FRONZ / ONTRACK

APPROVED CODE OF PRACTISE
FOR
HERITAGE NETWORK OPERATORS

Mechanical Supplementary Code B3.4.2.01

Axles

Issue	Prepared (P), Reviewed (R), Amended (A)	Approved by	Effective Date
1	P McCallum (P)	Heritage Technical Committee	27 June 2006

Reference Material

Source	Description	Date
NZ Railways	Mechanical Branch Code No 3, Issue 3	1/5/1947
NZ Railways	Mechanical Branch Code No 3, Issue 4 & 5	1/7/1973

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Amendment History

Version	Section	Amendment

Axles

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1 Introduction

This Supplementary Code relates to:-
B3.1.1.01- Mechanical Code Of Practice, Section 3.3 - Axles

It contains:-

- NZ Railways Mechanical Branch Code No 3 - Axles; Issue 3 of 1/5/1947 and Issue 4 of 1/7/1973 (plus part Issue 5)

which contain information pertaining to rail vehicle axles. Operators are to use those sections that are relevant to their operation.

NEW ZEALAND GOVERNMENT RAILWAYS	**AXLES**	**CODE No. 3**
		Issue No 3
MECHANICAL BRANCH	Cancelled by Issue 4, 1/7/73	Date Issued 1/5/47

(1) AXLES: Sizes for each Type of Vehicle

Description	Bogie Symbol on Rolling-stock Data Sheet.	Size of Axle Journal.	Axle B.P.
		Inches	
Cars and Vans--			
B.P. X. 25330 with S.X.F. axles-boxes	X	3 ½	X.25148
B.P. X. 25330 with Timken axle-boxes	X	3 7/8	Y.35480
B.P. X. 25140 (S.X.F. axle-boxes)	J	3 ½	X.25148
BY. X. 25855 (Timken axle-boxes)	XX	3 7/8	Y.35480
B.P. 3905	R	4 ½	2855
B.P.X.8558	M	3 ¾	3196
B.P.X.8655	U	4	Z.7904
B.P.X.7781	T	4	Z.7904
B.P. 4274	S	3 ¾	3196
B.P.2794	E and F	3 ¾	3196
B.P.1656	Q	3 ¼	1701
B.P.508	P	3 ¼	1701
Vehicles with other miscellaneous bogies	K	3 ¾	
	V	3 ¾	
	L	3 ¼	
	O	3 ¼	
Four-wheel vans		3 ¼	1701
Wagons--			
G wagons		3 ¼	1701
H and J wagons		3 ¼	1701 Heavier axles
		3 ¾	3196 under heavier wagons
HC and JC wagons		4	3081
K wagons		3 ¾	3196
L wagons with underframes B.P. X. 25810		4	3081
All other L wagons		3 ¾	3196
LA wagons		4	3081
LB wagons		3 ¼	1701
LC wagons		4 ½	2855
M wagons		3 ¾	3196
MA wagons		4	3081
MB wagon		3 ¼	1701
MC wagons		4	3801
N wagons		3 ¼	1701
P wagons numbered 121 and over		3 ¾	3196
P wagons numbered below 119		3 ¼	1701
Q wagons numbered below 1229		3 ¼	1701
Q wagons numbered 1229 and over		3 ¾	3196
W wagons with laminated springs " K" and "O" on Rolling-stock Data Sheet No.4		3 ¾	3196

Description	Bogie Symbol on Rolling-stock Data Sheet.	Size of Axle Journal.	Axle B.P.
		Inches	
W wagons with laminated springs "Q," 'T," and "X" on Rolling-stock Data Sheets Nos. 4 and 4/1		4	3801
WA wagons with laminated springs "B" on Rolling-stock Data Sheet No. 4		3 ¼	1701
WA wagons with laminated springs "R" on Rolling-stock Data Sheet No.4/1		3 ¾	3196
X, XA, and XB wagons with laminated springs "B" on Rolling-stock Data Sheet No. 4		3 ¼	1701
X, XA, and XB wagons with laminated springs "K," "O," and "R" on Rolling-stock Data Sheets Nos. 4 and 4/1		3 ¾	3196
XC wagons		4 ½	2855
YB wagons B.P.s 3282, X.25221 and B.P.2371 with steel extension sides		3 ¾	3196
YB wagons B.P.s 139l and 2371 as built or with wood extension sides (light ballast)		3 ¼	1701
Y wagons		3 ¼	1701
R and RA wagons with semi-wood underframes	A, B	3 ¼ 3 ¾	1701 3196
R wagons with all-steel underframes	A, B	3 ¾	3196
RB wagons	C, CX, HX, YX	4 ½	2855
S wagons	A, B	3 ¼	1701
T wagons	A, B	3 ¼	1701
U wagons with semi-wood underframes	A, B	3 ¼	1701
U wagons with all-steel underframes	A, B	3 ¾	3196
UA wagons except No.561	A, B	3 ¼	1701
UA wagon No.561 (oil fuel)	C	4 ½	2855
UB wagons	C, CX, HX, YX	4 ½	2855
UC wagons	C, CX, HX, YX	4 ½	2855
UD wagons (well)		4 ½	2855
UG wagon	A, B, E, F	3 ¼	1701
V wagons	A, B	3 ¼	1701
V wagons	YX	4 ½	2855
VB wagons	C, CX, HC, HL, HX, YX	4 ½	2855
Z wagons, 50 ft	J, X	3 ½	X. 25148
Z wagons, 50 ft. and 47½ ft	C, HL	4 ½	2855
Z wagons, 50 ft. and 47½ ft	T	4	Z. 7094
Z wagons, 33 ft	A	3 ¾	3196
Z wagons, 30 ft. (steel-underframes)	A	3 ¾	3196
Z wagons, 30 ft. (semi-wood underframes)	A, B	3 ¼	1701
ZP wagons	A	3 ¾	3196

NOTE:- For Rolling-stock Data Sheets see Code Instruction No.12.

