

Wheels

Railway Wheels

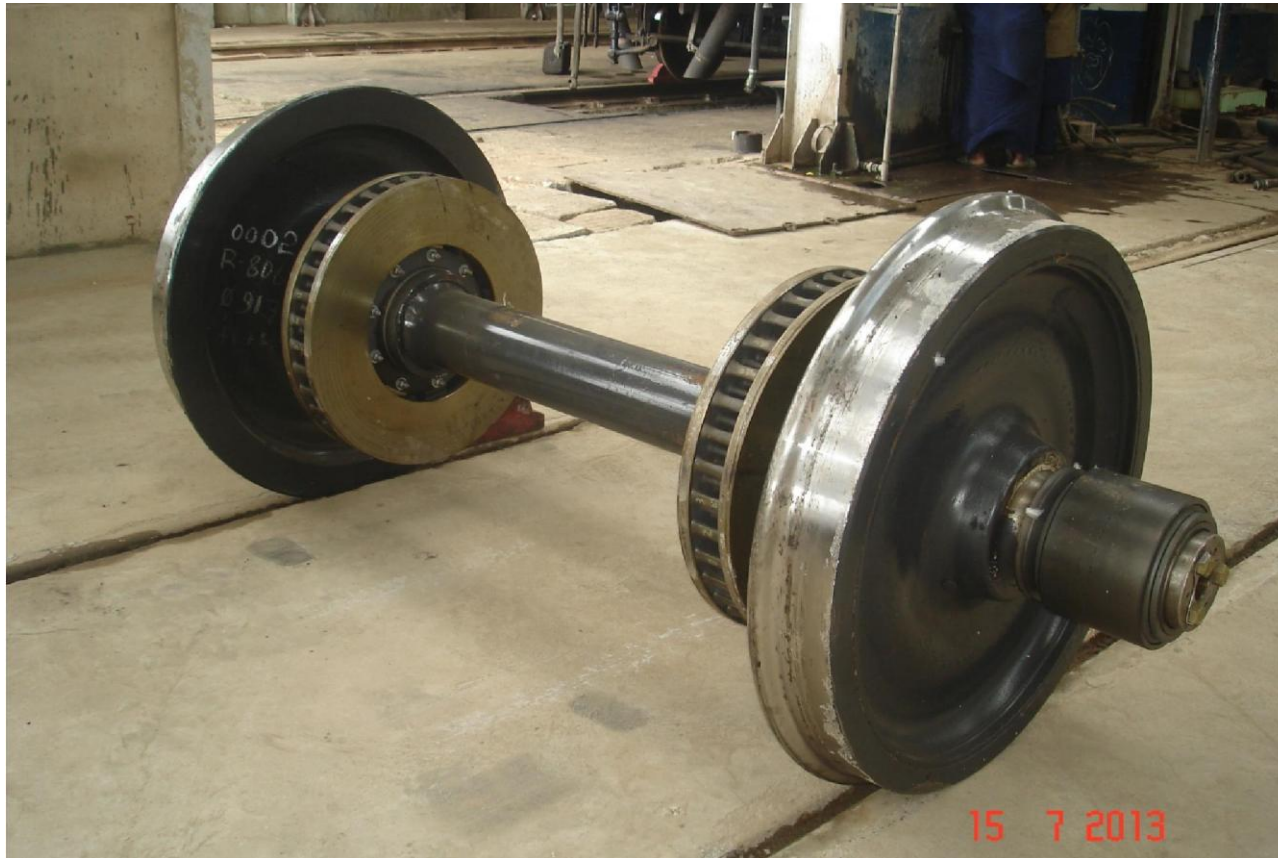
- Railway wheel is assembly of two wheels fixed to the axle by interference fit and they rotate along with the axle, without any independent relative movement as in the case of other automobile wheels.
- These wheels are provided with flange towards the inner side, which guide the wheels to travel on the rails and does not allow it to fall down from the rails.

Railway Wheels



ICF Coach Wheel

Railway Wheels



LHB Coach Wheel

Material of Wheel

- Steel made by Electric or Basic Oxygen process
- Steel shall be of killed quality for forged steel
- The max hydrogen content shall not exceed 3 ppm
- The max nitrogen content shall not exceed 0.007%

Railway Wheel



BOXN Wheel

Material of Wheel

The chemical composition of the steel for Cast Wheel	
C	0.47% to 0.57% for type A used for carriage stock 0.57% to 0.67% for type B used for wagon stock
Mn	0.60 to 0.80%
P	0.03% max
S	0.03% max
Cr	0.15% max
Ni	0.25% max
Mo	0.06% max
Combined % for Cr, Ni & Mo must be 0.40% max	

The procedure to calculate chemical composition will be in accordance to IS:228

Mechanical Properties of Cast Wheel

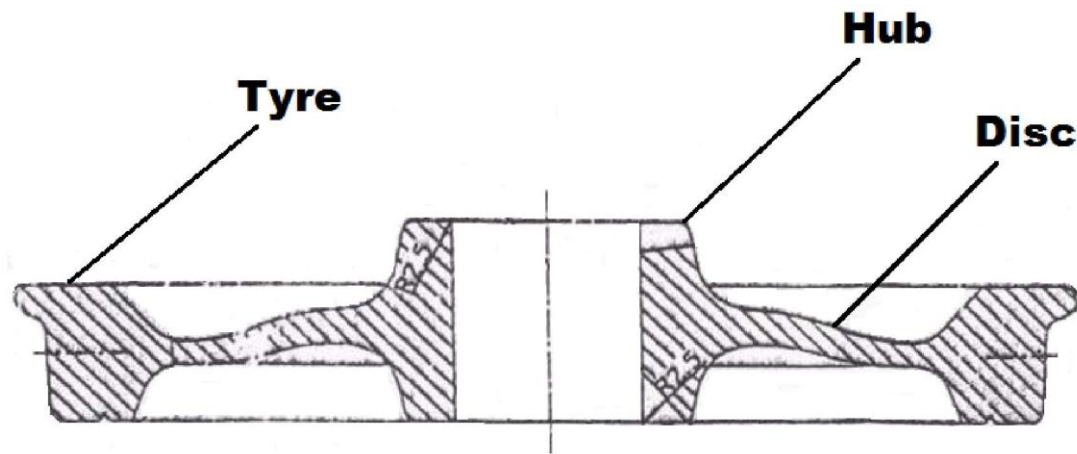
Sl. No.	Particulars	Type A	Type B
1	Tensile Strength at 15 mm below tread face	900 N/m ² min.	930 N/m ² min.
2	Tensile strength at middle of the web	800 N/m ² min.	800 N/m ² min.
3	Minum yield strength at 15 mm below tread face	50% of UTS	50% of UTS
4	Minimum yield strength at middle of the web	50% of UTS	50% of UTS
5	Minimum elongation at 15 mm below tread face	5.0%	4.5%
6	Minimum elongation at middle of the web	7.0%	7.0%
7	Hardness range at 15 mm below tread face	255-320 BHN	271-341 BHN
8	Minimum impact strength at 15 mm below tread face	10 J/cm ² at 20 deg C	--

Railway Wheels

The wheel is better understood by dividing it into the following parts

- Hub
- Disc
- Tyre

Wheel



hub

- Hub is the centre portion of the wheel, where the wheel is fixed to the axle by means of interference fit.
- Thickness of the wheel is maximum at the hub portion.
- UT details is marked on the Hub

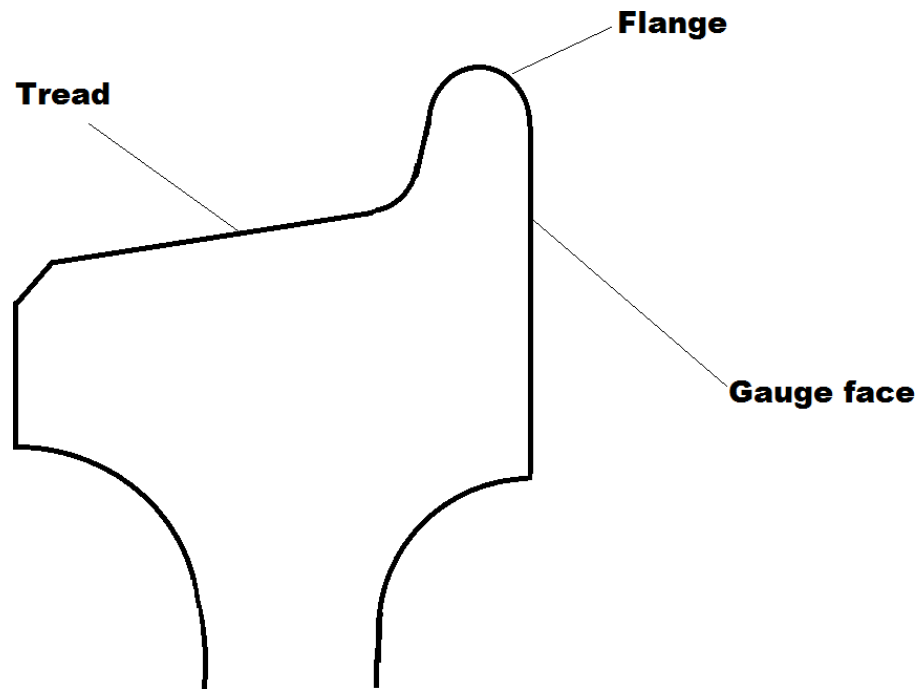
Disc

- Disc is the portion of the wheel between the hub and the tyre.
- This portion is the thinnest portion of the wheel as it does not come in contact with rail nor it is coming in contact with the axle.

