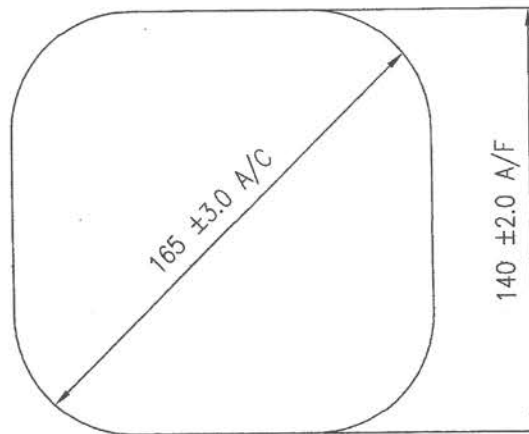


DRG. NO. F-638

A M E N D M E N T S

REV	DATE	DESCRIPTION	SIGN

PROVISIONAL



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 दिनांक: क.का.प्र./सी.डी.डी.  
 Date: 05/09/18

NOTE :  
 FOR MATERIAL AND OTHER DETAIL REFER SHEET NO 2 TO 6.

DIMENSIONS ARE IN mm			MATERIAL: ASTM A322, GRADE 4140		ORDNANCE FACTORY AMBAJHARI
THIRD ANGLE PROJECTION			NOMENCLATURE		
SCALE - 1 : 1			STEEL BILLET		DRAWING NO. F-638
2018	NAME	DATE			SHEET NO. - 1
DRAWN	<i>[Signature]</i>	05/09/18			NO. OF SHEETS - 6
CHECKED	<i>[Signature]</i>	05/09/18			OPERATION -
HOS/CDD	<i>[Signature]</i>				COMPT. FORGED BODY F-506
HOS/SF	<i>[Signature]</i>				
APPVD	WM/SF	<i>[Signature]</i>	05/09/18	STORE : 155mm IMI	

ORDNANCE FACTORY AMBAJHARI, NAGPUR

*W/SF*

SPECN. NO.

F-638

SPECIFICATION OF STEEL BILLETS  
FOR 155mm IMI

*HOS/SF*

SHEET NO. 2

HOS/SF

NO.OF.SHT. 6

PROVISIONAL

1. MATERIAL ANALYSIS:

1.1. MATERIAL SPECIFICATION: ASTM A322, GRADE 4140  
HOT WROUGHT STEEL BARS STANDARD QUALITY  
VACUM DEGASSED  
ALUMINUM KILLED.FINE GRADE STEEL.  
FREE OF SEGREGATION AND POROSITY

1.2. CHEMICAL COMPOSITION:

C% 0.40 MIN- 0.43 MAX

2. TECHNICAL REQUIREMENTS:

2.1. CHEMICAL ANALYSIS:

2.1.1. Results of all chemical analysis must conform with the figures laid down in para 1.2.

2.2. MECHANICAL PROPERTIES:

2.2.1. The test condition of the samples selected from billets for Mechanical Test is required to be in Hardened and Tempered condition. The billet sample is to be forged down to 40mm dia. and suitably hardened and temperature to achieve following Properties.

YIELD STRENGTH = 960 N/mm<sup>2</sup> MIN. (139100 psi)  
AT 0.2% OFFSET.

ELONGATION > 12%

2.3. MICROGRAPHICAL ANALYSIS:

2.3.1. The steel shall be killed and shall have austenitic grain size of 5 to 8 and finer (fine grain), to be determined in accordance with the comparison procedure in Test Methods of ASTM E112.

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Date: 20/06/15 JAW/CDD

ORDNANCE FACTORY AMBAJHARI, NAGPUR	<i>WM/SF</i>	SPECN. NO. F-638
SPECIFICATION OF STEEL BILLETS FOR 155mm IMI	<i>HOS/SF</i>	SHEET NO. 3
		NO.OF.SHT. 6

- 2.4. MANUFACTURING PROCESS: PROVISIONAL
- 2.4.1. 1. Steel is to be manufactured through EAF/BOF-VAD-Bottom poured ingot route  
2. Reduction ratio should be atleast 6:1.  
3. The material must be vacuum degassed and subjected to a hydrogen diffusion cycle to ensure freedom from hydrogen embrittlement and flaking. This must be stated on the release certificate. Hydrogen diffusion cycle is not required if Hydrogen level 2 PPM is achieved.
- 2.4.2. The steel shall be Aluminium killed and free from harmful defects such as seams, flaws, piping, cracks and surface defects.
- 2.4.3. Material to be supplied in the annealed condition.
- 2.4.4. Actual rolling temperature or final furnace temperature at the discretion of the Steel Manufacturer must be recorded and supplied on demand.
- 2.5. PRE-PRODUCTION SAMPLE:  
Melt must be supplied for testing. The billet from the bottom and the top end of each ingot must be marked ( B resp. T ).
- 2.6. CLEANLINESS:
- 2.6.1. Permissible Inclusion rating :  
permissible inclusion rating will be as under ;  
"2/1 (Thin/Tick) as per IS: 4163-1982 for each type of inclusion A, B, C and D".
- 2.6.2. Macro Etch Test:  
Macro Etch test to grade S2, R1 & C2 of ASTM E381-68 ( Re-approved 1974).
- 2.6.3. Internal Defects:  
The Ultrasonic testing shall be carried out in 100% Bars as per Specn. MIL-STD-2154 : Class = A Type = 1.  
The Magnetic Particle inspection shall be carried out in 100% Bars.
- 2.6.4. Bend Test:  
Bend Test 180° as per ASTM A675.

