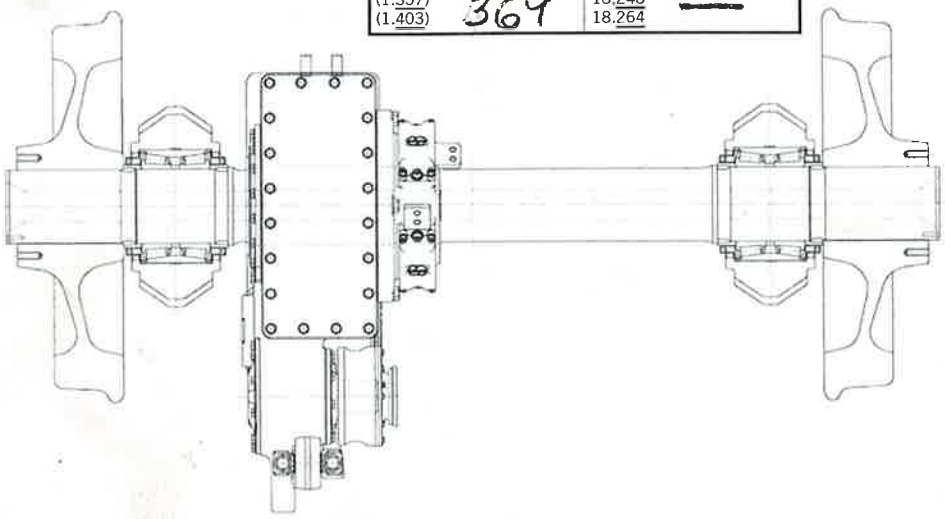
Min 53.250 53.375	291	Max 53.250 53.375	297
// (mils) 0 30	2	Tapes w/in ½ ✓ ✗	✓

GEAR UNIT

SN B1307015		Size 6.1000	
Seat Δ +00 +10	+10	Bore Δ (–40) (–50)	–50
Int (mils) 6.0		Mount (tons) 60 101	101
Quill Face–Brg Stop (1.357) (1.403)	369	Quill Face–Axle End, Sample 18.248 18.264	—

GROUND RING

Size 5.9800		Seat Δ +00 +10	+08
Bore Δ –35 –45	–37	Mount Temp (°C) 185 200	190



LEGEND

Δ	delta; the deviation from a reference size
↗	radial runout
⊥	axial runout; perpendicularity
↔	end play; lateral
//	parallelism
( )	reference only

AL 3-25-15 0832

GS WHEEL

SN 316		Date 01-14	
Mfg JW		Heat B2F ~~82F~~	
Tape 31.5 34.0	32	Size 5.6200	
Seat Δ +00 +10	+10	Bore Δ (–35) (–50)	–37
Int (mils) 4.7		Mount (tons) 55 80	66
Spike (tons) 25 40	31	↗ (mils) 0 5	4
⊥ (mils) 0 15	2	Reserved	

GS BEARING

SN 697392		Date 11-13	
Mfg Timken		Size 5.6905	
Seat Δ +00 +10	+06	Bore Δ –25 –35	–34
Int (mils) 4.0		Mount (tons) 13	
Seat (tons) 25 40	32	↔ (mils) 0 20	2

MS BEARING

SN 697717		Date 11-13	
Mfg Timken		Size 5.6905	
Seat Δ +00 +10	+07	Bore Δ –25 –35	–34
Int (mils) 4.1		Mount (tons) 10	
Seat (tons) 25 40	32	↔ (mils) 0 20	2

MS WHEEL

SN 287		Date 01-14	
Mfg JW		Heat A6P	
Tape 31.5 34.0	32	Size 5.6200	
Seat Δ +00 +10	+10	Bore Δ (–35) (–50)	–40
Int (mils) 5.0		Mount (tons) 55 80	69
Spike (tons) 25 40	32	↗ (mils) 0 5	3
⊥ (mils) 0 15	2	Reserved	

