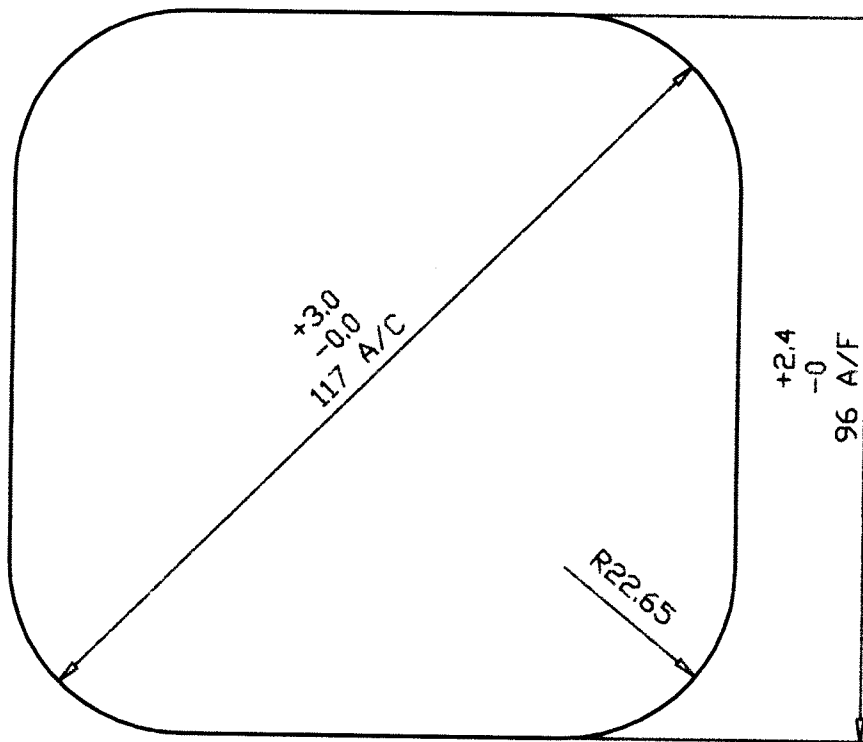


DRG. NO. F-330 K

A M E N D M E N T S

REV	DATE	DESCRIPTION	SIGN



DIMENSIONS ARE IN mm

THIRD ANGLE PROJECTION

SCALE - 1 : 1

2006	NAME	DATE
DRAWN	BAGDE	15-07-86
TRACED	<i>[Signature]</i>	27-02-06
CHECKED	B.K.CHAKRABORTY	15-07-86
JWM/CDD		
APPVD	WM/SF <i>[Signature]</i>	27-02-06

MATERIAL STEEL TO SPECN.
JSS 9510-1, Grade-SS/B27

NOMENCLATURE

STEEL BILLET

M/C :
STORE : 105 mm IFG SHELL

ORDNANCE FACTORY
AMBAJHARI

DRAWING NO.
F-330 K

SHEET NO.- 1

NO.OF SHEETS - 6

OPERATION -

COMPT. FORGED BODY
F- 160

ORDNANCE FACTORY AMBAJHARI, NAGPUR

P. B. W. M.
WM/SF ²⁷⁻²⁻⁰⁶

SPECN. NO.
F-330 K

SPECIFICATION OF STEEL BILLETS
FOR 105mm IFG SHELL

W. S. J. G. M.
JGM/CM ²⁷⁻²⁻⁰⁶

SHEET NO 2
NO.OF.SHT. 6

1. MATERIAL SPECIFICATION: JSS 9510-1, GRADE-SS/B27

2. TABLE 1 : CHEMICAL COMPOSITION

ELEMENTS	PERCENTAGE
C	0.43 - 0.53
Mn	1.30- 1.70
Mo	0.20 Max.
S	0.05 Max.
P	0.05 Max.
Si	0.10 - 0.35
Cr	0.30 Max.
Ni	0.50 Max.
Cu	0.30 Max.
Sn	0.04 Max.

Note: Atleast 3 sample should be taken in each heat & recorded.

3. MANUFACTURING PROCESS :

- 3.1. Steel is to be manufactured through EAF/BOF-LRF-VAD/VD-bottom poured ingot route.
Teeming temperature should be maintained in so that there is a uniform grain structure through out the cross section of ingot and dendritic structure is to be avoided
- 3.2. The steel shall be killed and free from harmful defects such as seams, flaws, piping, cracks porosity, impurities and surface defects.
- 3.3. Adequate top and bottom discards are to be given to all ingots to ensure soundness and freedom from piping, porosity, & harmful segregation. This is to be proved by sulphur print, macro-etch, or any other method mutually acceptable to the manufacturer, & purchaser
Macro sample shall be selected from billets representing top & bottom for atleast one ingots per plate or six no per heat whichever is max.
~~One~~ sample is to be drawn from Top of the first bar of first ingot cast & second sample is to be drawn from bottom of the last bar of last ingot cast.
- 3.4. Segregation tests are to be carried out according to ASTM A711-S7. The maximum allowable variation between the sampled points being 10%. 3 Samples from frist, middle & end of the bar from any Ingot of each heat are to be sampled by Cutting a slice off the bar. Sample for chemical analysis

SPECIFICATION OF STEEL BILLETS
 FOR 105mm IFG SHELL


is to be selected by taking 15% material from centre & balance along the same diagonal. Each of these chemical analysis are to confirm to Table 1. The chemical composition between each of the three points may not vary by more than that specified in table no 1.

