

THIRD ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

T0019-11-158-E DRG NO

TO JO TO HS

NOTE:

1. FOR LOUVER DETAIL REFER 4-35111-51002-01.

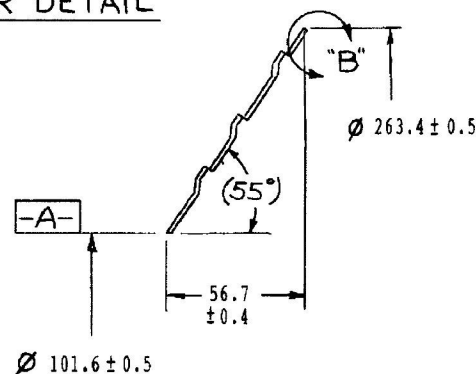
GENERAL DIMENSIONAL LIMITS, FITS &amp; TOLERANCES AS PER HY0230261

40 LOUVERS EQ.SP ON A  $\varnothing 241.0 \pm 0.5$ POINT AT WHICH  
LOUVER REGISTERS  
ON ITS LOCATING  
DIAMETERLOUVER  $\varnothing$   $\varnothing$  RADIAL

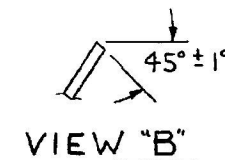
## LOUVER DETAIL

25 LOUVERS EQ SP  
ON A  $\varnothing 204.8 \pm 0.5$ 25 LOUVERS EQ SP  
ON A  $\varnothing 182.9 \pm 0.5$ 18 LOUVERS EQ. SP  
ON A  $\varnothing 157.5 \pm 0.5$ 18 LOUVERS EQ. SP  
ON A  $\varnothing 132.0 \pm 0.5$ 

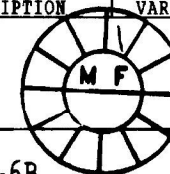
C"	
OUTER ROW	(4) INNER ROWS
$65^\circ \pm 2^\circ$	$5^\circ \pm 2^\circ$



## SECTION A-A



MATL:HY1271763010	01
DESCRIPTION	VAR



TYPE OF PRODUCT OR

GAS TURBINE FR-6B

NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LIMITED  
HYDERABAD

NAME	SIGN	DATE	NO OF VAR
DRN SCS	—	3 5 2000	
CHD R.SRINIVAS.	<i>R. Srinivas</i>	3 5 2000	NA
APPD KMM	<i>K. M. Madan</i>	3 5 2000	

DEPT	UNTOL DIMS	SCALE	WEIGHT (KG)	REF TO ASSY DRG	ITEM NO	NO OF ITEMS
GTD	OR	NTS	0 7	NA	NA	NA
CODE	1/M/1					
23						
TITLE				CARD CODE	DRAWING NO	REV
CAP - COMB				NA	3-351-11-61001	01
				SHT No 01	NO OF SHT 01	

INVENTORY NO  
SIGN AND DATE  
REF DRG NO  
242B9100 REV ' - '  
COMPUTER FILE NAME  
33511.61001-500-301.TIT  
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REV	DATE	ALTERED	REV	DATE	ALTERED	REV	DATE	ALTERED
		CHD/APPD			CHD/APPD	01	3.5.2K	CHD/APPD X SRINIVAS
ZONE			ZONE			ZONE		REDRAWN



# PLANT STANDARD HYDERABAD

**HY0230261**

**REV. NO. 03**

**PAGE 1 OF 2**

## LIST OF APPLICABLE STANDARDS ON LIMITS, FITS AND TOLERANCES

### 1.0 SCOPE:

The standard covers the list of applicable standards on Limits, Fits and Tolerances. These standards are applicable unless or otherwise specified.

### 2.0 LIST OF APPLICABLE STANDARDS:

SL. NO.	STANDARD NO.	TITLE
1.	AA0230201	- Limits and Fits (Tolerance grade, Position and Class).
2.	AA0230202	- Limits and sizes for commercial bolts and nuts.
3.	AA0230204	- Guide for selection of Fits.
4.	AA0230206	- Standard limits for Shafts (upto 500 mm).
5.	AA0230207	- Standard limits for Shafts (above 500 mm and upto 3150 mm).
6.	AA0230208	- Allowable deviations for dimensions without specified tolerances (linear and angular).
7.	AA0230402	- Permissible deviations for untoleranced dimensions of castings.
8.	AA0230403	- Tolerancing system ISO Metric Screw Threads
9.	AA0621101	- Tolerances and Machining allowances for Flame cutting.
10.	AA0621104	- General tolerances for welding constructions for length and angles.
11.	AA0621105	- General tolerances for welded structures – form and position.