(2) AXLE JOURNALS: Last Turning Size of Car and Wagon; Condemning Size of Car and Wagon

Size of Axle Journal	Axle B.P	Last Turning Size	Condemning Size
Inches.		Inches.	Inches.
3 ¼	1701	3 1/16	3
3 ¾	3196	3 3/8	3 5/16
4.	3081	3 9/16	3 ½
4	Z. 7904	3 13/16	3 ¾
4 ½	2855 [W. 31181]	4	3 15/16

When axles (with the exception of ax1es to B.P. 3196 and 2855) reach the condemning size, they are to be taken out of service immediately and condemned. Unserviceable axles to B.P. 3196 may be reconditioned for use under 3¼ in. journal brasses, and those to B.P. 2855 may be reconditioned for use under vehicles requiring 4 in. axles to B.P. 3081.

(3) (a) AXLES: Utilizing Unserviceable 3¾ in. Axles under Vehicles requiring 3¼ in. Axles

Axles to B.P. 3196 with journals reduced to 3 5/16 in. diameter (condemned size) may be utilized under vehicles using axles to BP. 1701 (3¼ in.).

Blue print Y. 35368 is to be worked to in re-turning the axles used for this purpose, and either one of the two methods shown on the blue print may be adopted as found most convenient.

Every axle is to be magnetically tested for defects before being placed into service, and each end of axle is to bear the brand 3¾ in./ 3¼ in.

(b) AXLES: Utilizing Unserviceable 4½ in. Axles under Vehicles requiring 4 in. Axles to B.P. 3081

Axles to BP. 2855 [& W.31181] with journals reduced to 3 15/16 in. diameter (condemned size) may be used under vehicles using axles to B.P. 3081 (4 in.).

B.P. Y. 35368 is to be worked to when re-turning axles, and every axle must be magnetically tested for defects before being placed into service and each end of the axle is to be branded 4½ in./ 4 in.

(4) AXLES: Condemned

All condemned axles removed from rolling-stock are to be deeply branded "X" on the journal with a cold set, and such axles are to be stored away from new and serviceable axles.

(5) AXLES, Material for Turning of

Axles are to be made from steel in accordance with specifications to Group 1 on B.P. W. 16298.

The wheel seats of axles are to be machined smooth and parallel and left free from defects.

A parallel burnished finish is to be produced on the journals, which are to be free from chatter-marks, striation-lines, or other defects.

Where other parts of any axle are turned down, the surface is to be left smooth and free from any abrupt changes in section, either by tool-marks or varying diameters.

(6) AXLES: Standard Centres for Turning

Every axle is to have standard lathe centres to B.P. Y. 20070, and under no circumstances are these centres to be tampered with.

(7) AXLES, Branding of

Every axle is to have the following particulars stamped on the ends, after the journal bearings are finished

ONE END.	OPPOSITE END.
Maker's name	Shop symbol
Maker's number	Year fitted.
W.R.No.	Serial No.
Pressure in tons	Pressure in tons.
Size of journal	Size of journal

[Brands of Da? axles to be located as shown on X.14838 & W16794]

An accurate record of these particulars is to be kept by the officers in charge of this work.

[So that axles may be periodically tested with supersonic flaw detection equipment, the ends must be finally finished with a flat smooth surface after branding. This must be done on all wheelsets fitted under locomotives or vehicles at workshops and on all spare wheelsets sent to depots.]

[C.M.E's 24/563 of 27.5.64]
[C.M.E's 28/286 of 11.5.64]

(8) AXLES, Examination of

Whenever wheels are removed from under locomotives and rolling stock, a thorough examination is to be made to ensure that all axles are sound and straight.

Bent or defective axles must be immediately taken out of service and condemned, and under no consideration are bent axles to be straightened.

(9) AXLES: Building up by Welding; Limit for outside Collars and Journals of

The wear on an outside collar may be corrected by building up with electric welding and the collar re-turned to conform with the original size.

An outside collar is not to be permitted to wear below ¼ in. in thickness.

Should the building-up of the outside collar to its original thickness still leave the journal more than ¼ in. longer than the original length, the axle is to be condemned.

The building-up by electric or gas welding on axles (other than outside collars) is not permitted.

[Code (3) clause (9) third paragraph instructs that axles are to be condemned when jouma1wear exceeds ¼" after the outside of the collar has been built up to full thickness. Where wheel sets are to be fitted with oversize brasses the condemning figure is to be increased to $^{3}/_{8}$". Existing provisions re the condemning of axles worn on the diameter will of course still stand.]

[C.M.E's 05/254 of 22.11.1957.]

(10) AXLES, Reporting Defective

Car and Wagon Inspectors and Locomotive Foremen are to report all axle failures on a Loco. 96 form, and forward same to the District Mechanical Engineer, who will, after noting, forward to the Chief Mechanical Engineer.

Works Managers, Works Foremen, and Stationmasters in Charge are to report any defective axles direct to the Chief Mechanical Engineer.

(11) AXLES, Examination of Defective

All defective axles are to be forwarded to the nearest Workshops, and the Works Manager or Works Foreman will forward to the Chief Mechanical Engineer and to the District Mechanical Engineer full particulars of the brands on the defective axle together with any other information which he considers may have any hearing on the cause of the failure.

The defective axles will be held at the Workshops until instructions regarding their disposal are received from the Chief Mechanical Engineer. Should these instructions necessitate forwarding the axle for examination or testing, the defective portions are to be out off and stamped with all brands relative to the axle from which they are out.

