SCHEDULE 2

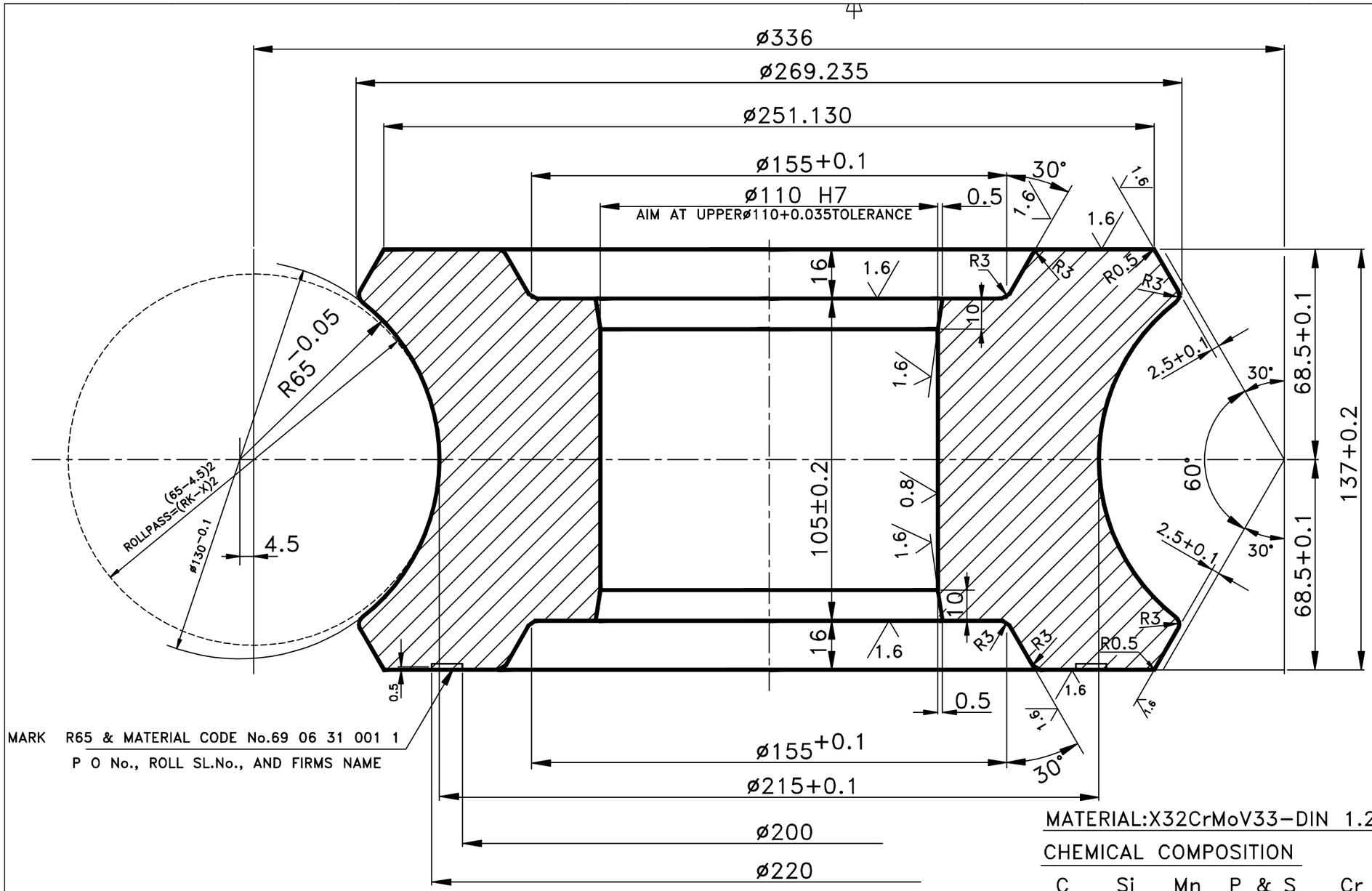
PUSH BENCH ADJUSTABLE ROLL 20-159/ 05

PUSH BENCH ADJUSTABLE ROLL (20-159/ 05)
ADJUSTABLE ROLL DRAWING No.: 20. ST.192.02.159/05
TDC NO.: TDC/TE/MFG: 05 REV.NO.: 09 dtd: 17.08.2012

ALL DIMENSIONS ARE IN MILLIMETERS

110 H7	+0.035 / 0

DEVIATIONS OF UNTOLERANCED DIMENTIONS TO BE AS PER IS:2102–1969 MEDIUM



MATERIAL:X32CrMoV33–DIN 1.2365(HOT WORKING TOOL STEEL)

