BHARAT HEAVY ELECTRICALS LIMITED
UNIT: JHANSI
(WORK. ENGG. & SERVICES DEPTT.)

EQUIPMENT : CNC VERTICAL BORING MACHINE

ITEM NO : MT-3/3/1445

LOCATION : LOCOMOTIVE

QUANTITY : 1 NO.

SPECIFICATION : 6106/R-2

CNC VERTICAL BORING MACHINE

1. PURPOSE OF MACHINE:-

Machine should be able to perform turning/boring of Railway wheels(having internal dia from 125 mm to 350 mm, maximum outside dia upto 1150 mm, bore length 400 mm & weight of wheel as 1000 Kg) with required finish & accuracies as per attached wheel drawing no.- drg no-17191101024/Rev 09.

2. CONFIGUARATION OF MACHINE:-

CNC vertical boring machine with single column of thermo symmetric design for thermal stability shall be of robust construction & shall be fitted with traversing cross rail. Machine shall have a Ram head and 12 station Automatic tool changer (ATC).The Rotary table shall be driven by AC spindle motor with two speed gearbox (made of alloy steel, hardened and ground) with infinitely variable speed. Table speed shall be infinitely variable & shall be controlled by **CNC** system provided with machine. Machine is to have four jaw manually operated chuck. Machine is to be capable of screw cutting and taper-turning. Graduated scale is to be provided to indicate cross rail position. Both x & z axes shall have built in encoders to show position of each axis slide on the CNC screen. Machine shall be equipped with Manual pulse generator (MPG) to position both x & z axes. Chip conveyor system with chip trolley may be quoted. Suitable coolant system with paper band filtration cum magnetic separator is to be provided with machine.

For grinding of railway wheels as per attached drawing ,an internal grinding arrangement as a special tool will be required , the same shall be quoted .

Tools required for machining the railway wheels as per attached drawing shall be recommended & quoted .

All feeds are to be reversible & the ram shall be balanced. The table is to have suitable lubrication system. Machine is to have centralized control-push button, table self lubricating, single helical gear table drive.

Safety limit switches for all traverse /slide axes shall be provided with machine.

A full height machine cladding is to be provided for the operator's safety as well as to avoid the splashing of chips & coolant while the machine is running at high speed.

A oil pump at the rear of the machine is to be provided to supply thoroughly filtered oil to all the systems of the machine like main drive gear box, driving gear in the base and table bearings, axis bearings and ball screws etc.. The pump should be suitably interlocked with the main driving motor to ensure that all parts are properly lubricated before the machine is started, and also to obviate any risk of damage due to failure of the lubricating system. A lubrication alarm is to be provided. A clearly visible sight-glass to be provided to check functioning of the pumps at any time. Machine is to have ball screws & ball nuts as axes drives, which are covered with metallic telescopic covers.

Machine is to be complete with all standard accessories with all electrics suitable for 415V , 3-phase, 4wire 50Hz AC supply .All scales to be calibrated in metrics

3. TECHNICAL SPECIFICATION FOR CNC VERTICAL BORING MACHINE (WITH INTERNAL GRINDING ATTATCHMENT) WITH STANDARD ACCESSORIES.-

1. **Machine should be able to meet all required finish & accuracies for turning /boring of Railway wheels(having internal dia from 125 mm to 350 mm, maximum outside dia upto 1150 mm, bore length 400 mm & weight of wheel as 1000 Kg) as per attached wheel drawing no.- drg no-17191101024/Rev 09. .(Making of work piece as per drawing shall be proven during commissioning)**