(12) AXLES: Record of Number condemned and replaced

A return is to be rendered as soon as possible after the 31st March each year, accounting for the number of all axles condemned and renewed during the previous twelve months.

(13) AXLES: Lubricant used for pressing into Wheel-centres

No lubricant other than tallow is to be used on wheel seat when wheels are being pressed on.

For instructions relating to the pressing of axles into wheel centres, see Code Instruction No.4.

(14) AXLES, Storing of

A protective coating of an approved rust preventative is to be applied to all axles that require to be stored.

Where journals are finished, they are to be protected with sacking or other substantial means.

(15) AXLES: Last Turning Size. of Engine-crank; Condemning Size of Engine-crank

Class.	Original Size.	B.P.	Last Turning Size.	Condemning Size.
	Inches.		Inches.	Inches.
A	7	Y. 9057	6 19/32	6 ½
G	8	X. 10525	7 17/32	7 7/16
X	8	4147	7 17/32	7 7/16

The bearing fillets are not to be reduced below 3/8 in. in radius.

[Sizes quoted in this table are superseded by those on drg Y21193 until further notice]

[C.M.E.'s 24/563 of 11.3.48]

(16) AXLES, Cutting Keyways in

Where keys are fitted to engine-axles, the keyways are to be well finished and all corners lightly filleted. Keys should be fitted accurately.

(17) AXLES: Fitted with Roller Bearings

Axles fitted with roller bearings are to be taken out of service and condemned after they have been in service for fifteen years.

[This clause shall be held in abeyance until further notice.]

[C.M.E.'s 24/563 of 30.7.47]

(18) AXLE JOURNALS (other than Roller Bearing): Original Sizes of Engine, Bogie, and Tender

Class	LEAD BOGIE		COUPLED		TRAIL BOGIE		TENDER	
	B.P.	Size	B.P.	Size	B.P.	Size	B.P.	Size
		Inches		Inches		Inches		Inches
A	3651	4.5	3651 Y.9057	D.T 6.5 L. 7.5	3651	4.75	W.15118	3.75
A.409	3651	4.5	3651	6.5	3651	4.75	W.15118	3.75
AA		4.25		D. 7.5 L.T. 7		5		4.25
AB			5924	6.5	5924	4.75	2855	4.5
B	2210	4.25	2210	6.5			2128	3.5
BA	5029	4.25	5029	6.25			W.15118	3.75
BB	5745	4.5	5745	6.25			W.15118	3.75
C	W.1511	4.25	X. 10234	6.25	X. 10237	4.25	W.15118	3.75

Class	LEAD BOGIE		COUPLED		TRAIL BOGIE		TENDER	
	B.P.	Size	B.P.	Size	B.P.	Size	B.P.	Size
		Inches		Inches		Inches		Inches
	7							
EO, EC				5.5				
F			2672	4.5				
G			X. 10525	7.5				
H			3957	L. 7	3300	4.75		
				D. 8				
K			X. 10761	8	X. 10782	6		
Q	3834	4.187	3834	6.5	3834	5.75	3834	3.75
U	3175	4.25	3175	6.5			1633	3.5
UB	[3834]			6.5				3.75
		4.~~25~~[187]						
UC		4.25		6.5				3.5
W	1015	3.5	1036	6.25	1015	3.5		
WA	1327	3.5	1036	6.25	1327	3.5		
WAB			Y. 6811	7.5	Y. 6811	4.75		
WB		4.25		6		4.25		
WE		4.25		6.5		3.5		
WF	3345	4.25	3345	6.25	3345	4.25		
WG	4773A	4.5	4773A	6.25	4773A	4.5		
WW	4773A	4.5	4773A	6.25	4773A	4.5		
X	4147	4.5	4147	L.D. 8.5	4147	4.75	W.15118	3.75
				I.T. 7.5				

Note.—L = leading axle D = driving axle I = intermediate axle T = trailing axle

(19) AXLE JOURNALS: Last Turning Size of Engine, Tender, and Bogie; Condemning Size of Engine, Tender, and Bogie

Diameter of Journal	Last Turning Size	Condemning Size	Diameter of Journal	Last Turning Size	Condemning Size
Inches	Inches	Inches	Inches	Inches	Inches
3.5	3.219	3.157	5.75	5.328	5.25
3.75	3.374	3.312	6	5.578	5.5
4.125	3.766	3.688	6.25	5.828	5.75
4.187	3.828	3.75	6.5	6.078	6
4.25	3.86	3.782	6.75	6.328	6.25
4.5	4.078	4	7	6.531	6.438
4.75	4.328	4.25	7.5	7.031	6.938
5	4.578	4.5	8	7.484	7.375
5.5	5.078	5	8.5	7.984	7.875

[Sizes quoted in this table are superseded by those on drg Y21193 until further notice]

[C.M.E.'s 24/563 of 11.3.48]

(20) AXLE JOURNALS: Last Turning Size of Traveling Crane; Condemning Size of Traveling Crane

Diameter of Journal	Last Turning Size	Condemning Size	Diameter of Journal	Last Turning Size	Condemning Size
Inches	Inches	Inches	Inches	Inches	Inches
6.5	6.078	6	4.75	4.328	4.25
6	5.578	5.5	4.25	3.86	3.782
5.5	5.078	5	4	3.641	3.562

Diameter of Journal	Last Turning Size	Condemning Size	Diameter of Journal	Last Turning Size	Condemning Size
Inches	Inches	Inches	Inches	Inches	Inches
5	4.578	4.5	3.5	3.219	3.157

[(21) AXLE JOURNALS: Difference of Journal Diameters

The difference in journal diameters of any one axle after turning shall not exceed $^{1}/_{8}$".]