Tyre

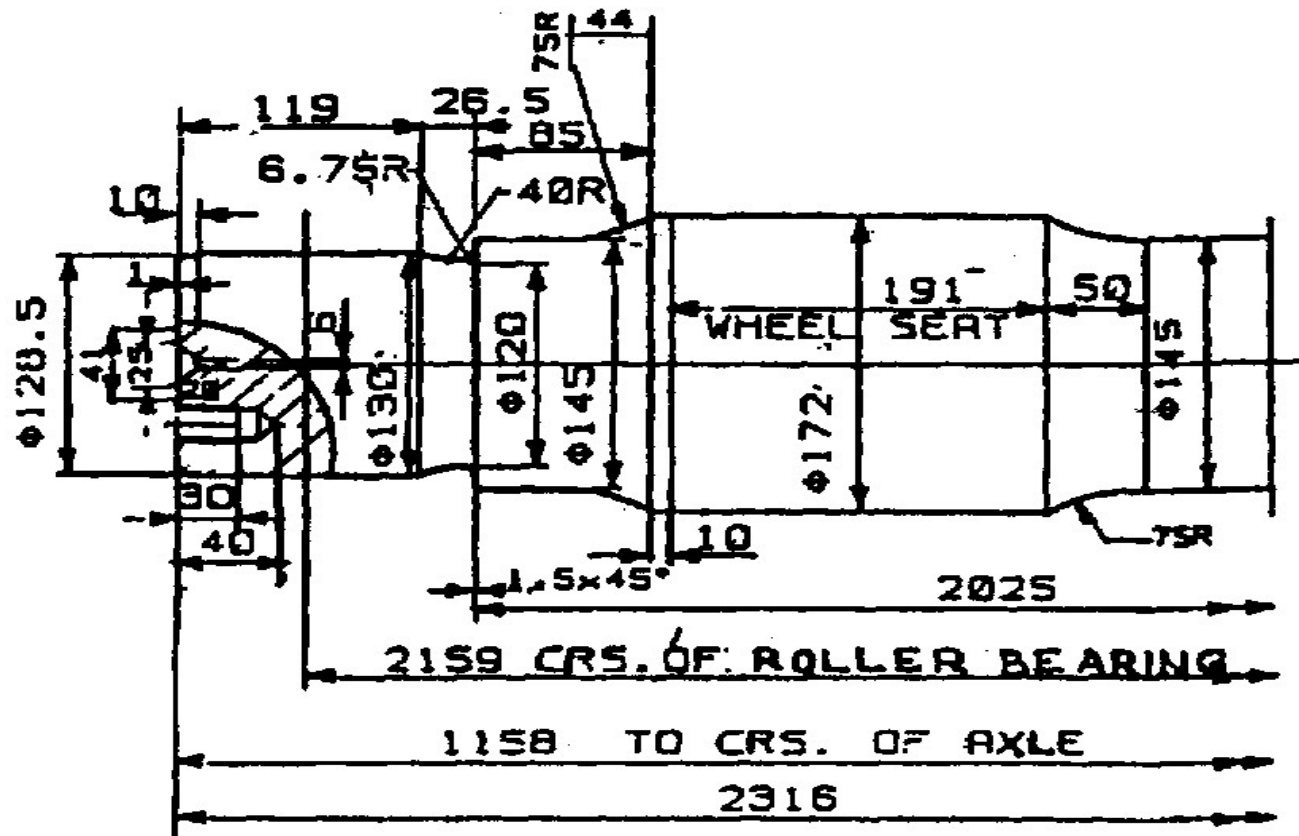
- Tyre is the portion in contact with the rail, which wears out in service.
- The profile of the tyre is significant for safe running of the trains.
- Taper is given on the tread to have higher diameter near the flange and lower diameter at the outer edge, to facilitate curve negotiation.

Tyre



Axles

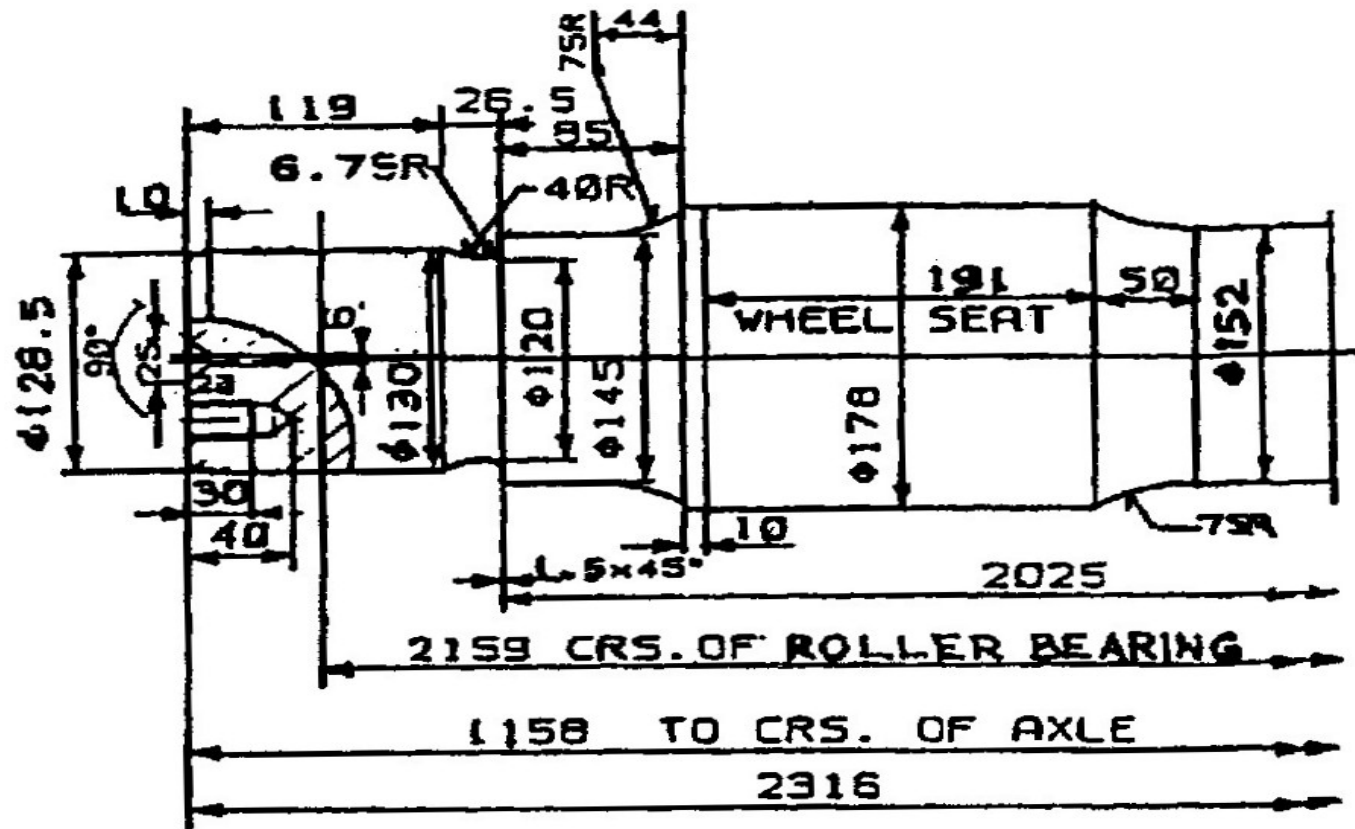
13 t Axle for ICF coach



ICF DRG. NO. T-0-2-622

Axles

16.25 t Axle for ICF coach



ICF DRG. NO. WTAC₃-0-2-301

Press fit of wheel on axles

- Wheel disc is pressed to axle with interference fit (the bore of the wheel should be 0.304 mm to 0.355 mm less than the outer dia of the wheel seat on the Axle)
- Wheel Gauge should be in between 1599 and 1602 mm
- Axial off centre should be within 1.0 mm (wagon) & 0.8 mm (coach)
- Radial off centre should be within 0.5 mm (wagon) & 0.25 mm (coach)
- The Journals should be protected with bituminous black to IS:9862
- All Axles fitted by workshop during POH or despatched to depot should be Ultrasonically tested

Press fit of wheel on axles

Hydraulic press is used for assembly of the wheel with a force of 400 to 500 Kgs per mm dia of wheel seat (approximate force used for different wheels are given below)

Description	Tonnage
13 tonne axle	68.8 to 103.2 t
16.25 tonne axle	71.2 to 106.8 t
BOXN & BLC	85 to 127 t

Stamping of particulars

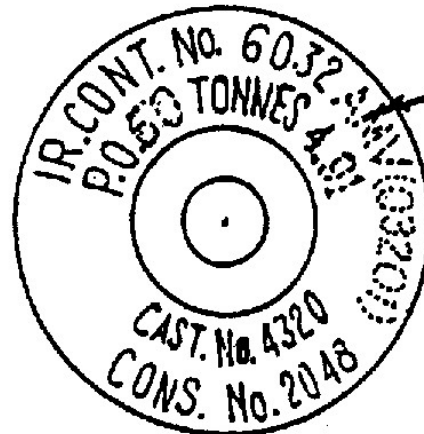
Whenever axles are renewed the workshop shall punch in 5 mm letters the following particulars on the journal face