KAWASAKI RAIL CAR WMATA 7000 WHEEL SET ASSEMBLY DATA	Doc No 00452	Rev P6	Dwg D6183-000005	Rev d	Authority	ORX
	ORX Item No WM7-0000		KRC Part No 6183-000005		PM AR	
PO 28792	QV 1284	By 1295	Asmy Date 9-3-14		DB AG	WM7 - 0114

AXLE	Forge No 141	Forge Heat KXZ	Forge Mfg OSW	Forge Date (MM-YY) 03-14

BACK TO BACK

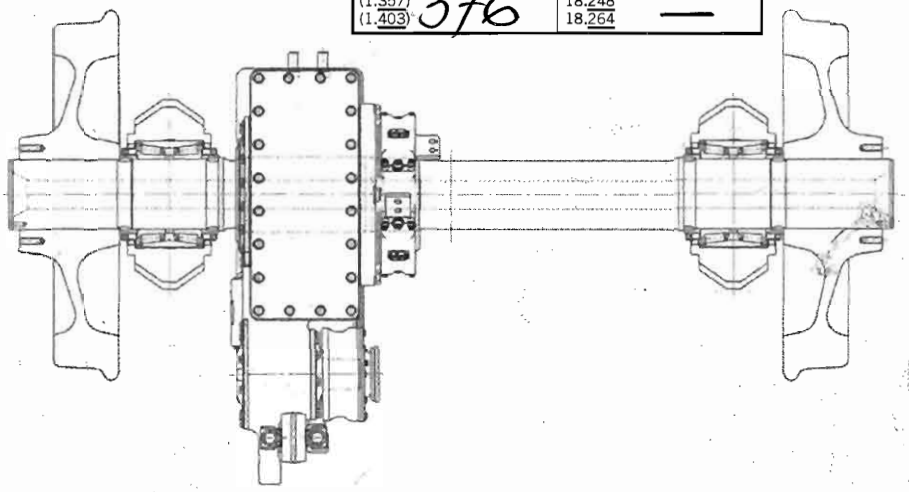
Min (53.250 / 53.375)	Max (53.250 / 53.375)
295	295
// (mils) (0 / 30): 3	Tapes w/in ½ (✓ / ✗): ✓

GEAR UNIT

SN	Size
B1311001	6.1000
Seat Δ (+00 / +10): +10	Bore Δ (–40 / –50): -43
Int (mils): 5.3	Mount (tons) (60 / 101): 70
Quill Face-Brg Stop (1.357 / 1.403): 376	Quill Face-Axle End, Sample (18.248 / 18.264): —

GROUND RING

Size	Seat Δ (+00 / +10)
5.9800	+10
Bore Δ (–35 / –45): -39	Mount Temp (°C) (185 / 200): 199



LEGEND

Δ	delta; the deviation from a reference size
↗	radial runout
⊥	axial runout; perpendicularity
↔	end play; lateral
//	parallelism
( )	reference only

GS WHEEL

SN	Date
745	06-14
Mfg: JW	Heat: C3A
Tape (31.5 / 34.0): 32	Size: 5.6200
Seat Δ (+00 / +10): +10	Bore Δ (–35 / –50): -42
Int (mils): 5.2	Mount (tons) (55 / 80): 70
Spike (tons) (25 / 40): 29	↗ (mils) (0 / 5): 3
⊥ (mils) (0 / 15): 2	Reserved

GS BEARING

SN	Date
158579	02-14
Mfg: Timken	Size: 5.6905
Seat Δ (+00 / +10): +09	Bore Δ (–25 / –35): -27
Int (mils): 3.6	Mount (tons): 10
Seat (tons) (25 / 40): 30	↔ (mils) (0 / 20): 3

MS BEARING

SN	Date
157842	02-14
Mfg: Timken	Size: 5.6905
Seat Δ (+00 / +10): +07	Bore Δ (–25 / –35): -30
Int (mils): 3.7	Mount (tons): 11
Seat (tons) (25 / 40): 30	↔ (mils) (0 / 20): 5

