MASTER Copy

RESTRICTED

GOVERNMENT OF INDIA
MINISTRY OF DEFENCE
DIRECTORATE GENERAL OF QUALITY ASSURANCE

QUALITY ASSURANCE INSTRUCTIONS
No.CQA(ICV)/QAI/506(REVISED)

FOR

ROAD WHEEL WITH SOLID RUBBER TYRE
DRG No.675-33-CD 104

or

CQA(ICV)/675-33-SA 001

CONTROLLERATE OF QUALITY ASSURANCE (ICV)
YEDDUMAILARAM – 502 205

Issue : 27 Feb 2003

RESTRICTED

GOVERNMENT OF INDIA

MINISTRY OF DEFENCE

DIRECTORATE GENERAL OF QUALITY ASSURANCE

QUALITY ASSURANCE INSTRUCTIONS

No.CQA(ICV)/QAI/506(REVISED)

FOR

ROAD WHEEL WITH SOLID RUBBER TYRE

DRG No.675-33-CD 104

or

CQA(ICV)/675-33-SA 001

Prepared by: Shri R V Pathak, A/F

Checked by: Shri K Lakshminarayana, FM (G)

Approved &

Authorised by: Col Pramod Sinha, JC (IAP)

CONTROLLERATE OF QUALITY ASSURANCE (ICV)

YEDDUMAILARAM – 502 205

ISSUE: 27 Feb 2003

RESTRICTED

FROM THE DESK OF THE GENERAL MANAGER

No:75004 / OFMK/GM/ROAD WHELS/11-12 Dt: 22- 06-2011.

Sub: Indigenisation of BMP Road Wheels – Reg

Ref: AVHQ LtR.no. 1312/AVHQ/PROD Dtd. 27-05-2011.

The following team of officers is nominated for indigenization of "ROAD WHEELs for BMP vehicles"

1) Sri. B.Rajesh Kanna , WM

2) Sri. Vivek Mungiker , JWM

The team is assigned to:

1) study the manufacturing process and quality requirements of the item thoroughly.

1) scan the Indian industry to identify likely sources to manufacture the road wheels with respect to their potential and required facilities.

2) visit those identified firms and to carry out the capacity verification of the firms physically.

3) consult the proposed and reputed established sources in this field like M/s Wheels India, Kolkata and M/s Bharat Forge Limited ,Pune and to negotiate for taking part in OTEs of the subject item.

4) submit the progress report on the subject matter to the undersigned for every fortnight.

(V.K.PANDA)
GENERAL MANAGER

COPY TO:

1) Sri. B.Rajesh Kanna , WM / LMS

2) Vivek Mungiker , JWM / FA

PROVISIONAL QUALITY ASSURANCE INSTRUCTIONS NO CQA(ICV)/QAI/506(REVISED) ROAD WHEEL WITH SOLID RUBBER TYRE

1.0. INTRODUCTION

1.1 This Quality Assurance Instructions give the details of inspection procedure and tests to be carried out on Road Wheel With Solid Rubber Tyre to Drg No 675 -33-CD104 or CQA(ICV)/675-33/SA 001 of article 675. This QAI is prepared based on acceptance standards and inspection parameters laid down in collaborator design documents.

1.2 Each procurement is guided by its contract modifications hereto and connected specifications and drawings.

1.3 Not withstanding the inspection procedures indicated in this Quality Assurance Instructions, the inspecting officer can carry out any test to check the store for conformance to the paper particulars quoted in the supply order before acceptance. As a result of experience gained in the inspection of Road wheel with solid tyres, the inspector is at liberty to suggest the improvement to this publication direct to the Controller, CQA(ICV) Yeddumailaram.

1.4 This Quality Assurance Instructions is the property of the Govt., of India. It is liable for amendment at any time and the latest issue will always be applicable. Copies of this QAI may be obtained from the Controller, CQA (ICV), Yeddumailaram.

2.0 AIM :

2.1 These instructions are issued to guide the authorised inspector in his routine inspection and set out main points to which his attention must be drawn to ensure that the accepted stores are thoroughly fit for Army service.

3.0 SCOPE :

3.1 This QAI outlines in general terms, the checks and methods to be used during inspection of Road wheel with Solid Tyres to Drg No 675-33-Cb 104 or CQA(ICV)/675-33-SA 001 with connected specifications.