2.	**Table diameter**	:	**1200 mm**
3.	**Maximum turning diameter**	:	**1250 mm**
4.	**Ram Head-**		
	(i) Cross section of Ram head	:	**200 x200 mm**
	(ii) Vertical traverse of Ram(z-axis traverse)	:	**700 mm**
	(iii) Horizontal traverse of Ram head to the left of the table centre (x-axis traverse)	:	**40 mm**
	(iv)) Horizontal traverse of Ram head to the right of the table centre (x-axis traverse)	:	**880 mm**
5.	**Maximum working height over-table**	:	**1100 mm**
6.	**Maximum distance between table and under-side of cross- rail turret**	:	**1100 mm**
7.	**Vertical movement of cross rail**	:	**700 mm**
8.	**Maximum load on table**	:	**5 Tons**
9.	**Table speed (infinitely variable)**	:	**2.5-315 RPM**
10.	**Range of feeds (X & Z axis)(Infinitely variable)**	:	**1 to 1000 mm**
11.	**Rapid traverse to heads**	:	**5000 mm/min**
12.	**Rapid traverse to cross rail**	:	**300 mm/min**
13.	**Positional Accuracy of M/c**	:	**0.010 mm (max.)**
14.	**Taperness of M/c**	:	**0.010mm(max.)in 100 mm length**
15.	**H.P. of main motor**	:	**40**
16.	**Automatic tool changer(ATC)**	:	**Disc type**
17.	**No. of ATC station**	:	**12 Nos.**

18. **Machine shall have Manual pulse generator to position both x& z axes.**
19. **Machine shall have coolant system with paper band filtration cum magnetic separator.**
20. **Internal grinding arrangement suitable for Railway wheels as per attached drawing (having internal dia from 125 mm to 350 mm, maximum outside dia upto 1150 mm, bore length 400 mm & weight of wheel as 1000 Kg)**
21. **Chip conveyor system with chip trolley.**
22. **Tools required for machining the railway wheel as per drawing, shall be recommended & quoted .**
23. **Machine shall have suitable CNC control system (with interfacing of AUTOCAD drawings / PC programs with machine software).**
24. **Machine should be suitable for power supply- 415 volt, 50Hz, 3-phase, AC**
25. **Standard accessories:-**

(i) Suitable CNC system with interfacing of AUTOCAD drawings / PC programs with machine software).
(ii) Electrical equipment.
(iii) Moving cross rail.
(iv) 4- Jaw manually operated chuck.
(v) Full height machine cladding.
(vi) 2 Nos standard tool holders.

(vii) Chip conveyor system with trolley
(viii) One set of service tools (tool kit).
(ix) Colour of machine as per BHEL requirement (Verdigris green to IS 5/1961)
(x) 3 set of O & M manuals
(xi) Panel AC for electrical/ CNC cabinet.
(xii) Coolant system with paper band cum magnetic separator.
(xiii) MPG (Manual pulse generator)
(xiv) Machine lamp.
(xv) Suitable internal grinding arrangement for work pieces as per drawing.
(xvi) Foundation bolts & leveling wedges for foundation
(xvii) Necessary tools for making work piece as per drawing.

Note:-1. All standard accessories shall be supplied with the machine as a part of machine without extra cost

2. Making of job as per drawing shall be proven during commissioning.

3. Geometrical accuracy tests as per IS -2368(part-I)/ 1979 shall be proven during commissioning

4. Training to BHEL personnel at BHEL works for the interfacing of AUTOCAD drawings / PC programs with machine software shall be given by suppliers

4. MANDATORY DOCUMENTS REQUIRED TO BE SUBMITTED WITH THE OFFER-

1. Dimensioned outline general arrangement drawing
2. Details of safety devices / guards provided.
3. Electrical schematic diagram.
4. Total electrical load.
5. Quotation with item wise prices of spares for 2 years normal working.
6. Details of standard & optional accessories offered.
7. Catalogues / leaflets of machine offered .Operation & maintenance manual (3sets)& tool kit to be provided with machine.
8. Make & details (rating) of the control panels & other items like motors, gears, pumps, hydraulic systems etc.
9. Charges for the Erection & commissioning of the machine at BHEL Jhansi should be quoted in offer separately.
10. Make of bought out items- Bought out items of following make are to be provided & mentioned in offer..

(a) CNC system-	**Preferably Siemens make**
(b) Motor-	**Siemens/ Alstom / GEC/ABB/Crompton make**
(c) Gear box-	**Greaves / Relicon / Shanti make**
(d) Hydraulic system-	**Rexroth / L& T make/vickers**
(e) Bearings-	**NBC/ SKF/FAG make**

5. GENERAL CONDITIONS-

1. The above should be most updated in design incorporating the features.
2. The machine should be painted with one coat of red oxide primer & two coats of finishing paint before dispatch. Colour of the finishing paint should be **verdigris Green to IS 5/1961.**
3. Machine will be inspected & tried by our engineer prior to dispatch. Provision is to be made for deputation of commissioning engineer for erection & commissioning of the machine at BHEL ,Jhansi. All tools tackles & manpower shall be in suppliers scope. All civil work shall be done by BHEL based on foundation drawing to be submitted by supplier.
4. The performance of the machine should be demonstrated by the supplier after its successful commissioning at our works. Training at BHEL works to our operators should be given by supplier's representative.