MS WHEEL

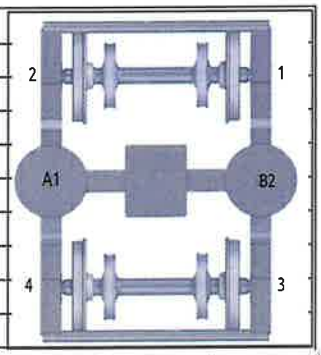
SN	Date
775	06-14
Mfg: JW	Heat: C3A
Tape (31.5 / 34.0): 32	Size: 5.6200
Seat Δ (+00 / +10): +10	Bore Δ (–35 / –50): -45
Int (mils): 5.5	Mount (tons) (55 / 80): 68
Spike (tons) (25 / 40): 31	↗ (mils) (0 / 5): 4
⊥ (mils) (0 / 15): 3	Reserved

Report

APPENDIX D: S/N 70442 FRONT TRUCK TRAM REPORT

BBM Railway Equipment, LLC.
20308

Type	KAWASAKI 7000
Serial Number	70442
Work Order	test71423
Vehicle Number	7219
Line Number	
Description	WMATA
Program	DIM CHECK WITH AIR
Date	2023-07-14 08:48:22
Program Executed	Program Completed
Time Executed	1955 s



	Measure	M.U.	Reference	Target	Min	Max	Result	Check
1	12-Pressing Heads To Target Force - PH A1	[in]	-	-	-	-	32.942	-
2	12-Pressing Heads To Target Force - PH B2	[in]	-	-	-	-	33.032	-
3	12-Pressing Heads To Target Force - PH A1	[STon]	-	-	-	-	7.011	-
4	12-Pressing Heads To Target Force - PH B2	[STon]	-	-	-	-	7.008	-
5	WG.21 - Wheel Gauge	[in]	-	53.313	53.250	53.376	53.406	NO OK
6	WG.43 - Wheel Gauge	[in]	-	53.313	53.250	53.376	53.318	OK
7	AD.24 - Axle Distance	[in]	-	88.000	87.921	88.079	87.990	OK
8	AD.13 - Axle Distance	[in]	-	88.000	87.921	88.079	87.993	OK
9	DAD - Difference Axle Distance (Axle Parallelism)	[in]	-	0	-0.031	0.031	0.003	OK
10	WDiag.23 - Wheel Diagonal	[in]	-	102.890	102.790	102.990	102.932	OK
11	WDiag.14 - Wheel Diagonal	[in]	-	102.890	102.790	102.990	102.883	OK
12	JBOX TO FRAME AW0 W1	[in]	[Absolute]	1.760	1.540	1.980	1.540	OK
13	JBOX TO FRAME AW0 W2	[in]	[Absolute]	1.760	1.540	1.980	1.520	NO OK
14	JBOX TO FRAME AWO W3	[in]	[Absolute]	1.760	1.540	1.980	1.580	OK
15	JBOX TO FRAME AW0 W4	[in]	[Absolute]	1.760	1.540	1.980	1.540	OK
16	12-Pressing Heads To Target Force - PH A1	[in]	-	-	-	-	32.584	-
17	12-Pressing Heads To Target Force - PH B2	[in]	-	-	-	-	32.689	-
18	12-Pressing Heads To Target Force - PH A1	[STon]	-	-	-	-	10.291	-
19	12-Pressing Heads To Target Force - PH B2	[STon]	-	-	-	-	10.292	-
20	WG.21 - Wheel Gauge	[in]	-	53.313	53.250	53.376	53.411	NO OK
21	WG.43 - Wheel Gauge	[in]	-	53.313	53.250	53.376	53.322	OK
22	AD.24 - Axle Distance	[in]	-	88.000	87.921	88.079	87.993	OK
23	AD.13 - Axle Distance	[in]	-	88.000	87.921	88.079	87.994	OK
24	DAD - Difference Axle Distance (Axle Parallelism)	[in]	-	0	-0.031	0.031	0.001	OK
25	WDiag.23 - Wheel Diagonal	[in]	-	102.890	102.790	102.990	102.935	OK
26	WDiag.14 - Wheel Diagonal	[in]	-	102.890	102.790	102.990	102.888	OK
27	JBOX TO FRAME AW2 W1	[KN]	[Absolute]	1.32	1.01	1.66	1.26	OK
28	JBOX TO FRAME AW2 W2	[in]	[Absolute]	1.320	1.010	1.660	1.230	OK
29	JBOX TO FRAME AW2 W3	[in]	[Absolute]	1.320	1.010	1.660	1.300	OK
30	JBOX TO FRAME AW2 W4	[in]	[Absolute]	1.325	1.010	1.660	1.260	OK
31	JB GAP DIFF W1	[in]	[Absolute]	0.420	0.320	0.530	0.280	NO OK
32	JB GAP DIFF W2	[in]	[Absolute]	0.420	0.320	0.530	0.290	NO OK
33	JB GAP DIFF W3	[in]	[Absolute]	0.420	0.320	0.530	0.280	NO OK
34	JB GAP DIFF W4	[in]	[Absolute]	0.420	0.320	0.530	0.280	NO OK