- Place of pressing
- Date of pressing
- Pressure of pressing

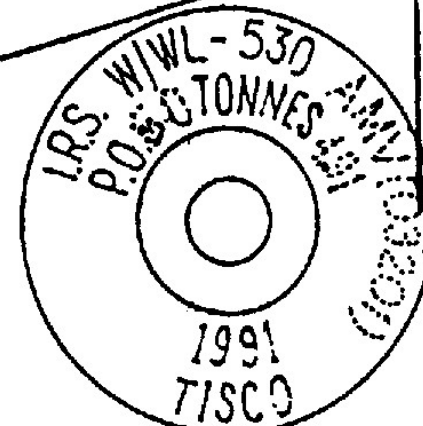
Whenever UT is done the details shall be stamped cold on the inner hub fillet with 6 mm punch not more than 1.5 mm depth

Stamping of particulars

DATE AND INITIALS OF WORKSHOP &
ITS CODE WHERE REAXLING IS DONE



ONE END OF AXLE

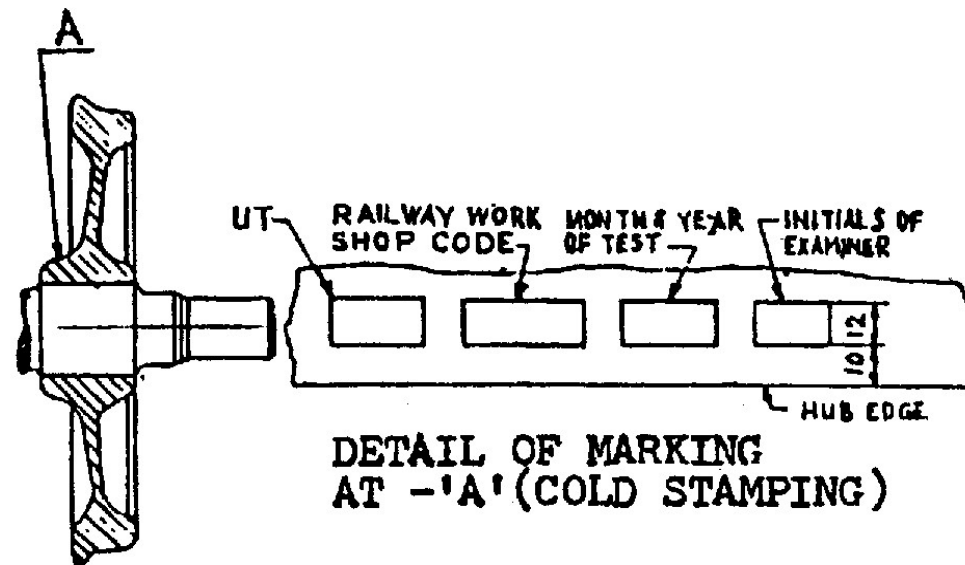


OTHER END OF AXLE

NOTE:

ALL STAMPING TO BE DONE WITHIN 63 DIA.
ON BOTH JOURNAL FACES.

Stamping of particulars

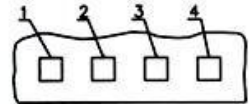
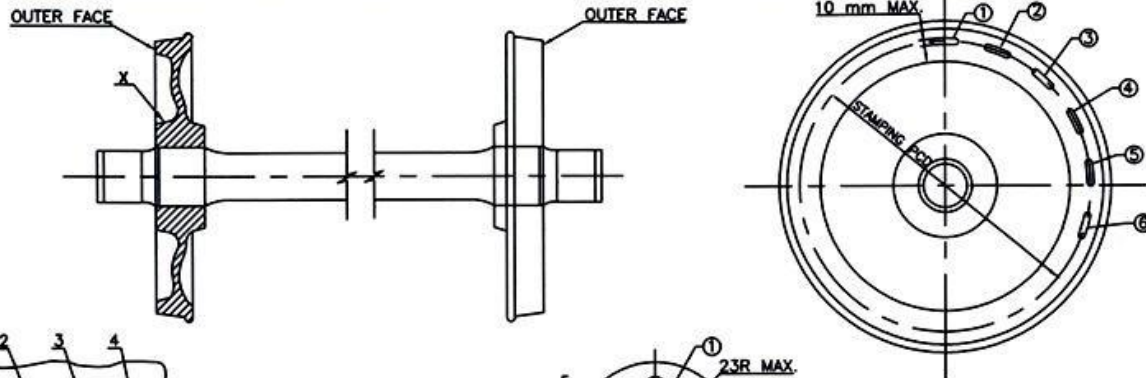


DETAIL OF MARKING
AT -'A' (COLD STAMPING)

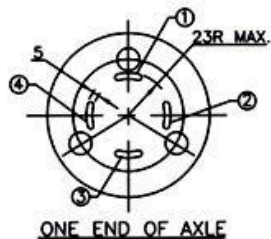
NOTE:-

1. 'UT' INDICATES ULTRASONIC TESTING OF AXLES.
2. THE MARKING SHALL BE STAMPED COLD ON THE INNER HUB FILLET AS SHOWN AT 'A' AFTER THE SURFACE IS GROUND PROPERLY.
3. THE EXAMINING WORKSHOPS SHALL MAINTAIN ALL THE PARTICULARS OF AXLES TESTED VIZ. I.R. PART NO., CONTRACT NUMBER, CAST AND CONSECUTIVE NUMBERS, MANUFACTURER'S INITIALS AND YEAR OF MANUFACTURE IN REGISTER PROPERLY MAINTAINED BY THEM.
4. REF. WDO DRG. NO. WD-81089/S-1

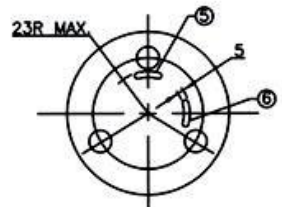
Stamping of particulars



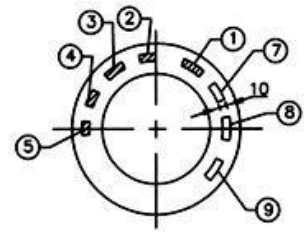
DETAILS OF 'X' FOR MARKING ON LHB COACH WHEELS



ONE END OF AXLE



OTHER END OF AXLE



OUTER FACE OF WHEEL/WHEEL CENTRE HUB

STAMPING PARTICULARS

WHEEL/WHEEL CENTRE AND AXLE DETAILS	
1	MANUFACTURER'S CODE
2	YEAR OF MANUFACTURE
3	CONSECUTIVE No.
4	BATCH No.
5	INSPECTOR'S APPROVAL STAMP
6	'UT' FOR ULTRASONIC TESTING
ASSEMBLY DETAILS	
7	MANUFACTURER'S/WORKSHOP'S CODE
8	MONTH AND YEAR OF ASSEMBLY
9	PRESSING ON PRESSURE IN TONNES

PCD OF STAMPING OF DIFFERENT WHEELS

TYPE OF WHEEL	PCD OF STAMPING ON RIM
COACHING	
WTAC3-0-2-301	788 mm
T-0-2-622	788 mm
W/WL-1660	788 mm
MG/T-0-1-004	610 mm
WAGON	
W/WL-4764	870 mm
W/WL-4771	780 mm
WD-89025/S-5	830 mm
WD-89025/S-9	960 mm
CONTAINER FLAT	
CONTR.-9404-S/13	755 mm
SOLID WHEEL FOR EMU	
Sk-K4004	842 mm (FOR MC) 832 mm (FOR TC)

NOTE:

- WHEEL DETAILS**
 - TO BE HOT/COLD STAMPED OR MARKED BY ELECTRIC ETCHING IN 10 mm LETTERS ON OUTER FACE OF THE RIM OF ROUGH TURNED OR FINISH TURNED WHEELS.
 - FOR LHB COACH WHEELS, STAMPING SHOULD BE DONE ON OUTER FACE OF THE HUB. PARTICULARS OF S.No. 1 TO 4 SHALL ALSO BE STAMPED ON OUTER HUB FILLET AT LOCATION MARKED AS 'X', FOR EASY IDENTIFICATION IN ASSEMBLED CONDITION.
- WHEEL CENTRE DETAILS**

TO BE COLD STAMPED OR MARKED BY ELECTRIC ETCHING IN 10 mm LETTERS AT THE HATCHED LOCATIONS ON OUTER FACE OF THE HUB.
- AXLE DETAILS**
 - TO BE STAMPED COLD OR MARKED BY ELECTRIC ETCHING ON BOTH ENDS IN 5 mm LETTERS IN CASE OF ROUGH TURNED OR FINISHED AXLES.
 - TO BE STAMPED IN 10 mm LETTERS IN CASE AXLES ARE SUPPLIED IN AS FORGED CONDITION.
- ASSEMBLY DETAILS**

TO BE STAMPED COLD OR MARKED BY ELECTRIC ETCHING IN 10 mm LETTERS ON THE OUTER FACE OF THE WHEEL/WHEEL CENTRE HUB.
- IT IS MANDATORY TO STAMP THE RESPECTIVE MARKINGS AT THE LOCATIONS INDICATED ABOVE.