4.0 REQUIREMENTS :

4.1 The item shall conform to the design drawings prepared and issued by CQA (ICV) Yeddumailaram.

4.2 Production deviations in respect of material and manufacture shall be resorted to only with the written concurrence of the Controller, CQA(ICV), Yeddumailaram.

ADDITIONS AND AMENDMENTS

Sl. No.	Page & Para	Brief Description of Additions / Amendments	Date of Amendment	Authority

5.0 This QAI is divided into three parts:

Part I: Details of inspection procedures and tests to be carried out on Welded Road Wheels to Drg No 675-33-Cb 105 or CQA (ICV)/675-33-SA 002 SA.

Part II: Details of inspection procedures and tests to be carried out on Solid Rubber.

Part III: Details of inspection procedures and tests to be carried out on Complete Road Wheel with Solid Rubber Tyre to Drg No 675-33-Cb104 or CQA (ICV)/675-33-SA 001 with connected specifications and drawings.

PART I

The welded Road wheels shall be inspected as follows:

Srl No	Description of test	Pilot	Bulk
1	Visual Inspection	100%	100%
2	Dimensions	100%	Level II,AQL-1.5% IS:2500-92
3	Inspection of Welded Joints	100%	10%
4	Material testing a) Chemical Composition	01 Sample each	01 Sample each per lot
	b) Mechanical tests	-do-	-do-
	c)Hardness	100%	10%

6.0 VISUAL EXAMINATION

6.1 This shall be carried out on 100% of the stores tendered. The welded road wheels must be free from poor welding penetrations, rolls, cuts, craters, dents, unsealed by fusion, blow holes and shrinks holes, surface cracks and pores, thinning, at places of dressing of welds and adjacent zone and other defects of surface of weld and adjacent zone.

6.2 Permissible surface pores and overlap are as per technical requirement No.7(b) of Drg No. 675-33-Cb105 or TC 8 & 9 of Drg No. CQA(ICV)/675-33-SA 002 SA. The effects such as Corrosion, Presence of Passivating substance, Acids, Alkali, Salts, oil etc., are not allowed on the surface of Road wheel.

6.3 Ensure the HUB inside area is free from Rust, Pitting and any other surface defects.

7.0 DIMENSIONAL CHECK :-

7.1 The dimensions of welded road wheels shall be checked as per Drg No. 675-33-Cb105 or CQA(ICV)/675-33-SA 002 SA and connected drawings and should conform to the drawings.

8.0 QUALITY INSPECTION OF WELDED JOINTS :-

8.1 Tests and checks may be carried out on all the samples of Pilot batch in accordance with Drg No 675-33-Cb105 or CQA(ICV)/675-33-SA 002 SA.

8.2 Ensure that Road Wheels should be welded with wire CB 18X MA as per GOST 2246-70 and Flux AN-348 Am as per GOST 9087-69 and other requirements of weld quality as per OST-3-4001-77.

8.3 Check parts for proper heat treatment by metallographic examination of their structure and by measurement of the welded joint hardness.

8.4 Hardness of basic metal of the Disc, Hub, Rim is HB-255-302 and of the weld and heat affected area is 400 HB Max. Check hardness of the weld and heat affected area on a Road wheel 50% of tendered qty (By Poultry or any suitable method).

8.5 Rectify welding defects by electrode 3-100 or 3-85 as per GOST 9467-75 or wire CB 18XMA as per GOST 2246-70.

9.0 MATERIAL :-

9.1 The material should conform to relevant specifications given in Table No.01.

TABLE NO-01

Srl No	Drawing No	Nomen-clature	Original Material	Alterna-te Material	Equival-ent Material	Hard-ness BHN
1	700-58-54	Plug	C_T3 Cn GOST 380-71	Cn5 GOST 380-71	Fe 410 to IS:1079-88	-
2	765-33-39	Plug	20 GOST 1050-74	-	20C8 Gde1 IS:9550-80	-
3.	675-33-2	Hub (Steel Casting)	35XH TT25011-00001	-	-	241-302
4	675-33-10	Hub (Forged)	33XC GOST 4543-71	-	-	255-302
5	765-33-130 & 131	Ring(Forged (Hub in 2 halves)	33XC GOST 4543-71	-	-	241-321
6	765-33-120	Road wheel Rim	33XC GOST 4543-71	-	42 Cr 4 Mo2 IS:5517-93 OR En19	255-302
7	675-33-3	Disc	Bn25 TY 14-1-1369-75	-	-	255-302
8	765-33-92	Cover Plate	30XrCA GOST 4543-71	25XrCA GOST 4543	En-19 'W'	-