### Revisions:

**Withdrawn standards deleted (2 Nos.).**

**Rev. No. 03**

**Amd. No.**

**Reaffirmed:**

**Dt. OCT. 06**

**Dt.**

**Year:**

### Issued :

**STANDARDS ENGINEERING DEPARTMENT**

**Prepared:  
MANAGER  
(STDS. ENGG.)**

**Approved:  
AGM (E&CC)**

**Date of 1<sup>st</sup> issue:  
MAY, 1992**

<b>HY0230261</b>	<b>PLANT STANDARD HYDERABAD</b>	
<b>REV. NO. 03</b>		
<b>PAGE 2 OF 2</b>		

NOTE:

1) AA 023 02 08

Medium class of deviation is applicable, if the same is not mentioned on the drgs./specs.

2) AA 023 04 02

Tolerance class 5 is applicable, if the same is not mentioned on the drgs./specs.

3) AA 062 11 04

Accuracy class A is applicable if the same is not mentioned on the drgs.

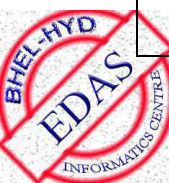
4) AA 062 11 05

Accuracy class E is applicable, if the same is not applicable on drgs.

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RESTRICTED USE





## PLANT PURCHASING SPECIFICATION HYDERABAD

**HY 12763**

REV. NO: 01

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### NICKEL BASE ALLOY SHEET, PLATE AND STRIP (HASTELLOY X)

#### 1.0 GENERAL:

This specification governs the quality requirements of, Nickel base alloy sheets and plates for high temperature application.

#### 2.0 APPLICATION :

For combustion liner and transition piece in Gas Turbines.

#### 3.0 CONDITION OF DELIVERY:

**3.1 Sheet & Strip :** Hot or cold rolled, solution heat treated and descaled unless solution heat treatment is done in an atmosphere yielding a bright finish..

**3.2 Plate:** Hot rolled, solution heat treated and descaled.

#### 4.0 COMPLIANCE WITH NATIONAL STANDARDS:

This specification in general complies with ASTM B435: UNS-N6002.

#### 5.0 DIMENSIONS AND TOLERANCES:

**5.1** Dimensions shall be as specified in the purchase order.

**5.2** Tolerances on the plates & sheets shall be as per ASTM B 435.

#### 6.0 MANUFACTURE:

The material is produced by Vacuum Induction Melting (VIM) followed by Vacuum Arc Refining (VAR) or Electro Slag Refining (ESR). Any other process shall be mutually agreed upon.

#### 7.0 HEAT TREATMENT:

This material shall be solution heat treated by heating to 1175°C (2150°F), holding at the temp. for not more than 30 minutes and rapidly cooling.

<b>Revisions:</b> Revised in general with latest ASTM B 435 and GE B50A436C – S5.			<b>Issued :</b> <b>STANDARDS ENGINEERING</b> <b>DEPARTMENT</b>		
<b>Rev.No. 01</b>	<b>Amd. No.</b>	<b>Reaffirmed:</b>	<b>Prepared:</b>	<b>Approved:</b>	<b>Date:</b>
<b>Dt. 6.10.2001</b>	<b>Dt.</b>	<b>Year</b>	Malts Engg.	GM (E&CC)	OCT., '91

# PLANT PURCHASING SPECIFICATION HYDERABAD



## 8.0 FREEDOM FROM DEFECTS:

The sheets shall be free from cracks, seams, fissures, laps and other harmful defects.

## 9.0 FINISH:

The material should possess a bright finish and have surface appearance as close as possible to a commercial corrosion resistant steel No.2D finish.

## 10.0 TEST SAMPLES:

**10.1 Chemical Analysis:** One test sample shall be taken per melt.

**10.2 Mechanical Tests:** One test sample for lot comprising of plate/sheet/strip of the same size, melt and heat treatment batch shall be taken for Mechanical Testing.

## 11.0 CHEMICAL COMPOSITION:

The chemical analysis of the material shall be as follows:

Element	C	Mn	Si	P	S	Cr	Co	Mo	W	Fe	B	Ti	Ni
Min. %	0.05	-	-	-	-	20.50	0.50	8.00	0.20	17.00	-	-	Bal.
Max. %	0.15	1.00	1.00	0.040	0.030	23.00	2.50	10.00	1.00	20.00	0.010	0.15	-
Permissible variation	±0.01	+0.03	+0.05	+0.005	+0.005	±0.25	-0.02 +0.05	±0.15	±0.04	±0.30	LAP Note(2)	LAP Note(2)	-

Note: 1) Elements not listed in this table shall not be intentionally added without prior approval of BHEL.

2) LAP – As low as possible.

## 12.0 MECHANICAL PROPERTIES:

The material shall conform to the following mechanical properties when tested in accordance with ASTM E8.



## PLANT PURCHASING SPECIFICATION HYDERABAD

**HY 12763**

Rev. No.01

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### 12.1 Tensile properties:

Thickness mm	Tensile strength Mpa min.	Yield strength 0.2% offset Mpa min.	Elongation % in L=50 mm min.
Upto 0.254 excl.	725	310	-
0.254 to 0.508 excl.	725	310	29
0.508 to 4.572 incl.	725	310	35
4.572 to 50.8 incl.	690	275	35
over 50.8	660	275	35

12.2 **Hardness:** Hardness shall be 90 HRB max.