⑦	--	SS/21/09	DETAILS OF 'X' FOR ADDITIONAL MARKING ON LHB COACH WHEELS ADDED AND NOTE 1.2 MODIFIED.	12/09	SUPERSEDED BY:		
⑥	--	SS/19/09	RADIUS AT END VIEWS OF THE AXLE CHANGED FROM 18R TO 23R.	10/09	SUPERSEDES:		
⑤	--	SS/01/06	DRAWING REVISED	1/06	SCALE	P	
④	--	SS/13/03	DRAWING REVISED	3/03	Z	C	G.V.RAMAN
③	--	SS/3/02	DRAWING REVISED	2/02		D	PANDE SANJAY
②	--	CD/17/99	DRAWING REVISED	8/99		T	--
①	--	CD/6/97	DRAWING REVISED	9/97		J.S.	--
ALT. ITEM		AUTHY.	DESCRIPTION	DATE	B.G.	R.D.S.O. [C]	

BRANDING DETAILS ON WHEEL & AXLE
SKETCH-92114

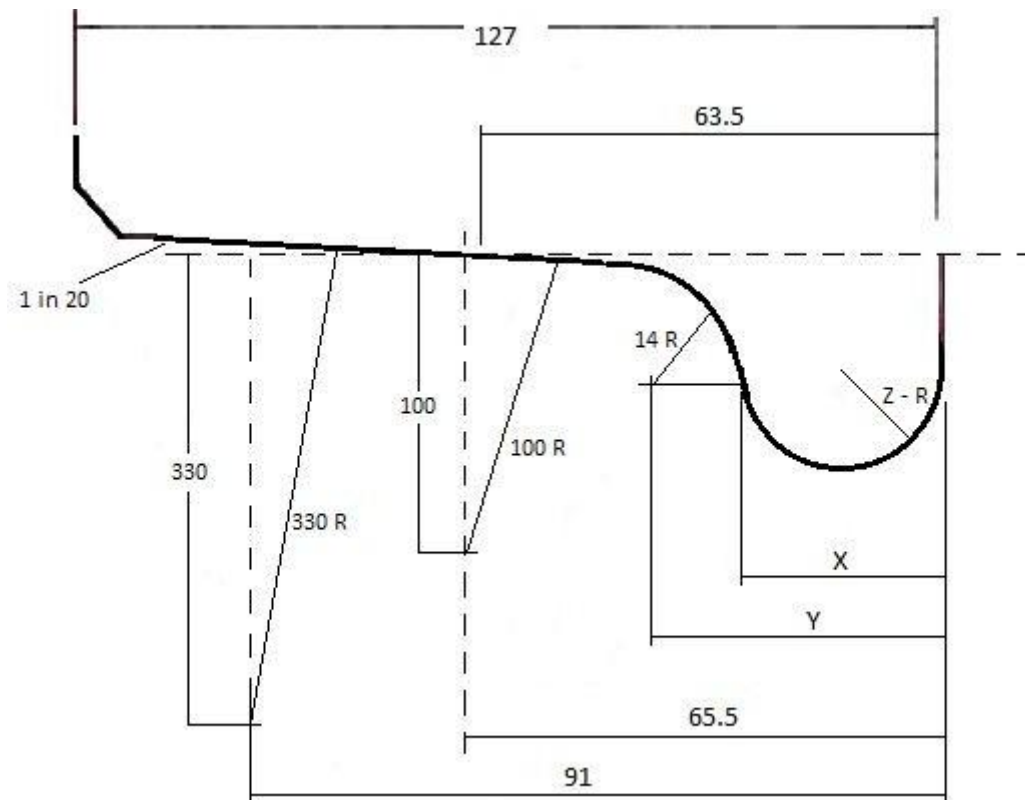
Worn Wheel Profile

80 % of the track in Indian Railways is having rails which are already worn in service. Standard wheel profile running on these tracks tend to wear to a specific profile within short time itself, and further wear from this profile is very slow. Hence if the wheels are turned initially to this worn wheel profile, it will increase the wheel life by avoiding frequent re-profiling.

Worn Wheel Profile

The worn wheel profile is made standard for all the wheels in Indian railways as the standard wheel profile is found uneconomical with lesser kilometres being run by the wheels within condemnation.

Worn Wheel Profile



Step Sizes of Worn Wheel Profile

Further to reduce the metal removal during tyre turning, intermediate worn wheel profile based on the flange thickness is introduced.

Flange Thickness (X)	Y	Z
28 mm	42.23 mm	13.5 mm
27 mm	41.29 mm	13.0 mm
26 mm	40.34 mm	12.5 mm
25 mm	38.41 mm	11.5 mm
24 mm	37.44 mm	11.0 mm
23 mm	36.47 mm	10.5 mm
22 mm	35.49 mm	10.0 mm
21 mm	34.5 mm	9.5 mm
20 mm	33.5 mm	9.0 mm

Wheel Defects

- Manufacturing Defects
- Improper Assembly Practices
- Normal Wear and Tear during service

Manufacturing Defects

- Casting Defects
- Improper Heat treatment
- Machining Imperfections

Improper Assembly Practices

- Stipulated dimensional tolerances for Wheel seat and bore not adhered to resulting in use of higher or lower than the prescribed force during pressing leading to improper wheel set assembly.
- Ovality on Journals - 0.02 mm (max)
- Taper on Journal - 0.01mm (max)
- Difference in dia of wheels on the same axle should not exceed 0.5mm

Wheel defects

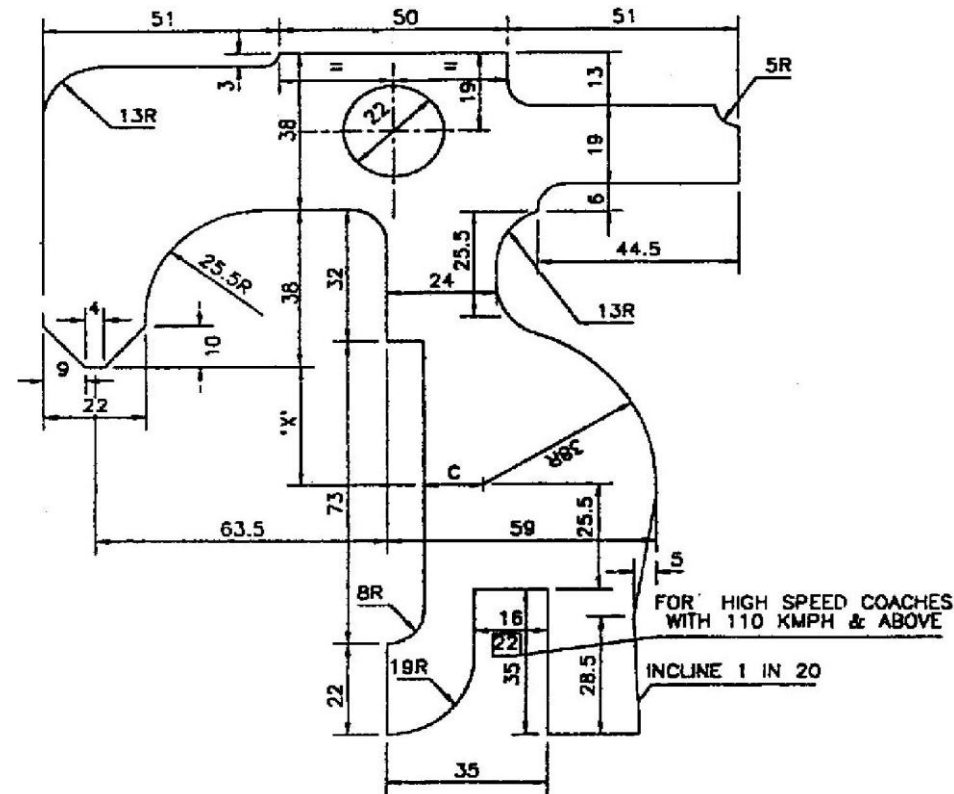
Measurable wheel defects arising due to normal wear & tear during service

- Thin flange
- Deep flange
- Sharp flange
- Less radius at root of flange
- Hollow tyre
- Thin tyre
- Flat tyre

Std & cond limits

Defect	Std	Cond
Thin flange	28.5	22 (Coaches) 16 (Wagons)
Deep flange	28.5	35
Sharp flange (radius)	14.5	5
Less radius at root of flange (radius)	14 (wwp)	13
Hollow tyre		5
Thin tyre		Based on wheeldia
Flat tyre		50 (Coaches) 60 (wagons)