Srl.	Drg. No.	Nomen-	Original Matl	Alt.Matl.	Equiva- Lent Matl.	Hardness BHN
9.	CQA (ICV) 675-33-PD 002	Hub	40 Cr 1 Mo 28 to IS:5517	En19 A		
10.	503-18-19-2011	Rim	40 CR 1 Mo 28 to IS;5517	En 19A		
11.	CQA(ICV) 675-33-PD001	Disc	35 Mn 2 Mo 28 to IS;5517 or En 16 A	40 Cr 1Mo 28 to IS: 5517 or En 19 A		
12.	503-18-19-2024	Cover plate	-do-	-do-		
13.	503-18-19-2013	Stopper	C 20, IS:5517	En2A or En 3A		

9.2 CHEMICAL COMPOSITION

The chemical analysis results shall conform to the values given at Table No.2

TABLE NO. 2

	% Material Specified	C	Si	Mn	Cr	Ni	S	P	V	Cu	W	Mo
PLUG	10 Gost : 1050-74	0.07 0.14	0.17 0.37	0.35 0.65	0.15 max	-	-	-	-	-	-	-
	20 Gost: 1050-74	0.17 0.24	0.17 0.37	0.35 0.65	0.25 max	-	-	-	-	-	-	-
	C_T 3 Cn Gost:380-71	0.14 0.22	0.12 0.30	0.40 0.65	0.30 max	0.30 max	0.05 max	0.04 max	-	0.30 max	-	-
	Fe 410 IS:1079-88	0.25 max	--	-	-	-	0.045 max	0.045 max	-	-	-	-
	20C8 Gde 1 IS:9550-80	0.15 0.25	-	0.60 0.90	-	-	-	-	-	-	-	-
HUB	35XHTT T T 25011-00001	0.30 0.40	0.17 0.37	0.50 0.80	0.50 0.80	0.70 1.00	0.045 max	0.045 max	-	0.30 max	-	-
DISC	B TT 25 TY 14-1-1369-75	0.23 0.28	0.90 1.20	0.50 0.80	0.90 1.20	0.90 1.20	-	-	0.05 0.15	-	0.50 1.00	-
	40Cr1Mo28 IS:5517	0.35 0.45	0.10 0.35	0.50 0.80	0.90 1.20	-	0.050 max	0.050 max	-	-	-	0.20 0.35
	35Mn2Mo 28 IS:5517	0.30 0.40	0.10 0.35	1.30 1.80	-	-	-	-	-	-	--	0.20 0.35
	En 16A BS:970	0.32 0.40	-	1.30 1.80	-	-	-	-	-	-	-	0.20 0.35
	En 19A BS:970	0.35 0.45	0.10 0.35	0.50 0.80	0.90 1.20	-	0.050 max	0.050 max	-	-	-	0.20 0.35
RIM	33 XC Gost:45431	0.29 0.37	1.00 1.40	0.30 0.60	1.30 1.60	-	-	-	-	-	-	-
C/PLATE	30XrCA Gost:45431	0.28 0.34	0.90 1.20	0.80 1.10	0.80 1.10	-	-	-	-	-	-	-
	42Cr 4 Mo2 IS:5517-93	0.38 0.45	0.10 0.35	0.60 0.90	0.90 1.20	-	0.035 max	0.035 max	-	-	-	0.15 0.30