6. QUALIFYING CONDITIONS

The subject machine will mainly be used for machining of locomotive's wheel as per attached drawing .Only those vender, who have supplied and commissioned **3 Nos**. such machines in the past ten years for similar application and have documentary proof to support that the machines are presently working satisfactorily for more than one year (more than six month if supplied to BHEL) after commissioning shall quote. The following information is to be submitted by the vender about the companies where similar machines have been supplied. This is required from all venders for qualifications of their offers.

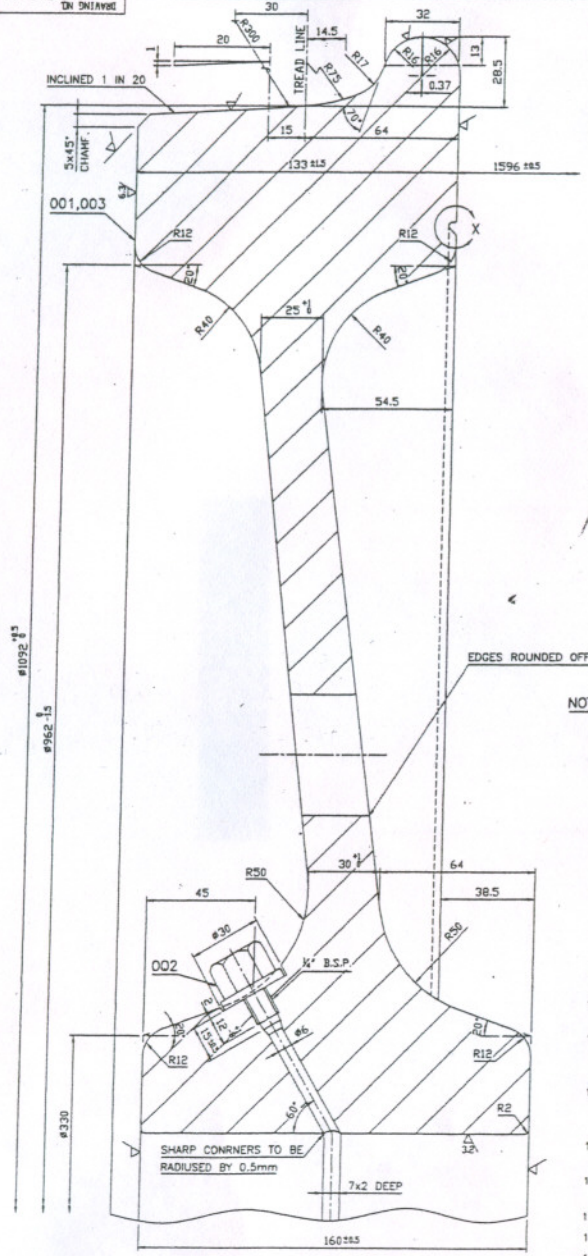
1. Name of the customer/ company where similar machine/ crane is installed
2. Complete postal address of the customer
3. Year of commissioning
4. Name and designation of the contact person of the customer
5. Phone , Fax No. and e-mail address of the contact person of the customer
6. Performance certificate from the customer regarding satisfactory performance of the machine/ crane supplied to them.