Tyre Defect Gauge

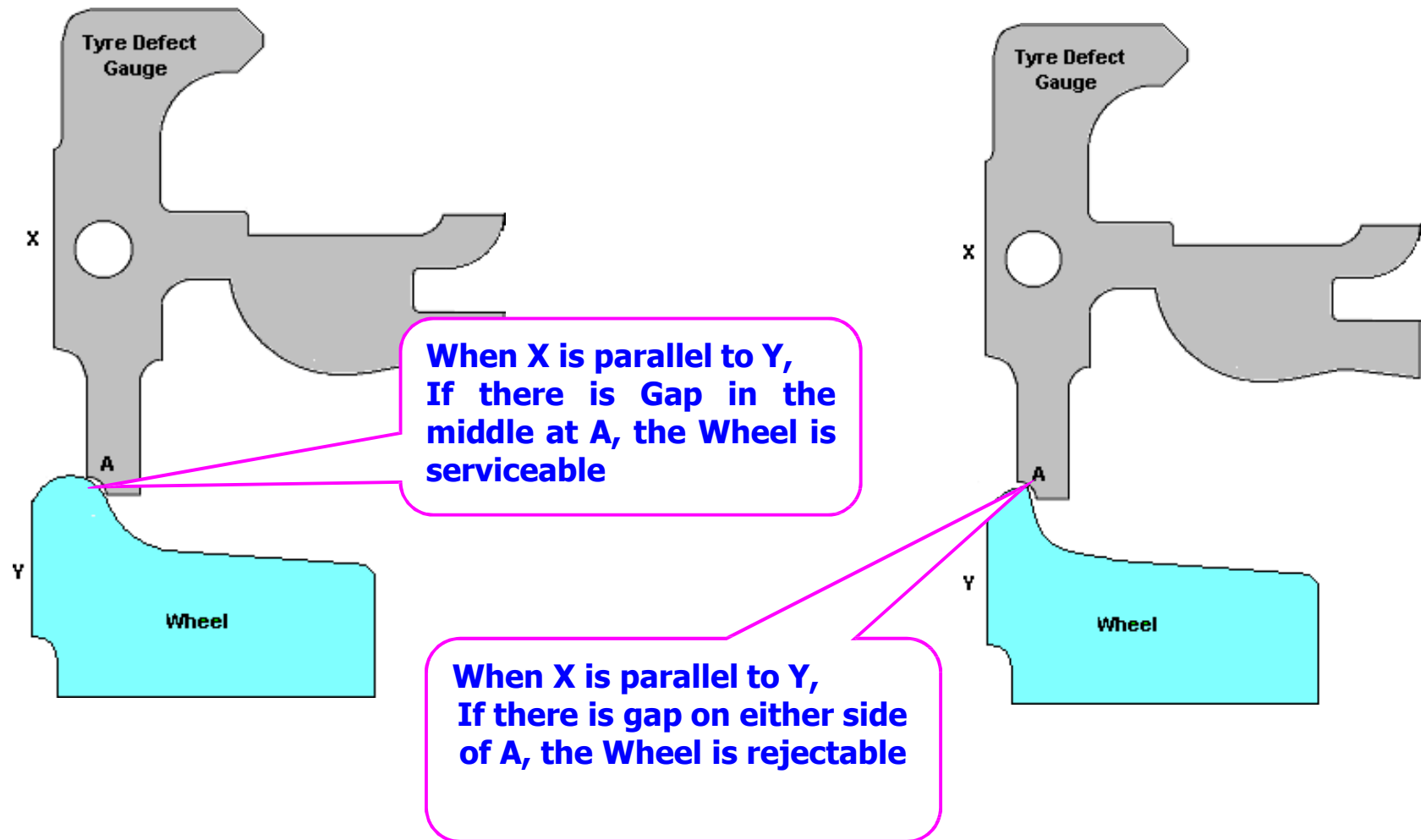


All coaches (Including EMU & DMU) 50 mm

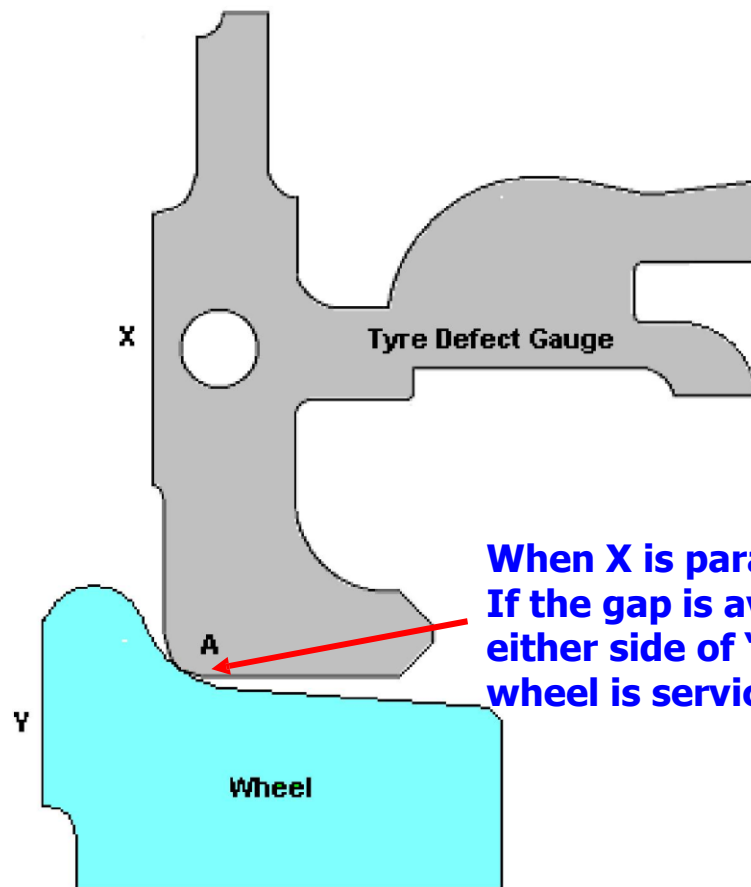
NOTE:-

1. CONDEMNING MARK 'C' TO BE STAMPED ON BOTH SIDE OF GAUGE.
 2. CONDEMNING MARKS FOR TYPE OF STOCK ON LINE ONLY NEEDS TO BE STAMPED.
 3. DISTANCE 'X' AT WHICH CONDEMNING MARK 'C' FOR VARIOUS TYPE OF WHEELS TO BE STAMPED ARE AS BELOW:-
- | | |
|---|----------|
| c) SOLID WHEEL OF ICF & BEML MAIN LINE COACHES | 6.5 mm. |
| ii) SOLID WHEEL OF IRS MAIN LINE COACHES | 5 mm. |
| iii) TYRED WHEEL OF IRS, ICF & BEML MAIN LINE COACHES | 26 mm. |
| iv) TYRED WHEEL OF ac & dc EMU MOTOR COACHES. | 38.5 mm. |
| v) TYRED WHEEL OF ac & dc EMU TRAILER COACHES. | 28.5 mm. |