NOTE: The AW0 and AW2 Journal Box-to-Frame measurement criteria are for new built-up trucks with new chevrons

Note	test
Operator : DHARRIS	Signature

Washington Metropolitan Area Transit Authority

7K SERIES RAIL CARS

WHEEL SET LATERAL PLAY

1. Wheel Set Lateral Play: 0.002” & 0.002"

WHEEL DISMOUNTS

2. Dismount the wheels from the axle and collect the press-off records from the press tool.

   a. Max Force Dismount (TON) – Right Wheel (Motor Side/Free End): 128 Tons
   b. Max Force Dismount (TON) – Left Wheel (GBX End):110 Tons

WHEEL INSPECTION

3. Wheels Size

   Right Wheel (Free End): 27.30” Left Wheel (GBX End): 27.325”

4. Visually inspect the wheel bore on each wheel and note findings.
   Notes:

   Rust observed on MS and GS Wheel bore. No visible damage, on either wheel. MS Wheel had a coarse finish compared to GS wheel bore.

5. Perform the measures indicated and fill in the table below.

Axle		MS Wheel	GS Wheel
S/N: MDZ-1423		S/N: 2945	S/N: 2959
Position	**Location**	**Wheel Bore Diameter** (inches)	**Wheel Bore Diameter** (inches)
1.	Inboard (IB) Side	5.167	5.169 & 5.167
2.	IB Side 1”	5.163	5.168 & 5.171
3.	IB Middle to Groove	5.163	5.163
4.	IB at Groove	5.165	5.163
5.	Outboard (OB) at Groove	5.160	5.156
6.	OB Middle to Groove	5.152	5.157
7.	OB Side	5.155	5.157

Failures:

7K SERIES RAIL CARS

AXLE INSPECTION

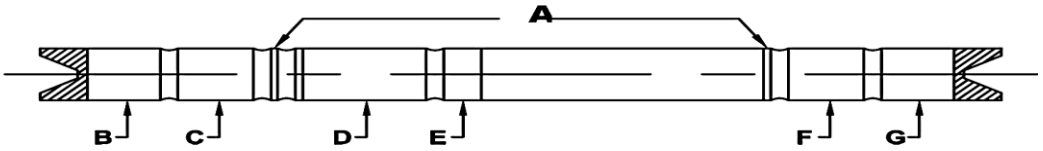
6. Visually inspect the wheel seats on the axle and note findings.
Notes:

MS and GS wheelseats had rust and signs of fretting. No visible damage was seen on the either wheelseats after the wheels were removed.