Should any one of the three bars be out of this specification, that bar is to be recorded and scrapped and every bar from that heat is then to be subjected to this segregation test.

- 3.5. The reduction ratio of ingot to end product should be atleast 6:1
- 3.6. The billet from the bottom and the top end of each ingot must be marked (B & T resp.)

4. MICROGRAPHICAL ANALYSIS :

~~The test sample material must inherently be fine grain with a grain size (after Normalising.) of 7-8 ASTM. (Test as per ASTM E 112 or approved equivalent)~~
~~Atleast two sample to be checked for micro examination in each heat.~~



- 4.1. Permissible Inclusion rating :
 permissible inclusion rating will be as under ;
 2/1 (Thin/Thick) as per IS: 4163-1982 (Reaffitmed 1996) for each type of inclusion A, B, C and D.
- 4.2. Macro Etch Test : Sample will be six no's per heat/One no per plate
 Macro Etch test should confirm to grade C1, R2 & S2 of ASTM E 381-68. Carbon based deposits/carbon dots are undesirable and are to be avoided.

~~Atleast two sample to be checked in each heat for macro examination~~

5. INTERNAL DEFECTS :

Ultrasonic test as per IS: 8791-1978 class 'A'
 100 % bars to be checked.

Two sides of the billets with 90° angle between each other to be scanned over their complete surfaces with suitable overlapping.

6. MECHANICAL PROPERTIES :

- 6.1. Samples selected from billets for Mechanica test is Normalised condition
 It should satisfy the following mechanical properties.

ORDNANCE FACTORY AMBAJHARI, NAGPUR	Baam WM/SF ²⁷⁻²⁻⁰⁶	SPECN. NO. F-330 K
SPECIFICATION OF STEEL BILLETS FOR 105mm IFG SHELL	mm JGM/CM ²⁷⁻²⁻⁰⁶	SHEET NO. 4
		NO.OF.SHT. 6

0.2 % PS = 420 Mpa. Min.
 U.T.S. = 930 Max.
 Elongation % = 10% Min.

Atleast two sample to be checked for above test in each heat.
 The heat treatment schedule should be recorded & mentioned in Test certificate.

7. QUALITY ASSURANCE REQUIREMENTS :

Firm must submit the quility plan giving all details of manu-
 facturing process and other requirements.

7.1. Visual inspection.

100% visual inspection of the bars shall be carried out to make
 sure that they are free from harmful seams, cracks, embedded
 scale and folds.

7.2. Straightness.
 Maximum bow 3mm/m.

7.3. Twist.
 Maximum 3mm/m.

7.4. Bendness.
 permissible bendness 3mm/meter max.

7.5. Hardness.
 Hardness 230 BHN max. and 180 BHN min. for shell bar.
 Hardness should be uniform from surface to core.
 5% of total shell bars to be checked against each heat no. if not
 found OK. further 20% to be checked, if not found OK. then 100%
 to be checked.

7.6. Surface.
 As rolled.

8. DELIVERY REQUIREMENTS :

8.1. Supply.
 Supply is to be made in length of 3m to 6m length in multiple
 of 345 mm plus 0 to 50 mm extra and maximum 5% short down
 to length 2120 mm is acceptable.

Any material which will not fall in the above length range, the
 corrsponding end pieces will be rejected by O.F.Aj. Supplier will,
 replace the same quantity immediately.

8.2. Suitable Post rolling treatment should be given to rolled bars
 such that it satisfies the cropping properties when cut in

ORDNANCE FACTORY AMBAJHARI, NAGPUR

Balmu
WM/SF²⁷⁻²⁻⁰⁶

SPECN. NO.

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SPECIFICATION OF STEEL BILLETS
FOR 105mm IFG SHELLJGM/CM
27-2-06

SHEET NO. 5

NO.OF.SHT. 6

1000T / 16000T cold shearing machine.

Incidental elements, inclusion and grain size to be controlled ~~with in~~ ^{such} ~~7-8 ASTM~~ so that the material can be parted off in cold shearing machine without any defect on sheared surfaces. ^{Balmu}

8.3. Dimension.

Bars shall have the dimensions as per drawing No. F-330 K latest issue.

8.4. Shape.

Hot or cold saw at one end & other end ~~gas~~ cut allowed with cut square. Ends to be deburred. However bundling is to be done with saw cut end at one direction.

8.5. Marking.

Each bar to be stamped with melt No/cast no. or melt code No. on one end. The melts are to be delivered separated in bundles. Two tags stating melt No/Cast No and steel brand to be attached to each bundles.