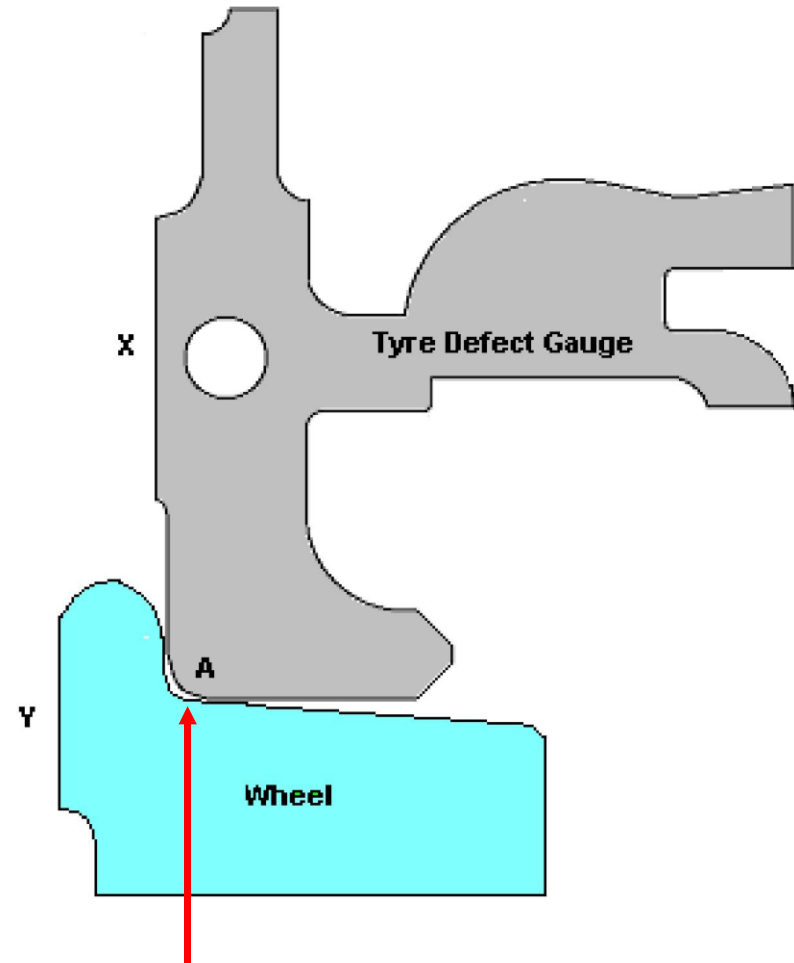
Checking for sharp flange



Checking the root of flange

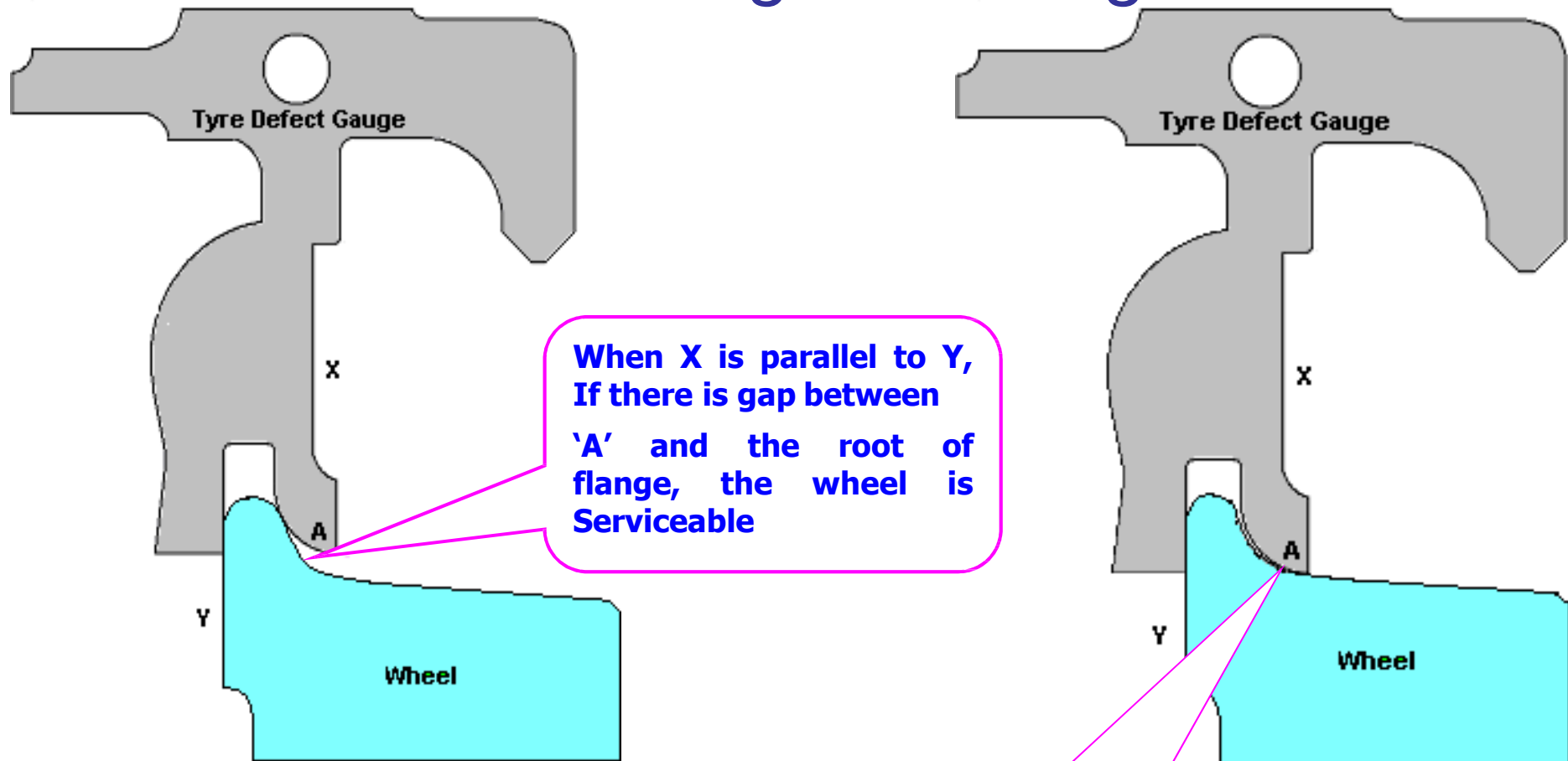


**When X is parallel to Y,
If the gap is available at
either side of 'A', the
wheel is serviceable.**



**When X is parallel to Y ,
If there
is a gap between gauge and the
Root of Flange at A , the Wheel is
Rejectable**

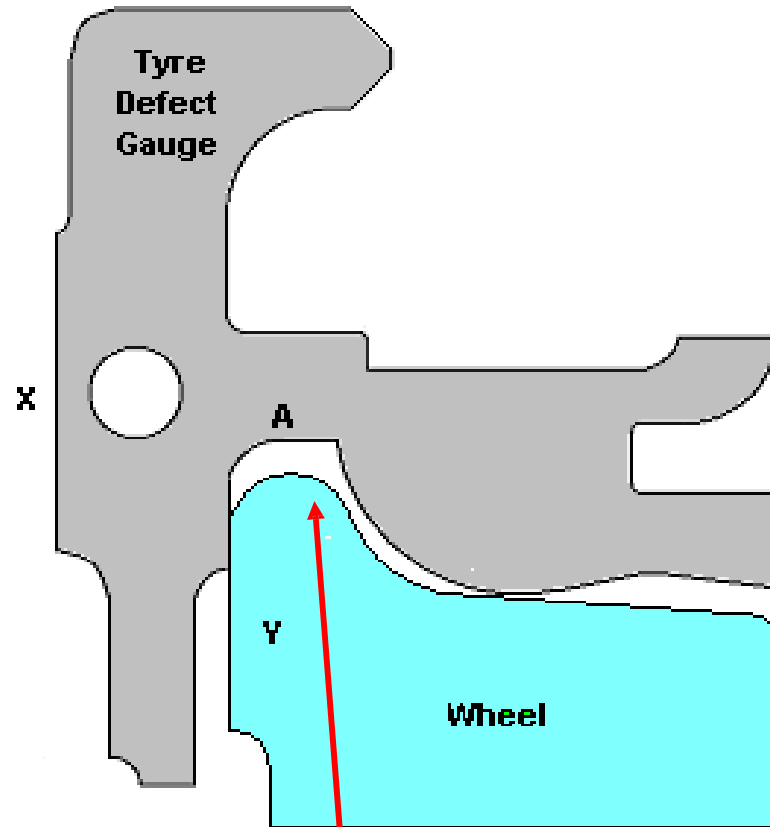
Checking Thin flange



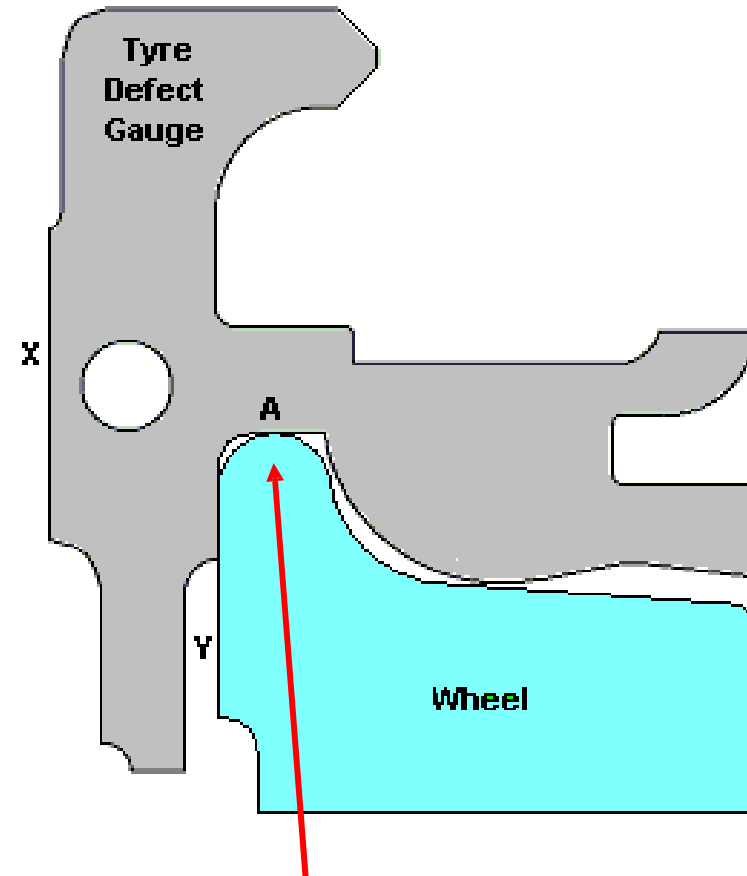
When X is parallel to Y,
If there is gap between
'A' and the root of
flange, the wheel is
Serviceable

When X is Parallel to Y, If
there is no gap between 'A'
and the root of flange, the
wheel is rejectable

Checking Deep Flange

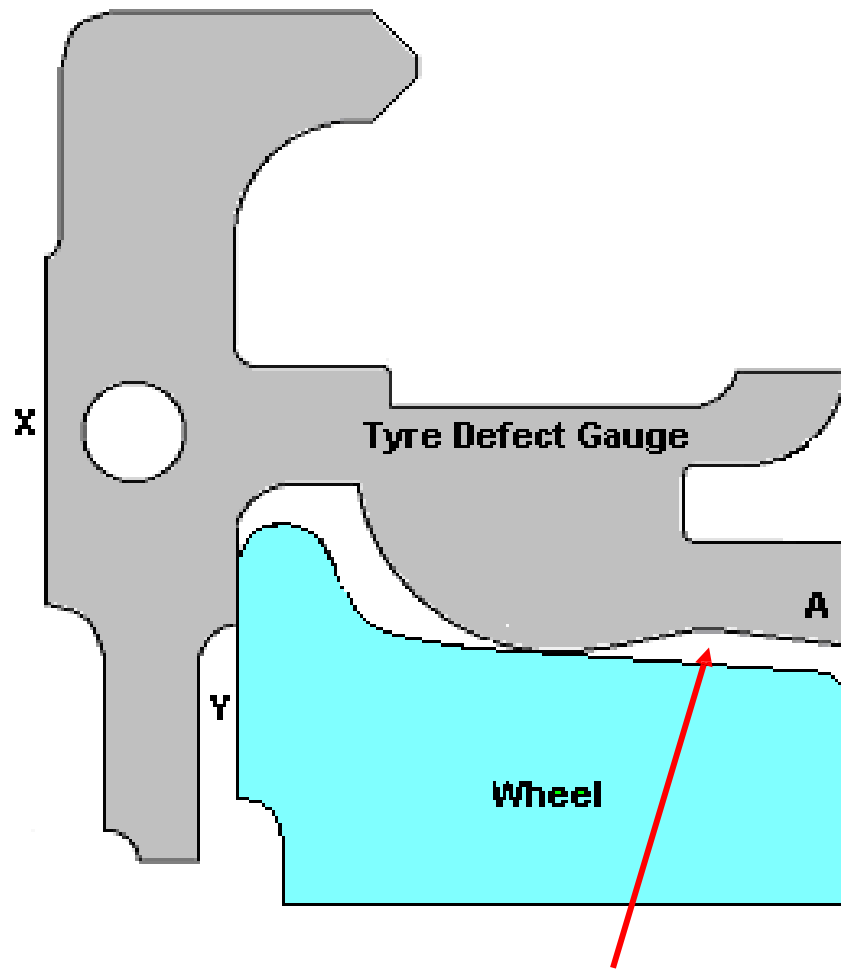


When X is parallel to Y,
If there is a gap between 'A'
and tip of the flange, the wheel is
serviceable.