Date	Prepared By	Checked By	Approved By	
16/3/08	Dy. Mgr (WEX)	Mgr.(WEX)	DGM (WEX)	Sr. Mgr (LMM) 18/3

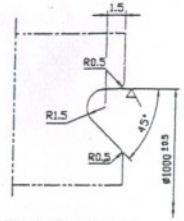
FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN mm)

DRAWING NO. 1 719 11 01 024

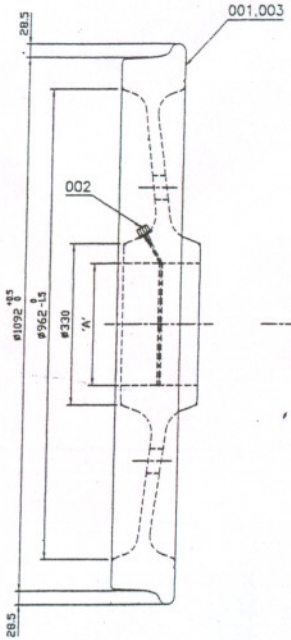
DIMNL. TOL:- AS PER CORP. STD. AA 023 02 08 MEDIUM GRADE UNLESS OTHERWISE STATED.

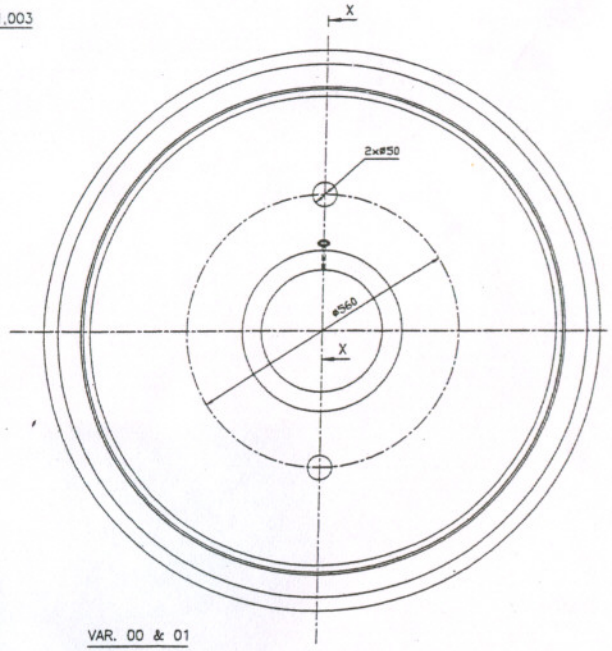


X–X (SCALE 1:1)



ENLARGED VIEW OF REFERANCE GROOVE FOR GAUGING AT–X





VAR. 00 & 01

NOTES:-

1. FINISHED WEIGHT OF EACH WHEEL MUST NOT EXCEED 475 Kg.
2. OPEN HEARTH OR ELECTRIC STEEL WITH THE FOLLOWING COMPOSITION TO BE USED FOR WHEELS. C – 0.57% TO 0.67% Mn. 0.60% TO 0.85% Si 0.15% MINIMUM P&S 0.05% MAX. EACH. HARDNESS OF RIM AFTER HEAT TREATMENT 300 TO 341 BHN. HARDNESS OF HUB 293 BHN. MAX. (i.e. IRS: R–34 OR A RM 107 CL–BR).
3. EACH WHEEL SHALL BE STAMPED ON OUTSIDE FACE OF WHEEL AS PER DRG. NO. 2 719 11 01 030.
4. ANNUAL GROOVE 7x2 IN THE WHEEL SEAT BORE TO BE MADE MATCHING WITH THE OIL INJECTION HOLE AFTER FINISH BORING.
5. THE OFF–SET OF TREAD FROM CENTRE OF HUB AS MACHINED TO BE WITHIN ±0.5mm.
6. IN ANY WHEEL THE RADIAL THICKNESS OF THE RIM SHALL NOT VARY 2mm. AROUND THE WHEEL.
7. IN ANY ONE WHEEL, THE DIFFERANCE BETWEEN THE MINIMUM AND MAXIMUM THICKNESS OF WEB AT ANY GIVEN RADIUS SHALL NOT BE MORE THAN 2mm.
8. THE THICKNESS OF THE HUB WALL IN ANY WHEEL MEASURED AT ANY TWO POINTS EQUIDISTANT FROM THE FACE OF THE HUB SHALL NOT VARY BY MORE THAN 2mm.
9. ECCENTRICITY BETWEEN THE ROUGH BORE AND TREAD MEASURED IN THE PLANE OF THE TREAD LINE SHALL NOT EXCEED 1mm.
10. ULTRASONIC TESTING AFTER ROUGH MACHINING OF THE WHEEL AT THE HUB AND RIM FACES IS REQUIRED TO ENSURE FREEDOM FROM INTERNAL FLAWS.
11. SURFACE FINISH:–
    (i) MACHINE ALL OVER TO OBTAIN SURFACE FINISH OF 6.3 Ra EXCEPT FOR THE SURFACES MARKED OTHERWISE.
12. ALL TESTS AS SPECIFIED IN IRS: R–34 SHALL BE CARRIED OUT AND TEST CERTIFICATES FOR SAME SUBMITTED TO BHEL IN TRIPLICATE. TEST CERTIFICATE FOR WHEELS SHALL MENTION THE STAMPING PARTICULARS OF RELEVANT WHEELS.
13. THE WHEELS SHALL BE SUITABLE PACKED AND PROTECTED SO THAT THERE IS NO DAMAGE DURING TRANSIT AND SHIPMENT.
14. WHEEL FLANGE PROFILE TO THIS DRG. IS AS PER WEAR ADOPTED WHEEL PROFILE TO RDSO DRG. NO. SK DL 2561 ALT.4
15. LATEST REVISION OF IRS: R–34 SHALL BE APPLICABLE.
16. VAR.00 IS APPLICABLE FOR 1400hp DEL AND ELECTRIC LOCOMOTIVES HAVING WHEEL DIA 1092mm.
17. VAR.01 IS APPLICABLE FOR 350hp, 700hp DESL AND D.H. LOCO HAVING WHEEL DIA 1092mm.