8.6. Colour code.

25mm to 30mm width ~~yellow~~ "BLUE" colour band is to be painted throughout length of each bar on one side. Heat no to be stamped on each bar.

8.7. Bundling.

The shell bar are to be bundled Heat wise with 5 to 6 mm dia M.S. wire or steel strap with a steel tag mentioning steel grade, heat no, qty. and firm name. Weight of each bundle not to exceed 4 tons.

8.8. A cast must be delivered in its full quantity before the delivery of any other cast may commence.

9. CERTIFICATES :

Certificate covering following analysis, steel melting practice and mechanical properties to be sent in triplicate to user.

9.1. Chemical Analysis Certificate : as per para 2.

9.2. Mechanical Properties Certificate : as per para 6.

~~9.3. Grain size certificate : as per para 4.~~

9.3. Cleaniness certificate : as per para 4.1.

9.4. Macro Etch Certificate : as per para 4.2.

9.5. Ultrasonic inspection certificate : as per para 5.

ORDNANCE FACTORY AMBAJHARI, NAGPUR

R Baun
WM/SF 27.2.06

SPECN. NO.
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**SPECIFICATION OF STEEL BILLETS
FOR 105mm IFG SHELL**

mm
JGM/CM 27.02.05

SHEET NO. 6
NO.OF.SHT. 6

9.6. Hardness certificate : as per para 7.5.

9.7. No of bars and total quantity.

Note : Certificates are to be signed by Inspecting authority.

386/06 K	01.09.06	PARA NO 2 Cr% 0.30 Max WAS 0.10 - 0.30 MAX. PARA NO 3.4. SEGREGATION TEST AMENDED. PARA NO 4 GRAIN SIZE DELETED. PARA NO 4.2. SAMPLES NO ADDED & LAST LINE DELETED. PARA NO 7.5. HARDNESS 230 BHN MAX & 180 BHN MIN. WAS 210 & 190 BHN. PARA NO 8.4. AMENDED. PARA NO 8.6. COLOUR CODE "BLUE" WAS "WHITE BLUE". PARA NO 8.1. SUPPLY LENGTH 345 mm & 2120 mm WAS 355 mm & 2120 mm PARA NO 3.3 AMENDED.	<i>R Baun</i> WM/SF
80/06 J	27/02/06	SPECIFICATION MADE IN NEW FORMAT WITH ALL DETAILS WHICH COVERING THE MONETERING INSTRUCTION ALSO R22.65 INTRODUCED IN BILLET. AUTHORITY: WM/SF L.NO. 2952/DRG/SPECN/SF DT. 27/02/06	<i>R Baun</i> WM/SF
153/05 H	29/11/94	TOL ON BILLET DIMNS. AMENDED AS PER IS:3937-87 & CONDITION NO 1 AMENDED REF WM/SF L.NO. 2952/DRG/SPECN/SF DT. 19/05/05	-sd- WM/SF
99/2004 G	10/03/04	NOTE NO 12 & 13 ADDED. IN NOTE NO 4 HARDNESS ADDED AWM/SF LNO. 2953/TOOLS/SF DT.08/03/04 IN NOTE NO 11 REDUCTION RATIO 6:1 WAS 5:1 AUTH CQA(MET) FAX NO 07104-237705 DT 09/02/04 INST/TECH/MQA-2 DT 09/02/04 NEW TRACING MADE & DRAWING ADVANCED.	-sd- AWM/SF
309/2003 F	10/09/03	NOTE NO1 AMENDED REF.AWM/SF L.NO.2953/SF SHELLFORGESHOP DT.7/09/03 IN NOTE NO 11 REDUCTION RATIO 5:1 WAS 4:1 AUTH CQA(MET) FAX NO 07104-237705 DT 08/07/03 & INST/TECT/MQA DT 25/06/03.	-sd- AWM/SF
430/94 E	29/11/94	NOTE NO 9 ADDED AUTH. CQA(MET) L NO. INST/MQA-2, DT 15-9-94	-sd- DGM/QA
62/88 D	06/02/88	IN NOTE 8 BILLET ON ONE SIDE WAS BAR ON TWO OPPOSITE SIDES.	-sd- DGM/SF
508/87 C	21/12/87	NOTE NO 8 FOR COLOUR CODE ADDED.	-sd- DGM/SF
152/87 B	18/4/87	IN NOTE NO.7 'GASSY' WAS 'GRASSY'.	-sd- F/DO
82/87 A	19/02/87	NOTE NO 7 ADDED.	-sd- DGM/PL
REV.	DATE	DESCRIPTION	SIGN

A M E N D M E N T S

ORDNANCE FACTORY AMBAJHARI

RECOMPILED BY : <i>PL</i>	SPECIFICATION OF STEEL BILLET	SPECN. NO.:	F-330 K
CHECKED BY : JWM/CDO <i>Bsu</i> 27.2.06		SHEET NO.-	6
APPROVED <i>R Baun</i> WM/SF 27.2.06		NO.OF SHEETS -	6
<i>mm</i> JGM/CM 27.2.06	STORE : 105 mm IFG SHELL	COMPT.	FORGED BODY F-160