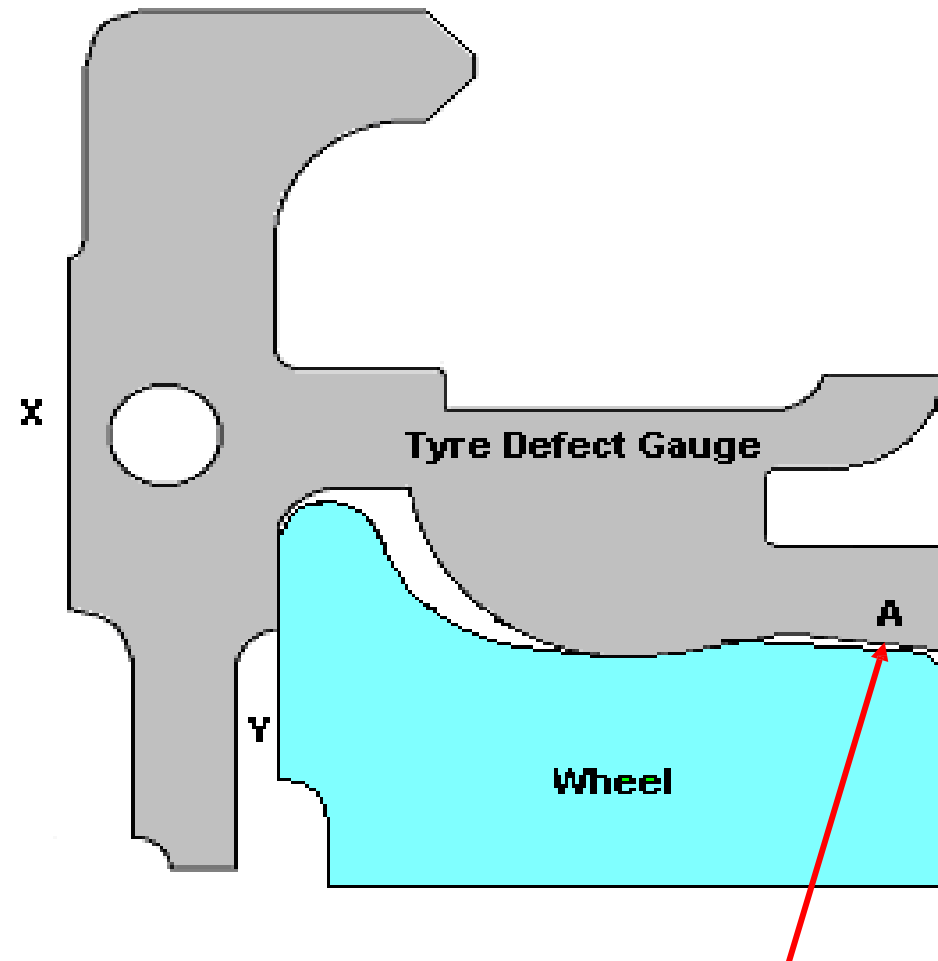


When X is parallel to Y,
If there is no gap between 'A'
and tip of the flange, the wheel is
rejectable