9.3. MECHANICAL PROPERTIES :

Mechanical Properties shall conform to Table No.3

TABLE No.3

Material	Yield kgf/mm² min	UTS kgf/mm² Min	%Relative Elongation min	Reduction in Area min	Impact kgfm/cm² min
33XC	70	90	13	50	08
30XГСА	85	110	10	45	05
35X H	50	70	12	25	04
ВП-25	125-130	145-155	7.5-8.0	-	-
Steel 10	21	34	31	55	-
Steel 20	25	42	25	55	-
C_T 3C	25	38-49	26	-	-
42 Cr 4 Mo2	—	700-850 Mpa	13	-	50J
F 410	235 N/mm²	410-490 N/mm²	22	-	-
20 C8 Gd-I	-	450-640 Mpa	10	-	-
40Cr1Mo 28	-	1000-1150 m/mm2	13	-	48J
En19A	-	70-100 kg/mm2	16-12	-	-
35Mn2Mo 28	-	1000 1150 N/mm2	13	-	48 J
En 16A	-	925	9	865	35J

9.4 HARDNESS :

Hardness of Steel in the normalised condition will be checked on the entire components forming road wheel and should conform to the corresponding design drawing values. Hardness values should be checked on all the welded road wheels of pilot batch.

10.0 Final machining on the road wheels shall be done only after rubberisation, to avoid damages of hub dimensions and concentricity of road wheels.

PART II

11. The Rubber shall be checked during pilot inspection for each mix. The following properties of Solid Rubber should conform to Rubber specification 34 PM-14 or 34PM -13 / FVRDE-1000-71.

TABLE NO 4

Sr. No.	Description of Characteristics		Standard	Test Procedure
1	Conventional Stress at elongation of 100% (kgf/cm^2(min)		60	Gost 270-75 stnd piece of Type-I
2	Conventional strength at elongation kgf/cm2 (min)		100	Gost 270-75 stnd Piece of Type-I
3	Elongation while breaking % (min)		140	Gost 270-75 stnd Piece of Type-I
4	Residual elongation % (max)		10	Gost 270-75 stnd Piece of Type-I
5	Brittleness temperature C(max)		Minus 60	Gost 7912-74. As per para 12.1 of this QAI
6	Resistance Tear KN/M	25 Min	Gost 262-73 standard piece for Type 'B' As per para-12.2 of this QAI.	
RUBBER CHARACTERISTICS AFTER AGEING FOR 24 HRS AT 100 ± 1° C				
7	Conventional strength at tension kgf/cm2 (min)		100	Gost 9024-74 stnd piece of Type-1
8	% Elongation while breaking (min)		105	Gost 9024-74 stnd piece of Type-1

12.0 TESTING PROCERES :

12.1 METHOD OF TESTING FOR TEMPERATURE LIMIT OF BRITTLENESS :

a) Test specimen size should be 25 ± 1.0 mm long, 6.0 ± 0.5 mm wide and 2.0 ± 0.2 mm thick.

b) The test should be carried out after 16 hrs but not later than 28 days after vulcanization.

c) Before the test, the samples on sheets, from which they are cut are conditioned at 23 ± 2 °C temperature for at least one hour.

d) Four samples should be clamped and loaded into the cryochamber, cooled to the test temperature (-60 ° C). the level of liquid over the samples should be at least 25 mm.

Before loading of Samples into the cryochamber, it may be cooled below the test temperature to the extent that after loading of samples, the temperature in it is equal to the test temperature.

e) The samples are kept for 3.0 $\pm$ 0.5 minutes counted from the moment the set temperature is attained.

f) On expiry of this time, the samples placed in cryo-chamber are struck once with the striker, the striker is returned to its original position, the clamp along with samples is taken out of cryochamber, the samples should be checked visually.

The sample is considered damaged even of sign of one of the damages is present in the sample i.e. splitting of samples into parts, presence of one or more cracks, decomposition, pitting

In the absence of sign of damage, each sample should be bent manually to 90° angle in the direction in which it was subjected to deformation in the cryochamber and is visually checked, if any signs of damage are detected, the sample is to be considered damaged.

In case damage of even one sample out of the four samples tested at the same temperature is noticed the rubber is considered damaged.