CHEMICAL COMPOSITION

C	Si	Mn	P & S	Cr	Mo	V
0.28	0.20	0.20	0.03MAX.	2.7	2.6	0.40
0.35	0.40	0.40		3.2	3.0	0.70

EACH ROLL MUST BE FORGED INDIVITUALLY

HARDNESS 46–50HRC

HEAT TREAT TO 155–170Kg/mm^2

SUPPLY TO BE ASPER TDC/TE/MFG–005 REV06

REV	DATE	ALTERED / CHECKED / APPROVED	ZONE	DESCRIPTION
05	08.08.08	ALTERED R.KUMAR / APPROVED S.KARUPPASAMY	ZONE	BHN VALUE DELETED HARDNESS VALUE HRC ADDED
01	6.8.99	ALTERED R.KUMAR / CHECKED / APPROVED S.KARUPPASAMY	ZONE	DIMN.0.2 IS INCREASED TO 0.5 FOR DISTINCT TAPER
02	4.11.99			EACH ROLL FORGING ADDED
03	09.12.99			DIMNø200,ø220&0.5 SPACE ADDED FOR MARKING
04	16.2.04			SL/No.02ADDED(FOR MATL. H11)

Bharat Heavy Electricals Ltd
SEAMLESS STEEL TUBE PLANT
TIRUCHIRAPALLI – 620014

	NAME	SIGNATURE	DATE
DRN	R.KUMAR		08.08.08
CHD			
APPD	S.KARUPPASAMY		

DEPT	GRADE OF UNTOL. DIM	SCALE	WEIGHT (Kg)	REF TO ASSY DWG NO	ITEM NO
T E	C/M/F	1:1	33.0	REF TO OLD DWG NO 10.....002	

TITLE: ADJUSTABLE ROLL (PRE FINISHED)

CARD CODE: U 01

DRAWING NO : 20.ST.192.02.159

REV: 05

Document No.	Revision No.	Effective Date	Page No.
TDC/TE/MFG- 05	09	17.08.2012	1 of 3
Record of revision	07 – Clause 3.1,3.2 & 3.3 modified w.r.t Forging, UT and TC for raw material Clause 7.0 Forging acceptance details added Clause 7.1.1 & 7.1.2 Tensile & hardness test details added Clause 7.2.1 Liquid penetrant test & acceptance details added Clause 9.0 report requirement details added In Table A, tensile test piece details added 08 – Clause 3.1- 3.3 modified as 3.1 – 3.5; Clause 4.0 modified 09 – Drawing No. 20.St.192.02.238 added in clause 1.0 for higher dia. roll.		

1.0 PRODUCT:

Sl.No.	Equipment / Product	Drg. No.	Drg. Rev. No.
1.	Push Bench Fixed Rolls	20.ST.192.01.158	AS PER LATEST ENQUIRY / PURCHASE ORDER
2.	Push Bench Adjustable Rolls	20.ST.192.02.159 20.ST.192.02.238	

2.0 APPLICATION:

Used in Push Bench Stands for hot rolling of tubes in Temperature 1100-1200 Deg.C. and subjected withstand 60T - 120 T force (impact load), with cyclic heating and cooling.

3.0 MATERIAL:

DIN 1.2365 - X32CrMoV33

3.1 Raw material is to be forged to ensure uniformity of structure & strength with reduction ratio in cross section area of 4:1 from ingot to final forging, close to final shape and size. The forging shall be made as disk / ring forging so that the flow lines are oriented parallel to the circumference. The forging supplier shall furnish TC clearly indicating the size of ingot (cross section X length) used and the forging reduction ratio achieved. Forging shall undergo post forge **Stress Relieving at 650 degree C for 24 Hrs.** with furnace cooling and further **Spherodizing Annealing at 800 degree C for 20 – 30 Hrs.** and cooled in furnace.

3.2 The ingot for the above forging shall be made with any one of the following:
Melting process : Electric Arc Furnace / Induction Furnace **and**
Refining : Vacuum De-gassing / Electro Slag Refining.

3.3 Inclusion rating shall be as per **ASTM E45**
1. Thick series 0.5 allowed. 2. Thin series 2 max.
3. Grain size shall be 6 or finer.