Checking Hollow tyre

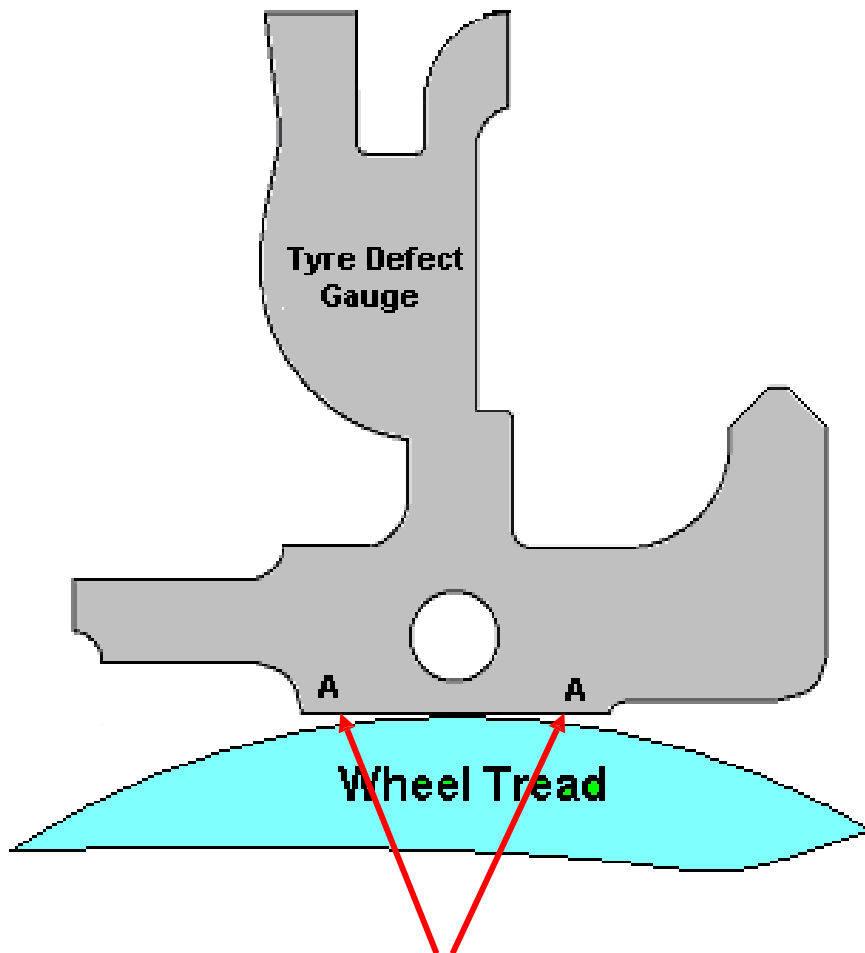


**When X is parallel to Y,
If there is gap between the wheel tread
and gauge at "A",the wheel is serviceable**

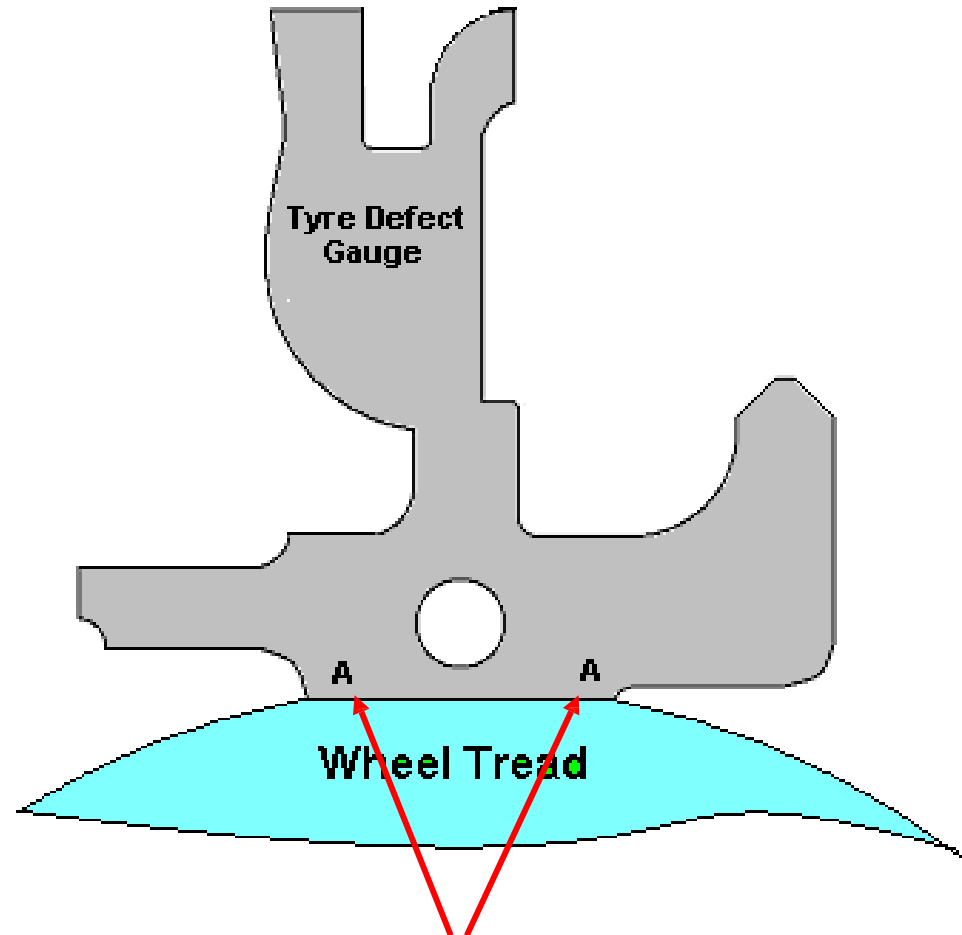


**When X is parallel to Y,
If the gauge touches the wheel tread at
"A",The wheel is rejectable.**

Checking Flat tyre

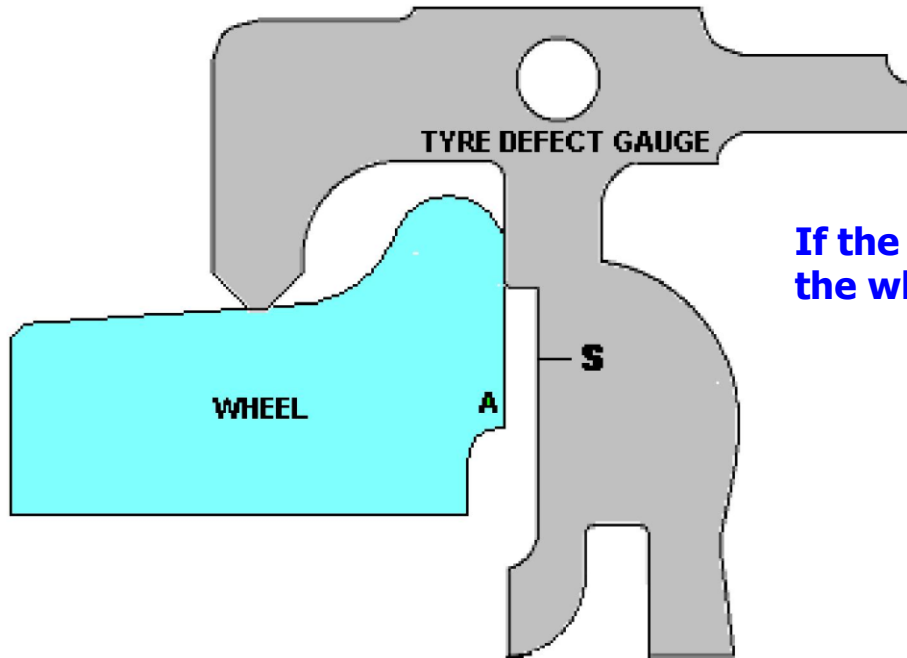


If there is gap between the gauge and the wheel tread at "A", the wheel is serviceable.

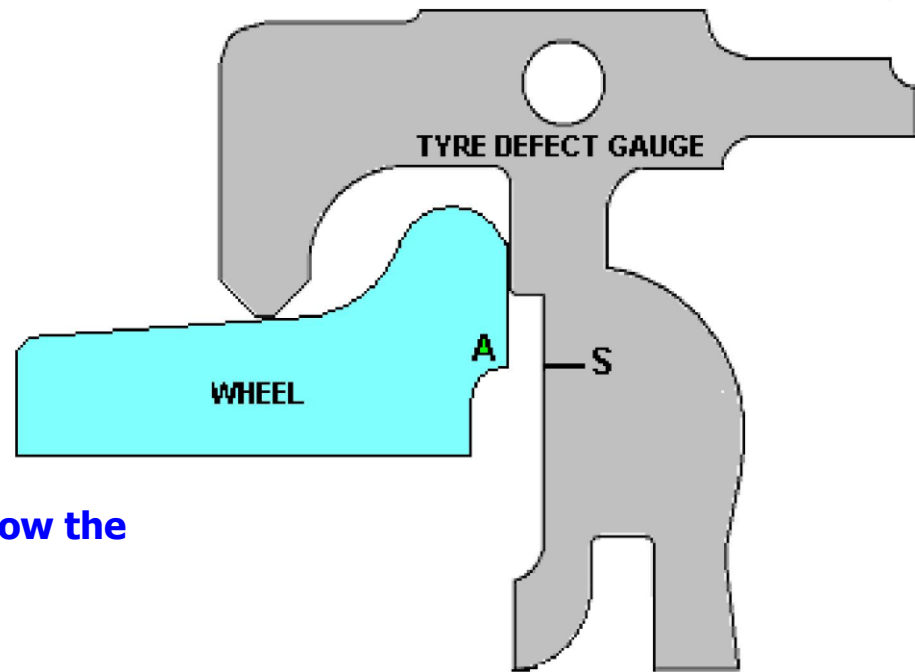


If there is no gap between the gauge and the wheel tread at "A", the wheel is rejectable.

Checking Thin tyre



If the mark S in the gauge is above the location A ,
the wheel is serviceable.



If the mark S in the gauge is in line or below the
location A , the wheel is rejectable.

Wheel defect as per CMI K 003

- Shelled tread
- Shattered rim
- Spread rim
- Thermal crack
- Heat checks
- Disc crack
- Loose axle

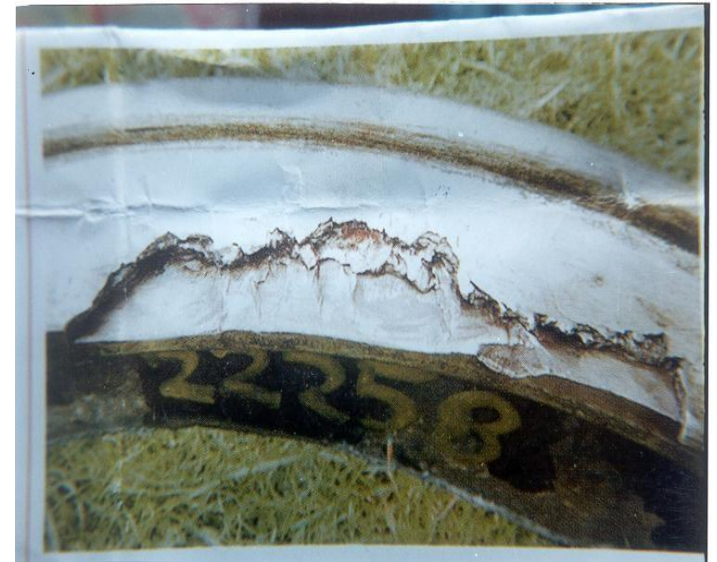
Shelled Tread

Shelling can be identified by pieces of metal breaking out of the tread surface in several places more or less continuously around the rim. Shelling takes place when small pieces of metal break out between the fine thermal checks. These are generally associated with small skid marks or “chain sliding” Such wheels should be withdrawn from service and sent to workshops for re-profiling.



Shattered Rim

A wheel with a fracture on the tread or flange must be withdrawn from service. Shattered Rim is a rejectable defect. (This does not include wheels with localized pitting or flaking without presence of any rejectable condition).



Spread Rim

If the rim widens out for a short distance on the front face, an internal defect may be present. Spreading of the rim is usually accompanied by a flattening of the tread, which may or may not have cracks or shelling on the tread. Such wheels must be withdrawn from service.



Rim Flow

The condition of widening of the tread should not be confused with a uniform curling over of the outer edge of the rim around the entire wheel, which is called rim flow. Rim flow is not a rejectable defect.

Thermal Crack

Thermal cracks appear on a wheel tread due to intense heating of the wheel arising out of severe brake binding. Such cracks occur on the tread and generally progress across the tread in a transverse & radial direction. Whenever such a crack becomes visible on the outer face of the rim or tread crack has reached the outer edge (non-gauge face) of the rim, the wheel should be withdrawn from service. If a crack becomes visible on the outer flange face, the wheel should be withdrawn from service. Such wheels should be sent to workshop for examination and subsequent rejection.

Thermal Crack

Wheels involved in brake binding during service, should be examined carefully during the maintenance to rule out the possibility of rejectable thermal cracks. Such wheels may be identified by presence of flats (even within acceptable limits) and severe discoloration or blue/ black heating marks on the tread.



Heat Checks

Fine superficial cracks visible on the tread on or adjacent to the braking surface are called heat checks, which are usually denser than the thermal cracks. Heat checks are caused on the tread due to heating and cooling cycles undergone by the wheel during normal braking. Such wheels need not be withdrawn but should be carefully distinguished from the rejectable thermal cracks



Disc Crack

A crack on the disc due to material failure is called disc crack. The wheel should be with drawn from service.



Loose Axle

- While assembling wheel with axle proper interference should be maintained between wheel and axle. Due to improper selection of interference the wheel may shift outwards or it may come out completely. Loose axle is a rejectable defect.
- Axles involved in Accidents should be magnaflux tested in addition to Ultrasonic test.
- Axle having notch should be withdrawn from service

- All wheel sets withdrawn from service for any of the conditions mentioned above must be sent to the associated workshops for detailed investigations and further disposal.
- The date and station code of the maintenance depot where the wheels are changed should be stencilled on the end panels. An entry should also be made in the maintenance card of the coach.
- No repairs, except wheel profiling of wheel sets is permitted to be done in the maintenance depot.

Wheel Gauge

Description	Std	Max	Min
Coach MG	930	932	929
ICF coach BG	1600	1602	1599
LHB coach	1600	1601	1599
Wagons	1600	1602	1599

Wheel Diameter

Description	Std	Cond
Coach MG		
ICF coach BG	915	825
LHB coach	915	845
BOXN	1000	906
UIC	1000	860
BLC	840	780

Wheel Changing

Wheels to be paired within the diameters variation as below while changing the wheels

Type	On the same bogie	On the same coach
Coach MG	5	10
Coach BG	5	13
Wagons	13	25

While tyre turning, it should be ensured that variation on the same axle is within 0.5 mm

For in service wheels the variation on the same axle shall be guided by the tyre defect gauge

Thank You