

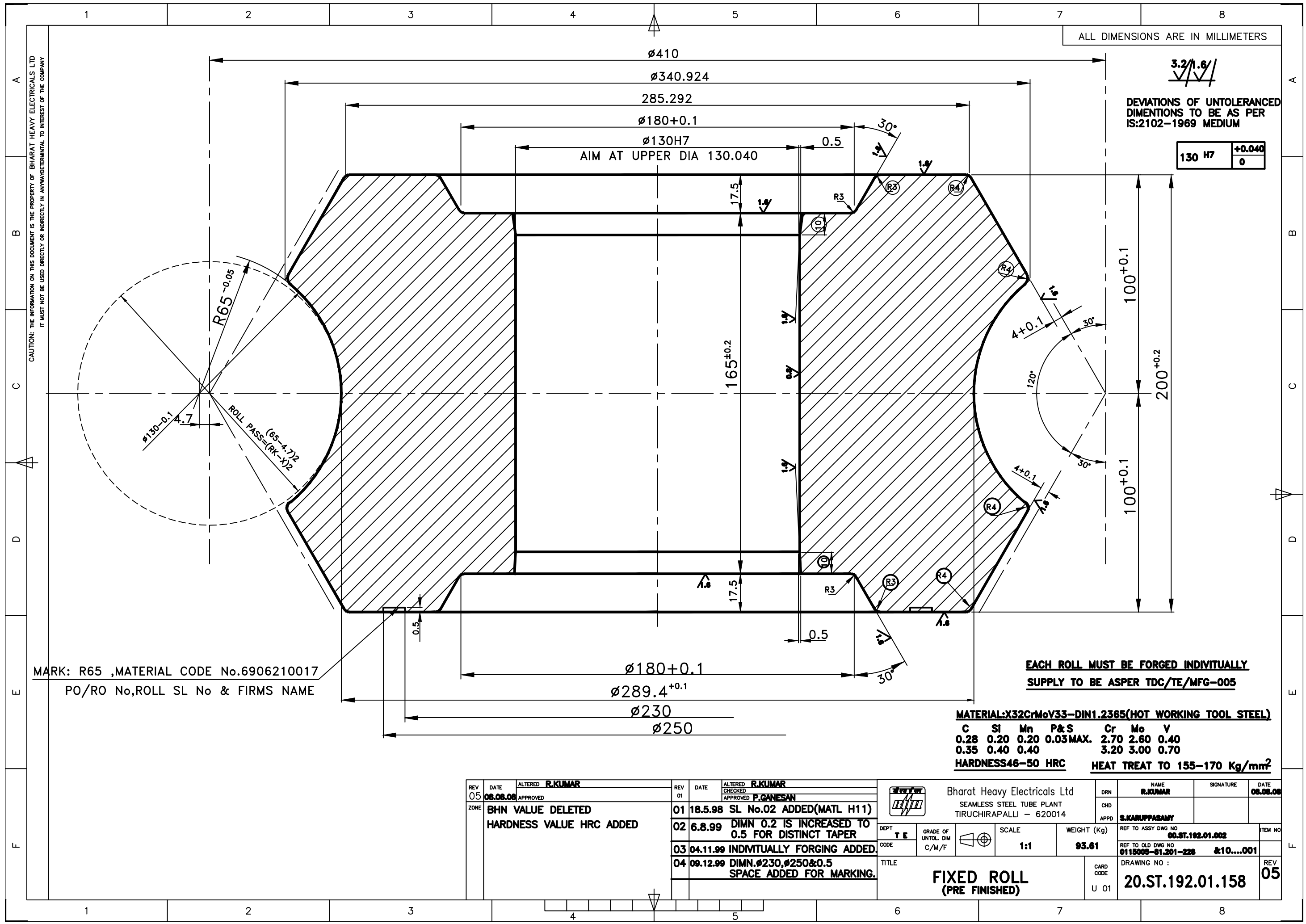
SCHEDULE 1

PUSH BENCH FIXED ROLL (20 - 158 / 05)

PUSH BENCH FIXED ROLL

FIXED ROLL DRAWING No.: 20. ST.192.01.158/05

TDC NO.: TDC/TE/MFG: 05 REV. No.: 09 dtd : 17.08.2012.



ALL DIMENSIONS ARE IN MILLIMETERS

3.2/1.6/
 DEVIATIONS OF UNTOLERANCED DIMENSIONS TO BE AS PER IS:2102-1969 MEDIUM

130 H7	+0.040
	0

CAUTION: THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LTD IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANYWAY DETERMINAL TO INTEREST OF THE COMPANY

MARK: R65 ,MATERIAL CODE No.6906210017
 PO/RO No,ROLL SL No & FIRMS NAME

EACH ROLL MUST BE FORGED INDIVIDUALLY
SUPPLY TO BE ASPER TDC/TE/MFG-005

MATERIAL: X32CrMoV33-DIN1.2365 (HOT WORKING TOOL STEEL)

C	Si	Mn	P&S	Cr	Mo	V
0.28	0.20	0.20	0.03MAX.	2.70	2.60	0.40
0.35	0.40	0.40		3.20	3.00	0.70

HARDNESS 46-50 HRC **HEAT TREAT TO 155-170 Kg/mm²**

REV 05	DATE 08.08.08	ALTERED APPROVED R.KUMAR	REV 01	DATE 18.5.98	ALTERED CHECKED APPROVED P.GANESAN	Bharat Heavy Electricals Ltd SEAMLESS STEEL TUBE PLANT TIRUCHIRAPALLI - 620014	DRN	NAME R.KUMAR	SIGNATURE	DATE 08.08.08	
ZONE	BHN VALUE DELETED HARDNESS VALUE HRC ADDED		01	18.5.98 SL No.02 ADDED (MATL H11)			DEPT	TE	GRADE OF UNTOL. DIM C/M/F	SCALE 1:1	WEIGHT (Kg) 93.61
			02	6.8.99 DIMN 0.2 IS INCREASED TO 0.5 FOR DISTINCT TAPER			REF TO ASSY DWG NO	00.ST.192.01.002		ITEM NO	
			03	04.11.99 INDIVIDUALLY FORGING ADDED			REF TO OLD DWG NO	0119005-01.201-228 & 10....001			
			04	08.12.99 DIMN. #230, #250 & 0.5 SPACE ADDED FOR MARKING.		TITLE	FIXED ROLL (PRE FINISHED)		CARD CODE U 01	DRAWING NO : 20.ST.192.01.158	

REV 05

BHEL, Tiruchirapalli-620014		SSTP / Tool Engineering		Technical Delivery Conditions	
Product : PUSH BENCH ROLL					
Document No.		Revision No.		Effective Date	
TDC/TE/MFG- 05		09		17.08.2012	
Page No.					
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 **Spheroidizing 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

BHEL, Tiruchirapalli-620014	SSTP / Tool Engineering	Technical Delivery Conditions	
Product : PUSH BENCH ROLL			
Document No.	Revision No.	Effective Date	Page No.
TDC/TE/MFG- 05	09	17.08.2012	2 of 3

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 Penetrant 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

BHEL, Tiruchirapalli-620014	SSTP / Tool Engineering	Technical Delivery Conditions	
Product : PUSH BENCH ROLL			
Document No.	Revision No.	Effective Date	Page No.
TDC/TE/MFG- 05	09	17.08.2012	3 of 3

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