[C.M.E.'s 24/563 of 27 October 1966]

[C.M.E.'s 24/563 of 29 April 1966]

[After overhaul, rolling stock must not be passed out with journals tapered or otherwise out of parallel in excess of $^{1}/_{32}$" on diameter.]

[24/563 of 3.5.1967]

[(22) ULTRASONIC TESTING

Following the derailment of any locomotive, railcar or electric multiple unit stock, the axles of all derailed wheelsets must be ultrasonically tested for cracks.

It shall be the responsibility of the District Mechanical Engineer on whose Division the derailment occurs to ensure that the ultrasonic testing is carried out as soon as possible after the derailment.]

[24/563 of 23/6/69]

NEW ZEALAND GOVERNMENT RAILWAYS **MECHANICAL BRANCH**	**AXLES**	**CODE No. 3** Issue No 4 Date Issued 1/7/73

(1) Sizes of Axles For Each Type of Vehicle:

Vehicle Class		Journal Size mm	Journal Size Length x Dia	Axle Drawing	Axle Blank Drawing
Cars and Vans with Bogies to Drawing: (RB Roller Bearing)					
	1656	178 x 83	7" x 3¼"	1701	
	2794	178 x 95	7" x 3¾"	3196	
	4274	178 x 95	7" X 3¾"	3196	
	X 7781	203 x 102	8" x 4"	Z 7904	W 41151-A
	X 7781 with Isothermos Axleboxes	203 x 102	8" x 4"	Z 7904	W 41151-A
	X 8558	178 x 95	7" x 3¾"	3196	
	X 25140 SKF	RB 100	RB 100mm	W/X 26099/1	W 41151-A
	X 25330 Timken	RB 98.53	RB 3.879"	W/X 25899/1	W 41151-B
	X 25330 SKF : Vans	RB 90	RB 3.54"	X 25148-A	W 41151-A
	X 25330 SKF	RB 100	RB 100mm	W/X 26099/1	W 41151-A
	X 25855 Timken	RB 98.53	RB 3.879"	W/X 25899/1	W 41151-B
	X 26530	203 x 102	8" x 4"	Z 7904	W 41151-A
	X 27250 Northerner Buffet and Steam Heat vans	RB 125	RB 125mm	W31326	W 41151-E
	X 28020 Southerner and Endeavour Buffet Cars	RB 110	RB 110mm	W 31581-2	W 41151-L
	X 28250 Silver Star Cars	RB 110	RB 110mm	W 31740-2	W 41151-L
Dm	M.U. Driving Coach (1936, 1942, 1946 Stock)	212 x 115		X 13681	W 41151-Y
D	M.U. Trailer Coach (1936 Stock)	214 x 100		X 13986	W 41151-Z
*D	M.U. Trailer Coach (1942 Stock)	212 x 110		X 13987	W 41151-W
D	M.U. Trailer Coach (1942 Stock Nos. 107 and 108)	199.5 x 130		W 15693	W 41151-W
*D	M.U. Trailer Coach (1946 Stock Nos. 109-179)	212 x 110		X 13724	W 41151-X
D	M.U. Trailer Coach (1946 Stock Nos. 109-179)	199 x 130		W 15694	W 41151-X

*Axles X 13987 and X 13724 to be eventually replaced by W 15693 and W 15694 rectively.

Wagon Stock: (HD = Heavy Duty)					
Ba		203 x 102	8" x 4"	3081	
Bc		203 x 114 HD	8" x 4½" HD	W 31181	W 41151-E
Bf		203 x 114 HD	8" x 4½"	W 31181	W 41151-E

Vehicle Class		Journal Size mm	Journal Size Length x Dia	Axle Drawing	Axle Blank Drawing
Bp		203 x 114 HD	8" x 4½" HD	W 31181	W 41151-E
Bt		203 x 102	8" x 4"	3081	
Btk		203 x 114 HD	8" x 4½" HD	W 31181	W 41151-E
Bxa		203 x 114 HD	8" x 4½" HD	W 31181	W 41151-E
Bxb		203 x 114 HD	8" x 4½" HD	W 31181	W 41151-E
Bxc		203 x 114 HD	8" x 4½" HD	W 31181	W 41151-E
Bxp		203 x 114 HD	8" x 4½" HD	W 31181	W 41151-E
C		RB 131.85	RB 5.191"	W 31472	W 41151-M
G		178 x 83	7" x 3¼"	1701	
H	Except 1243-1442, 1474-1543, 1554-1573	178 x 95	7" x 3¾"	3196	
H	1243-1442, 1474-1543, 1554-1373	203 x 102	8" x 4"	3081	
Hc		203 x 102	8" x 4"	3081	
J		178 x 95	7" x 3¾"	3196	
Jc		203 x 102	8" x 4"	3081	
Kc		203 x 114	8" x 4½"	2855	
Kp		203 x 114 HD	8" x 4¼" HD	W 31181	W 41151-E
Ks		RB 110	RB 110 mm	WIX 27762/1	W 41151-V
Ks		RB 110	RB 110 mm	W 31622	W 41151-V
La	12901-16184	203 x 102	8" x 4"	3081	
La	16234-24955 (See Loco. 204/8176 and C.M.E.'s 05/825 or 28.3.73 and 23.8.73)	203 x 102 or 203 x 114	8" x 4" 8" x 4½"	3081 2855 or W 31181	W 41151-E
Lc		203 x 114	8" x 4½"	2855	
Lc		203 x 114 HD	8" x 4½" HD	W 31181	W 41151-E
Lp		203 x 114	8" x 4½"	2855	
Lpa		RB x 11O	RB x 110 mm	W 31622	W 41151-V
M		178 x 95	7" x 3¾"	3196	
Mc		203 x 102 or 114	8" x 4" or 4½"	3081, 2855 or W 31181	W 41151-E
Mcp		203 x 102	8" x 4"	3081	
Nc		203 x 114 HD	8" x 4½" HD	W 41151-E	
Nf		203 x 114 HD	8" x 4½" HD	W 41151-E	
Nr		178 x 95	7" x 3¾"	3196	
Nr		203 x 102	8" x 4"	3081	