3.4 Ultrasonic testing shall be done on the forging after proof machining in accordance with **SA 388**. Acceptance Standard in accordance with Clause **3.3.4.2 of ASME Sec VIII Div.2**. Test shall be certified by **NDT Level II** qualified personnel as per **SNT-TC-1A** (Society for Non destructive Testing)

3.5 The ingot & forging supplier shall provide
Original mill Test Certificate (TC) for the Material Chemistry **(or)**
Copy of mill TC and NABL accredited Lab Test Report for Material Chemistry in original.

4.0 HEAT TREATMENT:

As per Table-A furnished in page 3. The temperatures shown are indicative which can be modified as necessary to achieve the specified mechanical properties.

5.0 DIMENSIONS AND TOLERANCE:

As given in the Drawing

6.0 DIMENSIONAL INSPECTION:

Dimensional inspection shall be carried out by the supplier - Acceptance as per drawing

7.0 INSPECTION & TESTING:

Forging details (refer clause 3.1 - 3.5) is to be submitted to BHEL and got approved before the start of proof machining.

7.1 MECHANICAL TESTING :

7.1.1 Tensile Test is to be done on test piece as per **DIN 50145.** Acceptance as per Drawing

7.1.2 Hardness Test is to be done on job & test piece as per **DIN EN ISO 6508-1**. Acceptance as per Drawing.

7.2 NON-DESTRUCTIVE TEST :

7.2.1 Liquid Penetrat Test :

To be done after finish machining as per **ASTM E165** and shall be certified by **NDT Level II qualified personnel as per SNT-TC-1A.**

Acceptance standards : All surfaces to be examined shall be free of,

1. Relevant linear indications,
2. Relevant rounded indications greater than 3/16 inch (5 mm)
3. Four or more relevant rounded indications in a line separated by 1/16 inch (1.5 mm) or less, edge to edge.

8.0 MARKING:

Shall be done as given in the drawing

9.0 TEST CERTIFICATE/REPORT:

Following test certificates /reports shall be sent with materials. In all the TCs & reports BHEL PO No., Component Name, TDC NO. and Drawing No., Material Identification No (heat/melt no), Job Sl. No. shall be mentioned where ever applicable:

1. Raw Material Chemistry – Clause 3.5
2. Ultrasonic Test Report for Raw Material – Clause 3.4
3. Hardness & Tensile Test - Clause 7.1.1 & 7.1.2
4. Temperature-Time-Recorder Graph for the Heat Treatment Cycle followed (Table A)
5. Liquid Penetrant Test – Clause 7.2.1
6. Dimension Report – Clause 5.0

10.0 PRESERVATION & PACKING :

1. Supply with rust preventive coating which shall be dry after application and removable by common solvents.
2. Pack suitably to avoid transit & handling damages

TABLE – A

Rolls shall be heat-treated as per the following procedure.

Sl.No.	Process	Detail
1.	Stress Relieving	650–675 Deg. C . Hold for 1 Hour / 25mm of thickness Cool in Furnace upto 400 Deg. C and then Air-cool.
2.	Hardening – I Preheat	Charge during Furnace Temp. at 250 Deg.C. Raise Temp. to 540 – 650 Deg.C Rate of heating – 110 Deg.C per hour Hold for 1 Hour / 25mm of thickness of material.
3.	Hardening – II Preheat	845 – 870 Deg.C. Rate of heating – 110 Deg.C per hour Hold for 1 Hour / 25mm of thickness of material
4.	Austenising	1010 – 1040 Deg.C Soaking 15 – 40 min. in Salt Bath
5.	Quenching	596 – 650 Deg.C. Salt Bath Hold for 30 minutes After Temp. equalization – cool in Air.
6.	Alternate Quenching	After soaking – quench in Air
7.	Quenched Hardness	56 – 59 HRC
8.	First Tempering	Immediately after reaching 50 Deg.C – Temper to 525 – 550 Deg.C. Hold for 1 Hour / 25mm thick of materials Air Cool.
9.	Second Tempering	Temper to 600 – 620 Deg.C. Hold for 1 Hour / 25mm thick of materials Air Cool.
10.	Third Tempering	Temper to 580 – 600 Deg.C. Hold for 1 Hour / 25mm thick of materials Air Cool.

Tensile Test piece as per **DIN 50125 - A10 X 50** (Refer Page 3, Clause 4.2, Table 2 of DIN 50125) made from a test coupon heat treated in the same heat treatment batch of the P B Rolls shall be prepared to carry out the tensile test as given in **Clause 7.1.1**

Prepared By	Reviewed By	Approved By
SR. ADDL ENGR / TE	SM / QA&C	MANAGER / TE