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दिनांक: 06/05/77  
Date: 06/05/77

ORDNANCE FACTORY AMBAJHARI, NAGPUR

SPECIFICATION OF STEEL BILLETS  
FOR 155mm IMI

*WM/SF*

WM/SF

*HOS/SF*

HOS/SF

SPECN. NO.

F-638

SHEET NO.

4

NO.OF.SHT.

6

PROVISIONAL

3. QUALITY ASSURANCE REQUIREMENTS:

3.1. VISUAL INSPECTION:

3.1.1. 100% visual inspection of the bars shall be carried out to make sure that they are free from harmful seams, cracks, embedded scales and folds.

3.2. STRAIGHTNESS:

3.2.1. Maximum bow 3mm/m.

3.3. TWIST:

3.3.1. Maximum 5mm/m.

3.4. HARDNESS:

3.4.1. Hardness 240 BHN max.

3.5. SURFACE:

3.5.1. As rolled.

Depth of cracks 1mm max.

Depth of local grinding 3mm max.

3.6. DISCARD, SEGREGATION AND PIPING:

3.6.1. Adequate top and bottom discards are to be taken in all cases to ensure soundness and freedom from piping and harmful segregation. This is to be proved by sulphur print, macro-etch, or other method mutually acceptable to the manufacturer, purchaser and the company. Every ingot is to be sampled by taking a section from the top of the first bar and the bottom sample per plate for bottom poured ingots. Macro sample shall be selected from Billets representing Top & Bottom for 2 Ingots per plate (ie 4-samples - 2 Top & 2 Bottom per plate).

3.6.2. Segregation tests are to be carried out according to S7 OF ASTM A711-67. The maximum allowable variation between the sampled points being 10%. The first, middle and end bars of each ingots are to be sampled by cutting a slice off the bar. A Chemical Analysis at center 15% and 80% along the same diagonal are to be taken. Each of these chemical analysis are to conform to para1.2.

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दिनांक: क.का.प्र.सी.डी.डी.  
Date: *20/07/13* JWM/CDD

ORDNANCE FACTORY AMBAJHARI, NAGPUR

SPECIFICATION OF STEEL BILLETS  
FOR 155mm IMI

*Cup*  
WM/SF

SPECN. NO.  
F-638

*Wm*  
HOS/SF

SHEET NO. 5  
NO.OF.SHT. 6

PROVISIONAL

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 ingot is then to be subjected to this segregation test.

4. DELIVERY REQUIREMENTS :

4.1. SUPPLY:

4.1.1. Supply is to be made in length of 3m to 6m in multiple length of 500+5mm plus 50 minus 0.

4.2. DIMENSION:

4.2.1. Bars shall have the dimensions as per SHEET NO.1

4.3. SHAPE:

4.3.1. Hot or cold sawn on both ends with cut square.  
Ends to be deburred.

4.4. MARKING:

4.4.1. Each bar to be stamped with melt No. or melt code No. on one end. The melts are to be delivered seperated in bundles. Two tags stating melt No. and steel brand to be attached to each bundle.

4.5. COLOUR CODE:

4.5.1. 75mm to 80mm width "LIGHT GRAY" colour band to CODE 631 IS: 5 - 1978 is to be painted throughout the length of each bar on one side.

4.6. A cast must be delivered in its entirety before the delivery of any other cast may commence.

5. CERTIFICATES:

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

5.1. Chemical Analysis Certificate:

Certificate of chemical analysis as per para 2.1.

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दिनांक: क. हा. प्र. / सी. डी. डी

Date: *20/11/18* CDD/OFAJ

BASED ON SPECIFICATION F-501& IMI-434116-380-E (MAT. SPECIFICATION)

ORDNANCE FACTORY AMBAJHARI, NAGPUR SPECIFICATION OF STEEL BILLETS FOR 155mm IMI	WM/SF	SPECN. NO. F-638
	HOS/SF	SHEET NO. 6 NO.OF.SHT. 6

PROVISIONAL

- 5.2. Mechanical Propertiec Certificate:  
Mechanical Propertiec Certificate as per para 2.2.
- 5.3. Grain size certificate :  
A Certificate certifying grain size as specified in para 2.3.1 must be supplied.
- 5.4. Cleaniness certificate:  
A certificate to certify cleanliness as specified in para 2.6.1.
- 5.5. Macro Each Certificate:  
A certificate to certify Macro etch results as per para 2.6.2.
- 5.6. Annealing:  
The certificate shall contain a statement to verify that this has been done.
- 5.7. Ultrasonic inspection certificate:  
A certificate to certify Ultrasonic Testing as per para 2.6.3.
- 5.8. Magnetic Particle inspection Certificate.  
A certificate to certify Magnetic Particle inspection as per para 2.6.3.

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Date: *[Signature]* CDD

REV.	DATE	DESCRIPTION	SIGN
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A M E N D M E N T S

ORDNANCE FACTORY AMBAJHARI

COMPILED BY : <i>[Signature]</i> 05.09.18	SPECIFICATION OF STEEL BILLET	SPECN. NO.:	F-638
CHECKED BY : <i>[Signature]</i> 05.9.18		SHEET NO.-	6
HOS/CDD <i>[Signature]</i>		NO.OF SHEETS -	6
APPROVED		COMPT.	FORGED BODY F-506
<i>[Signature]</i> WM/SF	<i>[Signature]</i> HOS/SF	STORE :	155mm IMI