Vehicle Class		Journal Size mm	Journal Size Length x Dia	Axle Drawing	Axle Blank Drawing
Q	Below 1229	178 x 83	7" x 3¼"	1701	
Q	1229 and above	178 x 95	7" x 3¾"	3196	
R		178 x 95	7" x 3¾"	3196	
Rb	All except 599-608	203 x 114	8" x 4½"	2855	
Rb	599-608	RB 120	RB l20 mm	X 26448 or X 27526	W 41151-P
T	76, 77, 78, 80	178 x 83	7" x 3¼"	1701	
T	124-173	203 x 102	8" x 4½"	2855	
T	174-273 (With Trays For Ferry Traffic	RB 120	RB l20 mm	X 26448 or X 27526	W 41151-P
U		178 x 95.	7" x 3¾"	3196	
Ua	23, 117, 152	178 x 83	7" x 3¼"	1701	
Ua	Except 23, 117, 152, 561	178 x 95	7" x 3¾"	3196	
Ua	561	203 x 114	8" x 4½"	2855	
Ub		203 x 114	8" x 4½"	2855	
Ub	With U' Frame X25824 and bogies X27396	RB 120	RB120 mm	X 26448 X 27526	W 41151-P
Uba		203 x 114	8" x 4½"	2855	
Ubc	1450-63, 1490-98	203 x 114	8" x 4½"	2855	
Ube	Except 1450-63, 1490-98	203 x 114 HD	8" x 4½" HD	W 31181	W 41151-E
Ubf		203 x 114	8" x 4½"	2855	
Ubh	1394, 1443	203 x 114	8" x 4½"	2855	
Ubh	1370, 1385, 1421, 1161	RB 120	RB120 mm	X 27526	W 41151-P
Ubj		RB 120	RB120 mm	X 27526	W 41151-P
Ubl		203 x 114	8" x 4½"	2855	
Ubm	178 x 95	178 x 95	7" x 3¾"	3196	
Ubp		RB 120	RB120 mm	X 27526	W 41151-P
Ubs		RB 120	RB120 mm	X 27526	W 41151-P
Uc	Other than those enumerated below	203 x 114	8" x 4½"	2855	
	[Uc wagons with wheelset 203mm x 114 standard (Drg. ~~2866~~ 2855) are to have wheelset 203 x 114 heavy duty fitted when replacement is required.]				
Uc	788-93, 795-98, 801, 832-35, 837-41, 846-47, 878, 881-82, 913, 1030, 1033, 1082-83, 1107, 1213, 1217-18, 1232, 1234, 1245, 1254-55, 1262, 1266, 1300, 1305, 1318-19, 1332, 1334, 1336, 1342-43 (i.e. 42 tons and over gross load)	203 x 114 HD	8" x 4½" HD	W 31181	W 41151-E
Uc	1224, 1328-29, 1344-49, 1567-71	RB 120	RB l20 mm	X 26448 or X 27526	W 41151-P
Uc	1576-1595	RB 120	RB l20 mm	X 27526	W 41151-P
Uct	1555-1564	RB 120	RB l20 mm	X 26448 or X 27526	W 41151-P
Uct	1599-1603	RB 120	RB l20 mm	X 27526	W 41151-P
Ucx		RB 120	RB l20 mm	X 26448 or	W 41151-P

Vehicle Class		Journal Size mm	Journal Size Length x Dia	Axle Drawing	Axle Blank Drawing
				X 27526	
Ud		203 x 114	8" x 4½"	2855	
Udk		RB 119.15	RB 4.691"	W 31506	W 41151-U
Ug		178 x 95	7" x 3¾"	3196	
Uge		178 x 95	7" x 3¾"	3196	
Uk		RB 119.15	RB 4.691"	W 31506	W 41151-U
Uka		RB 119.15	RB 4.691"	W 31506	W 41151-U
Ul		RB 120	RB 120 mm	X 26448 or X 27526	W 41151-P
Ur		203 x 114 HD	8" x 4½"HD	W 31181	W 41151-E
Urc		RB 120	RB 120mm	X 27526	W 41151-P
Url		203 x 114 HD	8" x 4½" HD	W 31181	W 41151-E
Us	3000-3149	RB 120	RB 120 mm	X 27526	W 41151-P
Us	3150 onwards	RB 119.15	RB 4.691"	W 31506	W 41151-U
Usf	3152-3184	RB 119.15	RB 4.691"	W 31506	W 41151-U
Usk	3000-3149	RB 120	RB 120 mm	X 27526	W 41151-P
Usk	3150 onwards	RB 119.15	RB 4.691"	W 31506	W 41151-U
Uss	3184	RB 119.15	RB 4.691"	W 31506	W 41151-U
V	Except 426-430	178 x 83	7” x 3¼"	1701	
V	426-430	203 x 114	8" x 4½"	2855	
Vb	Except 434, 438, 440	203 x 114	8" x 4½"	2855	
Vb	434, 438, 440	203 x 114 HD	8" x 4½" HD	W 31181	W 41151-E
Vr		RB 120	RB l20 mm	X 26448 or X 27526	W 41151-P
Vs		RB 120	RB 120 mm	X 26448 or X 27526	W 41151-P
W		203 x 102	8" x 4"	3081	
Wa		178 x 95	7" x 3¾"	3196	
Wb		203 x 102	8" x 4"	3081	
Xa		178 x 95	7" x 3¾"	3196	
Xb		178 x 95	7" x 3¾"	3196	
Xc		203 x 114	8" x 4½"	2855	
Xp		203 x 114 HD	8" x 4½" HD	W 31181	W 41151-E
Yb	To drawings 3282, X 25221, 2371 with steel extension sides	178 x 95	7" x 3¾"	3196	
Yb	To drawings 1391, 2371 as built or with wood extension sides	178 x 83	7" x 3¼"	1701	
Yc		203 x 114 HD	8" x 4½" HD	W 31181	W 41151-E
Yd	1001-1035	203 x 114	8" x 4½"	2855	
Yd	1036-1070	RB 120	RB 120 mm	X 26448 or X 27526	W 41151-P
Yf		203 x 114 HD	8" x 4½" HD	W 31181	W 41151-E
Yh		RB 130	RB 130 mm	X 28170	W 41151-M
Z	214, 260, 261, 263-66, 268-73, 335-54, 371-88, 390-98, 401-29, 430-89, 491-570, 631-50	203 x 114	8" x 4½"	2855	
Z	279-99, 316-19 321 322,	RB 90	RB 90mm	X 25148	W 41151-A