7. Perform the measures indicated and fill in the table below.

AXLE SERIAL No.: 1423 HEAT No.: MDZ AXLE MFG. DATE: 12-15

TYPE: [X] HOLLOW [ ] SOLID MFG: _____



INSPECTION		REQUIREMENT	AS CHECKED			NOTES / REMARKS
B	WHEEL SEAT DIA. (GS) New/Used	*5.620-5.621 / 5.618-5.621	Diameter(Circle minimum)			Average: 5.6205
			OB	C	IB	
			5.6203	5.6207	5.6206	
			OB	C	IB	
			5.6204	5.6206	5.6206	
G	WHEEL SEAT DIA. (MS) NEW/USED	* 5.620-5.621 / 5.618-5.621	Diameter(Circle minimum)			Average: 5.6202
			OB	C	IB	
			5.6202	5.6204	5.6205	
			OB	C	IB	
			5.6198	5.6202	5.6203	

***** Per approved axle inspection procedure, two (2) measurements 90 degrees apart are required to be checked in three (3) locations (minimum one [1] inch from Inboard [IB] edge at the Center [C], and minimum one [1] inch from Outboard [OB] edge) and the minimum dimension to be circled. **NOTE:** Describe in detail all failures here.

Failures:

All measurements within spec for a used axle wheelseat.

8. Measure Journal Bearing Lateral Play.

a. Lateral Play – Right Bearing (Free End): 0.005”
b. Lateral Play – Left Bearing (GBX End): 0.050”

Machinist	Date

APPENDIX F: MDZ-1423 AXLE RECORD SHEET

Axle Assembly Mounting Record

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

Series # 1 2 3 4 5 6 (7) 8 9

Axle SN: 1423	Date Worked: 07-18-23	Work Order #: 18013865 / 1713169	
Date Mfg.: 12-15	Mfg.: OSW	(Hollow) Solid	Shop: G/B (B/W) DUL

Discrepancy: T/D (GBX SIDE WHL FAILED GAP & BtoB test)

Axle Data		**Gear Box Data**	
			Off: 31000383
Heat No.: MDZ		GBX SN	
Ground Ring Seat	Bore	GBX O/H Date	NEW 2015
GBX Seat		GBX Lateral Play	.002 → (NOT ENOUGH)
BRG Seat LH		High Speed Axial Play (T/A Only)	
BRG Seat RH		Bore Diameter	
Wheel Seat LH		Press Fit	
Wheel Seat RH		Mounting Pressure	

LH Bearing Data GBX End	Off: 331422	Date: 05-15	**RH Bearing Data** Free End	Off: 331204	Date: 05-15
Bearing SN			Bearing SN		
Date Mfg.	Mfg. Tim		Date Mfg.	Mfg. Tim	
Lateral Play			Lateral Play		
Bore Diameter			Bore Diameter		
Press Fit			Press Fit		
Mounting Pressure			Mounting Pressure		

LH Wheel Data GBX End	Off: 2959-1511	Size: 27.27	**RH Wheel Data** Free End	JW Off: 2945-1511	Size: 27.27
Wheel SN			Wheel SN		
Date Mfg.	Mfg.		Date Mfg.	Mfg.	
Wheel Heat #			Wheel Heat #		
OD Size			OD Size		
Wheel Bore Dia.			Wheel Bore Dia.		
Press Fit			Press Fit		
Mounting Pressure			Mounting Pressure		

Runout	Backface	Wheel Back to Back Measurement	Runout	Backface

Personnel 1	Personnel 2	Approved by
BIRVING	R. TAMMARO	

50.076 (07/12)