g) Tests at each temperature are to be carried out on four new samples

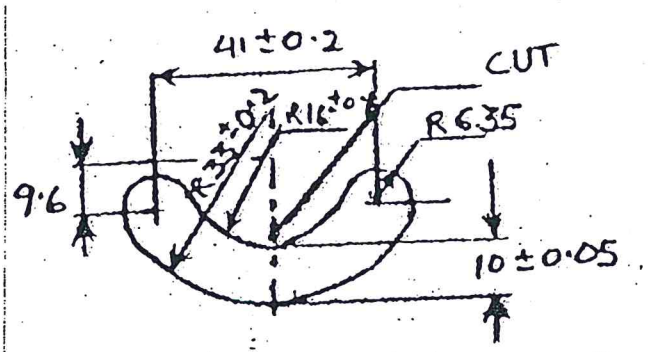
The tests are to begin from the temperature at which damage of rubber is expected and in case such temperature is unknown even approximately, then it is to be selected. The tests are carried out with increments of temperature 10° C to a temperature at which the rubber remains undamaged, thereafter the temperature is reduced by 8°C, the test is carried out at this temperature and incase of damage of rubber the temperature is raised with an increment of 2° C . The tests are carried out until the temperature is attained, at which rubber is not damaged.

This temperature being the lowest temperature, at which Rubber is not damaged, represents the temperature limit for brittleness of rubber.

12.2 METHOD OF TESTING FOR RESISTENCE TO TEAR

(a) Types and dimensions of specimen of test should conform to the sketch given below:-

SKETCH



(b) In the testing machine with a pendulum dynamometer, the load scale must be selected that the force measurement ranges between 20 &90% of the nominal scale value.

or 100°±2°C

(c) The test is carried out at 23±2°C at a rate of displacement of moving clamp of 500± 50mm/minute.

The specimen is fixed in the clamps of the machine without stretching, symmetrically relative to the Notch. The distance between clamps must be not less than 70-mm. The dynamometer is set the zero position and the tensioning mechanism is brought in to action. When specimen is under tension, the maximum force at which tearing take place is registered.

(d) The tear resistance (B) in KN/M (Kgf/cm) is calculated by using the formula.

$$B = P/S$$

Where 'P' is the maximum force, at which specimen tore KN (Kgf) and 'S' is the thickness of the specimen mm (cm).

PART III

Road Wheels with solid tyres shall be checked as under;

Pilot batch of Rubberised Road Wheel shall be tested to ensure the suitability of the rubberised road wheel for its end use. Solid rubber tyres represent solid rubber ring, vulcanized with the help of adhesive to the surface of the rim of wheel to be rubberised.

S.No.	TESTS	PILOT	BULK
1.	Visual	100%	100%
2	Dimensions	100%	Level-II, AQL 1.5% IS-2500-92
3	Hardness(74°- 84° 'A')	100%	100%
4	Resistance to Rubber Separation from metal (4 kn/m=10kg/inch)	No.	01%of bulk
5	Heat Generation Test	2pairs	2pairs of tyres for every 500 tyres
6	Under cutting test	-do-	-do-
7	Vehicle Trials	2500 km (min) *	-do-

* will be decided by AHSP.

15.0 VISUAL EXAMINATION :

15.1 This shall be carried out on 100% of the stores tendered. The tyres should not have pores, cracks, bubbles and foreign inclusions visible to the naked eye.

15.2 At the metal rubber boundary the dispersal separate faulty fusion of total area 4.0 cm^2 are allowed if minimum area of each faulty fusion does not exceed 1.0 cm^2. If area of each faulty fusion is in the limit 0.25 to 1.0 cm^2, then distance between them should not be less than15 cm. If the area of each faulty fusion is arranged with in the limits from 0.1 to 0.25 cm^2 then the distance between them should not be less than 5 cm. Smaller non-group faulty fusion are allowed.

16.0 DIMENSIONAL CHECK :

16.1 Road Wheel with solid rubber tyre should conform to the dimensions mentioned in drg No.675-33-Sb104 with connected specifications.

17.0 HARDNESS :-

Hardness should be within 74° – 84 ° Shore A or 70± 3 BS °

17.1 Hardness checking of Rubber will be carried out on 100% of Tyres

17.2 All the tests are to be carried out not earlier than 12 hrs after vulcanization of tyres.

17.3 All rejected tyres should be marked with clearly visible stamp 'REJECTED' with yellow paint.

18.0 METHOD OF TESTING FOR RESISTANCE TO RUBBER SEPERATION FROM METAL :

18.1 Resistance to Rubber Separation from Metal = 4 KN/M (10 kg/inch).

(a) Resistance to separation from Metal is determined by method of separation of bond of rubber from Disc and measurements of obtained force.