Vehicle Class		Journal Size mm	Journal Size Length x Dia	Axle Drawing	Axle Blank Drawing
Z	302, 323-34, 355-70, 399, 400 571-670, 631-650	RB 120	RB 120 mm	X 26448 or X 27526	W 41151-P
Z	308, 309, 490	178 x 95	7" x 3¾"	3196	
Z	275, 278	203 x 102	8" x 4"	Z 7904	W 41151-A
Zp	651	RB 120	RB 120 mm	X 26448 or X 27526	W 41151-P
Zp	652-1150	RB 120	RB 120 mm	X 27526	W 41151-P
Zp	1018	RB 119.15	RB 4.691"	W 31506	W 41151-U
Zm		RB 119.15	RB 4.691"	W 31506	W 41151-U
Za		RB 119.15	RB 4.691"	W 31506	W 41151-U
Ukb		RB 119.15	RB 4.691"	W 31506	W 41151-U
U~~m~~ n		RB 119.15	RB 4.691"	W 31506	W 41151-U

(2) Axle Material:

Axles are to be made from steel to B.S.S. 24, Part 1, Section 2.

(3) Finish on Axles:

All parts of axles shall be machined cylindrical and concentric. Journals and wheelseats shall also be machined parallel.

Surface, finishes on axles shall be to Ra values as follows unless otherwise stated on particular drawings and/or specifications:

Journals for plain bearings - turned to between 1.6 and 3.2 micrometers and then roller burnished or otherwise suitably turned and rolled to give a comparable finish to that produced by the above mentioned method.

Journals for roller bearings - ground to not greater than 0.8 micrometers.

Wheelseats - ground to between 0.4 and 0.8 micrometers.

Axle surfaces other than journals and wheelseats - turned or ground to not greater than 3.2 micrometers.

Axle surfaces shall be free of any abrupt changes in section.

When plain bearing axles are turned, the inside edges of the outside collar are to be turned to 0.8 mm rad. (1/32 in. rad.) so that there is less likelihood of wool packing being caught.

(4) Standard Axle Centre:

Every axle is to have a standard lathe centre to drawing Y20070 and these centres are not to be tampered with under any circumstances.

(5) Branding of Axles:

Every axle is to have the following particulars branded on the ends within the 60 mm (2-3/8") dia. circle shown on the appropriate drawing. All letters and figures shall comply to B.S. 308:

One End

(a) Makers name or initials
(b) Cast number
(c) Letters WR followed by the number of the contract for axles made in Europe.

Opposite End

(a) Shop symbol (see drawing Y 35008)
(b) Year fitted
(c) Serial number
(d) Pressure in tonnes (or tons)

Letters DSB followed by the number of the order for axles made in Australia or Asia.

(d) Pressure in tonnes (or tons)

(e) Size of journal in mm (or inches)

(e) Size of journal in mm (or inches)

[In the case of imported complete wheelsets no branding of the axle ends by N.Z.R. workshops is required.]

An accurate record of these particulars is to be kept by the officer in charge of this work.

After branding is completed, all axle ends are to have a flat surface with a finish not greater than 3.2 micrometres ~~G.1A~~ [Ra] so that they are suitable for ultrasonic test equipment probes.

See Clause 8 for details of branding of vehicles when axles are ultrasonically tested.

Axles to drawings 1701, 3196, 2184, Y35472, 3081, Z7904 and 2855 which reach condemning size are to be replaced with axles and wheelsets ex condemned stock. Should there be insufficient supplies ex condemned stock, the matter is to be referred to the Chief Mechanical Engineer's Office.

(6) Axle Journals:

Last Turning and Condemning Sizes of Car and Wagon Plain Bearing Axles.-

Size of Axle Journal		**Axle Drawing**	**Last Turning Size**		**Condemning Size**	
Inches Dia.	mm Dia.	**Number**	Inches	mm Dia.	Inches	mm Dia.
3¼	82.55	1701	3-1/16	78	3	76
3¾	95.25	3196	3-3/8	86	3 5/16	84
4	101.6	3081	3-9/16	91	3 ½	89
4	101.6	Z 7904	3-13/16	97	3 ¾	95
4½	114.3	2855	4	102	3 15/16	100
4½	114.3	W31181	4	102	3 15/16	100

Axles to drawings 1701, 3196, 2184, Y35472, 3081, Z7904 and 2855 which reach condemning size are to be replaced with axles and wheels ex condemned stock. Should there be insufficient supplies ex condemned stock, the matter is to be referred to the Chief Mechanical Engineer's Office.