APPENDIX G: MDZ-1423 WHEEL DISMOUNT CHARTS

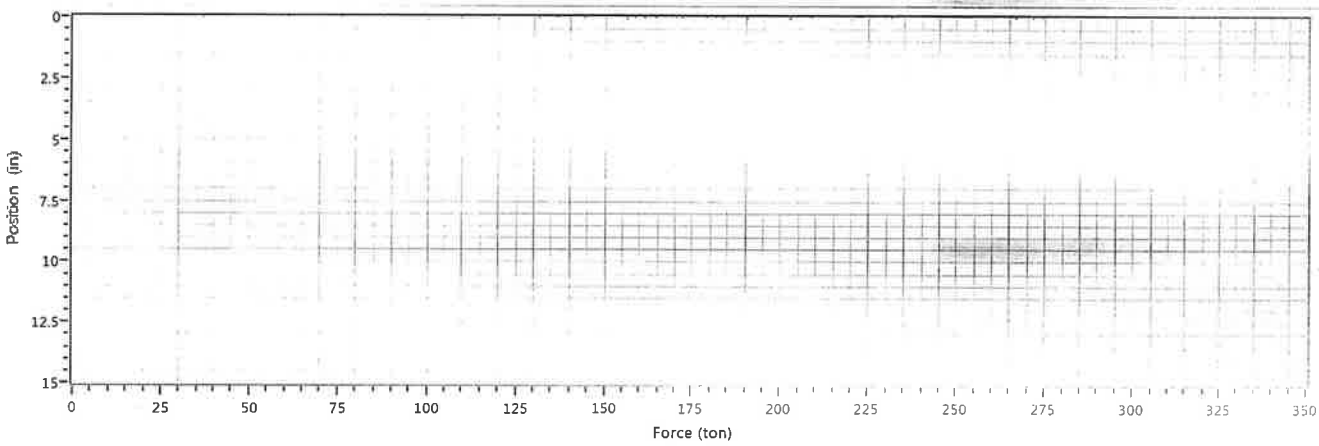
metro

DISMOUNT REPORT

BBM Railway Equipment, LLC.

Wheelset number	Type	Axle number
WMATA	7000 SERIES	OSW1423
Manufactured Date	**Customer**	**Drawing #**
12-15		HEAT LOT: MDZ

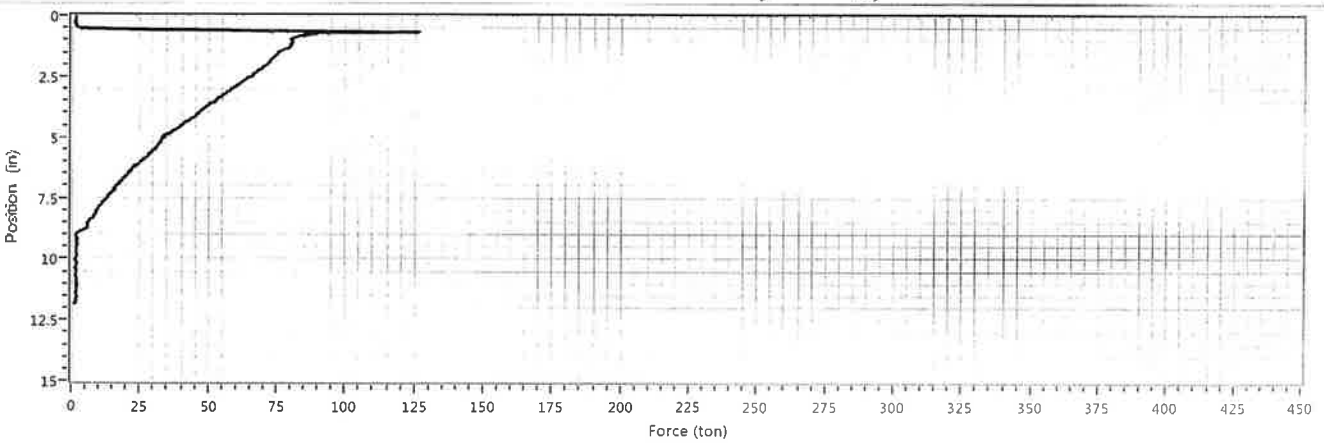
DISMOUNT - GEARBOX



Serial number	Manufactured Date	Date	Max force (ton)
31000383	NEW 2015		0

Operator	Inspector	Result	Note

DISMOUNT - RIGHT WHEEL (FREE END)