(b) From the tyre, selected for testing, rubber mass along the are equal tyre's 1/5 length should be cut and the uniform layer of rubber of thickness 8-10 mm is to be left on metal therewith. Two slits reaching metal and situated at distance 25mm of are from another should be made at mid part of the remaining on the disc rubber layer. The rubber beyond the strip formed by the slit and intended for separation should be cut off. The remaining strip of the rubber is be cut partially at the rubber metal boundary along with section with the length of 80-100 mm. The tyre is fixed and fastened on freely rotating check with part of strip, which is cut partially secured with clamp of breaking machine. Cross section paper is to be fixed on the cylinder of recording equipment.

c) Drive of break machine is to be turned on and separation of strip of rubber is to be performed at the section with the length of 50 – 80 mm at speed of 100 mm/minute.

d) Characteristic of resistance to separation of rubber from metal is calculated by dividing the average force by width of strip to be separated.

19.0 HEAT GENERATION TEST
CONSTANT MAXIMUM LOAD 1640 to 1680 kg

Speed (KMPH)	Duration (HRS)
¼ of max speed 16.25 kmph	3 hrs
½ of max speed 32.50 kmph	3 hrs
¾ of max speed 48.75 kmph	3 hrs
Max speed 65 kmph	3 hrs

Each tyre shall be closely examined at the conclusion of the tests as per para-15 of this QAI.

19.1 To be run at maximum safe speed on the test track under dry conditions; This test shall consist of three continuous runs, each of 30 minutes duration, with a stop of approximately 5 minutes in between consecutive runs, the third run to be followed by at least a period of one hour for cooling and then a further continuous run of 1 ½ hours. Road wheel with tyre temperature shall be recorded at the end of each run. At the end of this test the road wheel with tyres shall be examined. The extent of tyres undercutting, break-up grooving, chipping or other faults shall not be greater than that on stock road wheel with tyres used in the same test.

20.0 UNDER CUTTING TEST :—

Two pairs of Wheels shall be subjected to under cutting test as given below;

20.1 PROCEDURE: The wheel mounted on a Hub and Spindle Assy shall be loaded radially against the drum and the Tyre concentricity shall be checked to ensure conformity with the limits specified in the drawing. Prior to commencement of this test the Wheel shall be conditioned for Two Hours at test Speed (26 KMPH) and test load (1250 kgs). If non-continuous test schedule is selected the tyre internal temperature shall be permitted to return to Ambient Temperature between each period. Test schedule shall be followed as under and observations shall be recorded.

Wheel No.

Outside Dia of Wheel :

Run out of Wheel :

Wobble of Wheel :

Hardness of Wheel :

Specification:

Load 1500 kg

Speed 20 kmph

Duration 48 hrs continuous (or) 10 period of 7 hrs each

Observation:

Starting Time

Stopping time

Results:

Tyre shall be close examined and shall be free from any separation from the rim, cuts, cracks, pores, bubbles etc.

21.0 TRIALS:

21.1 Qty 12 Nos of Road Wheel with tyres out of 18 Nos. of pilot batch are to be forwarded to CQA(ICV) Yeddumailaram.

22.0 LOADING :

22.1 The test vehicle shall be loaded with 14.3 ton weight with standard weight distribution and shall be free from any suspension or other mechanical defects likely to influence tyre performance.

23.0 TEST COURSES:-

23.1 High way mileage will be carried out on the test track and / or public road –

– and cross country mileage on the long valley course.

24.0 ENDURANCE:

24.1 At average cruising speed and of sufficient mileage on an approved cross country course and on good roads alternatively, starting on the former and changing from one to the other at intervals not exceeding 160 km, so that at any time the total cross country and road mileage shall be approximately equal.

25.0 PAINTING / MARKING /STAMPING :

25.1 Metal portion shall be painted with2, coats of primer to specification -03 K Gost 9109-81.

25.2 The Inspector shall ensure marking of (Rubberisation details) the following information on the side of rubberised portion of the road wheels.

Manufacturer's name
Serial Number / Batch Number
Year and Month of manufacture

25.3 Inspection mark shall also be stamped adjacent to the details indicated above at para ~~25.1~~ 25.2

26.0 GENERAL :

The manufacturer shall provide all facilities for all the tests to be conducted at their premises or otherwise they should get samples checked at near by recognized laboratory.