(7) Building up Axles by Welding - Limits For Outside Collars and Journals:

The wear on an outside collar may be corrected by building up with electric welding and the collar returned to conform with the original size.

An outside collar is not permitted to wear below 6.5 mm (¼") in thickness.

Should the building up of the outside collar to its original thickness still leave the journal more than 6.5 mm (¼") longer than axlebox bearing, the axle is to be condemned.

The building up by electric or gas welding on axles (other than outside collars) is not permitted.

See Clause 3 for the finish required on outside collars.

(8) Examination and Testing of Axles:

Whenever wheels are removed from under locomotives and rolling stock, a thorough examination is to be made to ensure that all axles are sound and straight.

Defective or bent axles must be removed from service immediately and condemned.

Bent axles are not to be straightened under any circumstance.

Ultrasonic and magnetic testing of axles is to be carried out in accordance with the following:

(a) ~~All locomotives and rolling stock, including travelling cranes passing through workshops for any repairs, other than a repair involving 20 manhours or less, must have axles ultrasonically tested if these have not been done within the previous six months. For the purposes of this instruction the light repair road at Otahuhu Workshops is considered a car and wagon depot.~~

[All locomotives and rolling stock, including travelling cranes passing through workshops for

any overhaul or lift must have axles ultrasonically tested.]

[Amendment No 20]

~~(b) All spare wheelsets are to be ultrasonically tested at workshops before dispatch to depots or other workshops and are to be labelled accordingly. Labels are to be removed from axles before vehicles are passed into traffic.~~

~~(c) All rolling stock fitted with axles of 101.6 mm (4 in) nominal journal diameter or less, including roller bearing axles and vehicles with isothermos axleboxes, are to have axles ultrasonically tested at the time of the annual brake overhaul.~~

~~(d) All rolling stock fitted with 114.3 mm (4½ in.) nominal journal diameter parallel axles to drawing 2855 are to have axles ultrasonically tested annually at the time of the air brake overhaul.~~

~~(e) Class Q wagons without air brakes are to have axles ultrasonically tested annually.~~

~~(f) Axles of Vulcan railcars are to be ultrasonically tested at six monthly intervals, in March and September.~~

~~(g) In addition to (c) and (d) above, all class La wagon axles, except those with heavy duty axles to drg. W31181 [and package roller bearing to drg. W32714], are to be ultrasonically tested as wagons pass through depots for repairs to the extent of the availability of testing facilities.~~

~~(h) In addition to (a) above, all axles which have the wheels pressed off for any reason are to undergo a magnetic test before wheels are pressed on again.~~

~~If air brake overhauls on wagons referred to in (c) above are done at depots which are without ultrasonic testing equipment, arrangements are to be made for the axles to be tested elsewhere before the wagons are returned to traffic.~~

~~Axle testing is to be carried out as laid down in Workshops Instruction No.B50/2/1.~~

~~All axles are to be ultrasonically tested from both ends.~~

~~Vehicles which have axles ultrasonically tested at the time of the annual brake overhaul shall have a 50 mm diameter (2") white five pointed star stencilled on the solebars adjacent to the airbrake overhaul date. Vehicles which have axles ultrasonically tested at times other than at annual brake overhaul or at periods in excess of twelve months shall have a 50 mm diameter (2") white five pointed star and date (month and year) stencilled on the solebars adjacent to the air brake overhaul date.~~

~~"Opaque" or "dead" axles with journals 102 mm diameter or less (4" dia. or less) on wagon stock or less than 110 mm diameter on car stock are to be scrapped. If the journal size is 110 mm diameter or above on wagon and car stock, the vehicle is to be marked as having been tested and returned to traffic.~~

[(b) **Test Methods:** (1) Far end test - ultrasonic
(2) Near end test - ultrasonic
(3) 45^{O} Angle test — ultrasonic
(4) Magnaglow test - magnetic particle

(c) **Test Applications:**

(1) The Far End Test is to be applied to:

1.1 Every axle at the time specified in clause 8(a) above

1.2 All plain journal bearing axles fitted to rolling stock (including rolling stock fitted with isothermos axle-boxes), at the time of annual brake clean.

Note: Each axle is to be tested from both ends.

(2) The Near End Test is to be applied to:

2.1 Any plain bearing axle whose bearing journal has run hot.

2.2 Any plain bearing axle branded with the letters S.M.I. at the time specified in clause 8(a) above, or, when fitted to rolling stock at the time of the annual brake clean.

Note: Locomotive suspension bearing journals which have run hot are excluded.

(3) The 45^{O} Angle Test is to be applied to:

3.1 Every axle at the time specified in clause 8(a) above. This test is to be applied to all axle wheel seats.

(4) The Magnaglow Test. Magnetic particle test may be used as a substitute test for all three of the above ultrasonic tests, whenever an axle is stripped of all fitted components.

(d) **Level of Defect Acceptance:**

(1) Far End Test: Any axle found to be cracked by this method is to be scrapped

(2) Near End Test: Any axle found to be cracked by this method is to be scrapped.

(3) 45^{O} Angle Tests: Any axle found to be cracked (except-see clause 8(d 5) by this test method may be returned to traffic after being labelled in accordance with clause 8(e) l.2).

(4) Magnaglow Test: Any axle found to be cracked by this test method is to be scrapped unless the cracks are sufficiently shallow that removal of cracks by reducing axle diameter is feasible. Retest all axles after machining to confirm crack removal.

Note: No bare axle possessing a crack of any kind is to be reassembled and returned to service.