Serial number	Manufactured Date	Date
2945-1511	15-11	07/19/2023 08:38

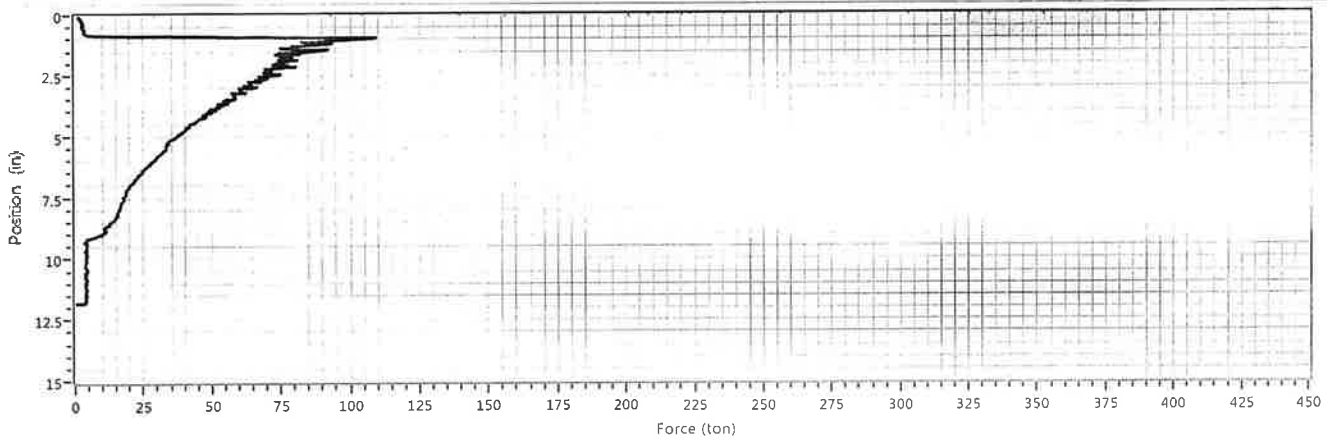
Operator	Inspector	Result	Note
SERVICE			

AXLE LENGTH (in): 71.0000

DISMOUNT REPORT

Wheelset number	Type	Axle number
WMATA	7000 SERIES	OSW1423
Manufactured Date	**Customer**	**Drawing #**
12-15		HEAT LOT: MDZ

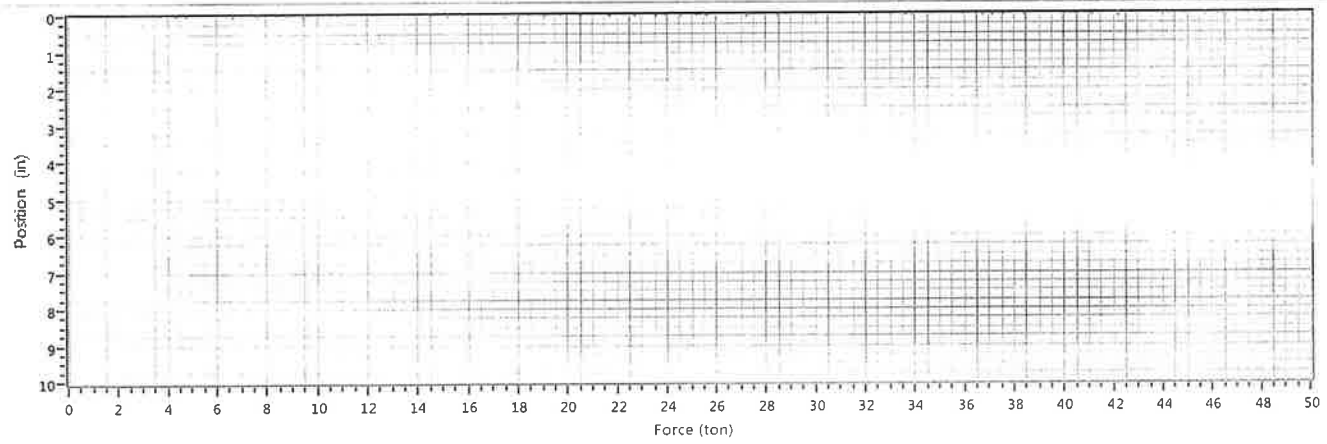
DISMOUNT - LEFT WHEEL (GBX END)



Serial number	Manufactured Date	Date	Max force (ton)
2959-1511	15-11	07/19/2023 08:35	110

Operator	Inspector	Result	Note
SERVICE			

DISMOUNT - RIGHT BEARING (FREE END)



Serial number	Manufactured Date	Date

Operator	Inspector	Result	Note

AXLE LENGTH (in): 71.0000