'A' FOR VAR.00 – ø252 +0.27 +0.17

'A' FOR VAR.01 – ø186 +0.029 0

STYLE LIST				
STYLE NO.	ITEM VAR	DESCRIPTION	VERIFIED SIGN.	VERIFIED DATE
708006	001	SOLID ROLLED WHEEL MODIFIED THICK FLANGE (FINISHED)		27.12.89
958512	003	SOLID ROLLED WHEEL MODIFIED THICK FLANGE (FINISHED)		22.07.05

THIS DRG. SUPERSEDS DRG. NO. 1 718 11 01 020

VAR.01	VAR.00	REMARKS	VAR NO.	ITEM NO.	DESCRIPTION	SYS	DRAWING NO.	IT. NO.	MATL. CODE	& UNIT	UNIT WT. (Kg.) QTY.	GS	DNC
001	--			003	WHEEL MONOBLOCK (ROUGH FINISHED)				IRS: R–34		475.000		
001	001			002	PLUG		4 719 11 01 005	001	ST. 706179		0.017		
--	001			001	WHEEL MONOBLOCK (ROUGH FINISHED)		2 719 11 01 012	001	IRS: R–34		475.000		

CARD TYPE – 1 CARD TYPE – 1 CARD TYPE – 2

ADDITIONAL INFORMATION W.O.NO. 35047G32200
STATUS OF DRAWING U
DISTRIBUTION OF PRINTS LME (DV) – 1, LMP (DV) – 1, LMH (DV) – 3

TYPE OF PRODUCT STANDARD OR NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LTD. JHANSI

	NAME	SIGN	DATE	NO. OF VAR.
DRN	N.K.SINGH	Sd/–	18.10.89	02
CHD	VS	Sd/–	18.10.89	
APPD	VKV	Sd/–	20.10.89	

REV	DATE	ALTERED CHECKED	REMARKS
09	12.02.08	ALTERED Santosh CHECKED APPD	DRG. UPDATED AND REDRAWN.
08	22.07.05	ALTERED Sd/– CHECKED Sd/–	

DEPT. CODE LME 454 | GRADE OF UN TOL. DIM. SHARP | SCALE 1 : 5 | WEIGHT (KG) 475.017

REF. TO ASSY. NO. 1 719 11 04 002, 1 719 11 01 021, 1 719 11 04 000 | ITEM NO. 003 | NO. OF ITEM 003

TITLE SOLID ROLLED WHEEL MODIFIED THICK FLANGE (FINISHED)

CARD CODE

DRAWING NO. 1 719 11 01 024 REV. 09

SHEET NO. 01 NO. OF SHEETS 01

SIZE A1

COPY NO. SIGN & DATE REF. DRG. NO.