(5) Any straight axle 4½" (114mm) diameter or less found to be cracked by any test method is to be scrapped.

(e) **TEST STENCILS**

(1) All axles and wheelsets crack tested at the time specified in clause 8(a) above are to be labelled with the following YELLOW painted stencil marks along the length of the axle, between wheel seats.

1.1 Axles with no cracks: (1) a 50mm diameter five pointed star
(2) Workshop symbol
(3) Year of test

1.2 Axles found to have cracks to defect acceptance level – clause 8(d) (3) i.e. found by the 45 angle tests

(1) A 50mm diameter five pointed star
(2) Workshop symbol
(3) Year of test
(4) Two 25mm wide yellow bands 50mm apart painted around the center of the axle trunk.

Note: Locomotive axles which are fitted with traction motors cannot be stencilled. In this case test information in clause 8(e) above is to be noted on paper and taped to each axle inside a waterproof envelope. When axles are fitted to Locomotives, supervisory staff are to remove the test information and transfer the information on to the correct reporting forms as laid down in clause 9.

(2) All plain bearing axles fitted to rolling stock which are crack tested at the time of the annual brake clean are to be labelled with the following WHITE painted stencil marks:

(1) A 50mm diameter five pointed star painted alongside of the annual brake clean date and depot symbol.

(2) A 50mm diameter five pointed star painted on the axle box cover.

It is the responsibility of the ultrasonic operator to ensure that stencilling is correctly carried out.

(f) Ultrasonic axle testing is to be carried out as laid down in Workshops Instruction No B51/1-24 amended 17 June 1987.

(g) Where rolling stock axles require testing at the time of annual brake clean, but, there is no test equipment or the test equipment is out of service, or if there are no staff members who have attended an ultrasonic crack detection course, then rolling stock are to be carded with a TMS 58A and consigned to the nearest depot where testing can be carried out.

(9) AXLE TEST REPORTING

(a) All axles whose defect level require that the axle is to be scrapped. See clause 8(d) (2), (d)(4) and (d)(5) are to be reported on a Loco 96 form and forwarded to the Manager, Rolling Stock, Wellington.

(b) Locomotive axles which have been passed fit for service, and fitted to a locomotive at a Workshop, are to be reported on Page 1 of a Loco 135E form. The defect acceptance level must be reported as follows:

(1) No defects 8, d, 0

(2) Defect, 45^{O} angle test 8, d, 3

Note: In the case where locomotive axles are fitted at depots, the depot supervisor is to use a "Change of Equipment" form, (Loco 502) to record, the defect acceptance level, position under the locomotive and the locomotive number.

Both Loco 135E and Loco 502 forms are to be forwarded to the Manager, Motive Power, Wellington.

(c) All rolling stock ultrasonically tested at depots are to be reported as tested by recording on a Loco 67 form or MISS terminal, with the rolling stock repair code No.83.

(d) All rolling stock filled with axles painted with two YELLOW bands are to be reported as being fitted, with the following reference, "CME's 05/825 of 9 April 1985", in the Loco 204 column of a Loco 67 form.

Amendment No.49 24/563 of 8 July 1987]

~~**(9) Reporting and Examination of Defective Axles**~~

~~**(a) Fractured Axles:** Axles (except 4½ in heavy duty to drawing W 31181) found cracked on class La wagons need not be reported on Loco 96 forms unless cracks occur in unusual places. Car and Wagon Inspectors and Works Foremen are to forward a period return showing the total number of cracked axles found in this category on La wagons to District Mechanical Engineers who will collate and forward a period return to the Chief Mechanical Engineer.~~

~~All other cases of cracked axles are to be reported to the Chief Mechanical Engineer on Loco 96 forms without delay.~~

~~All defective axles, other than those La wagon axles not required to be reported on Loco.96 forms, are to be held at workshops for three months in case they are required for further examination by the Chief Mechanical Engineer, after which period they may be scrapped.~~

~~Class La wagon defective axles not required to be reported on Loco.96 forms may be scrapped immediately.~~

(10) Condemned Axles

All axles which are finally condemned are to be deeply branded "X" on both journals with a cold set and are to be stored away from serviceable and new axles.

Cracked axles on La wagons that do not required reporting on Loco.96 forms may be branded at car and wagon depots or smaller workshops.

All other cracked axles are to be finally condemned and branded at main workshops.

(11) Lubricant for Pressing Axles into Wheel Seats:

No lubricant, other than animal tallow, is to be used on axle wheel seats when axles are pressed into wheel centres.

For other instructions relating to the pressing of axles into wheel centres, see Mechanical Branch Code No.15.

(12) Storing of Axles:

A protective coating of an approved rust preventative is to be applied to all axles that require to be stored.
Where journals are finished on axles to be stored, they are to be protected with sacking or other substantial means.

(13) Cutting of Keyways:

Where keys are fitted to axles, the keyways are to be well finished and all corners slightly filleted. Keys should be fitted accurately.

(14) Difference in Journal Diameters

The difference in plain bearing journal diameters of any one axle after turning shall not exceed 3 mm (1/8").

After overhaul, rolling stock must not be passed out with journals tapered or otherwise out of parallel in excess of ~~9.8~~ 1.0 mm (1/32") on diameter.

Traction motor suspension bearing journals on the same axle are to have the same diameter.

[**(14) Difference in Journal Diameters**

The difference in plain bearing journal diameters of any one axle after turning shall not exceed 3 mm (1/8").

After overhaul, rolling stock must not be passed out with journals tapered or otherwise out of parallel in excess of 0.8 (1/32") on diameter.

Traction motor suspension bearing journals on the same axle are to have the same diameter.
Issue No.5 28/11/83]