### 13.0 RETESTS:

13.1 If, any of the test specimen fails to meet the requirement specified, the sample sheet from which the test specimen are taken shall be rejected and two further sample sheet from the same lot shall be taken for retest.

13.2 If, any of the retests also fails, manufacturer is at liberty to heat treat the sheet in question. However, not more than two heat treatments are allowed.

13.3 If, after heat treatment, the mechanical properties are not complied with, the entire lot shall be rejected.

### 14.0 STRESS RUPTURE TESTS:

The material shall be capable of meeting the following minimum stress rupture requirements when tested at 815° C (1500°F). This test is conducted as per ASTM E139.

Thickness mm	Stress MPa	Life hours	Elongation % in l = 50 mm
0.254 to 0.508 excl.	110	15	3
0.508 and over	110	24	8

NOTE: Stress rupture testing may be conducted at stress levels higher than that specified provided all other test conditions are maintained. The specified life and elongation requirements shall apply and stress shall remain constant while the test is in progress. Stress values used shall be reported in the vendor's test certificate.

### 15.0 BENDING:

Material shall withstand without cracking, bending at room temperature through an angle indicated below around a diameter equal to the bend factor times the nominal thickness of the material, with axis of bend parallel to the direction of rolling. Inspect bend test specimens at 20x magnification. This test shall be done in accordance with ASTM A370.



Thickness mm	Angle, degrees min.	Bend factor
0.254 to 1.27 excl.	180	1.5
1.27 to 4.57 incl.	180	2

#### 16.0 **METALLOGRAPHIC INSPECTION:**

- 16.1 Grain Size:** The material shall conform to the following grain size requirements when examined as per ASTM E112 Plate I.

Thickness, mm	Average grain diameter (Max.) (mm)	ASTM Micrograin Size No.
3.175 & under	0.127	3.0 or finer
Over 3.175	0.214	1.5 or finer

- 16.2 Microstructure:** The microstructure in the solution annealed condition shall be clean and exhibit uniform austenitic structure. The microstructure shall not show massive carbide precipitation in the matrix or at the grain boundaries. Photomicrographs shall be enclosed to the test report.

#### 17.0 **INSPECTION AT SUPPLIER'S WORKS:**

The representative of BHEL shall have free access to the supplier's works at all times during the execution of the order, to satisfy himself that the material is produced as per the quality requirement of this specification. All reasonable facilities shall be extended to him, free of charge. He may witness sampling, testing and marking called for in this specification/order.

#### 18.0 **TEST CERTIFICATES:**

Five copies of the test certificates shall be supplied furnishing the following details:

- (a) HY 12763 Rev.01
- (b) Material grade : Hastelloy X
- (c) BHEL Order No.
- (d) Dimensions



## PLANT PURCHASING SPECIFICATION HYDERABAD

**HY 12763**

Rev. No.01

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- (e) Melt Number
- (f) Process of Manufacture
- (g) Heat treatment and details batch number
- (h) Results of Chemical analysis, Mechanical Tests, Stress Rupture, Bend Tests and Metallographic tests with representative photomicrographs.

### **19.0 PACKING AND MARKING:**

**19.1 Marking:** Sheets shall be bundled together as per size and each bundle shall have a metal tag with following information.

- (a) HY 12763 Rev.01
- (b) BHEL Order No.
- (c) Melt No./Heat treatment batch
- (d) Size/weight
- (e) Manufacturer's Trade transit.

**19.2 Packing:** The sheet shall be suitably packed to prevent corrosion and damage during transit.

### **20.0 REJECTION AND REPLACEMENT:**

In the event of any material proving defective in the course of processing or testing, such material shall be rejected and the supplier shall make immediate arrangements to replace the same free of cost.



Sl. No.	Terms & Conditions	Supplier confirmation (YES/NO)	Deviations (if any mention clearly)
1.	<b>Scope of Supply:</b> Fr6 Cap, Combustion to be supplied as per BHEL Material code: SG9711033011, Material Specification HY12763, Rev 01, Drg. No. 33511161001-01		
2.	<b>Pre-Qualifying Requirements for all Vendors:</b> The bidder is required to furnish self-attested documentary proof for having acquired following pre-qualification requirement (PQR)  The following conditions have to be satisfied by the vendor, with documentary proof to be enclosed with tender (Technical), failing which the offer will not be considered for evaluation:  <ol style="list-style-type: none"> <li>Vendor should furnish the sheet metal forming/Fabrication experience with Stainless steel/Super alloys (like Hastelloy, Nimonic and etc...). Latest PO copies not less than 5 years, Material test reports, quality plans and etc. shall be submitted to BHEL.</li> <li>Vendor should provide details on making Dye, jigs &amp; Fixture required to manufacture the Cap, combustion.</li> <li>Vendor should have in house facility of suitable Press for sheet formation (cone shape), Laser cutting/CNC cutting for trimming of extra length. If the vendor doesn't have the facility of Hydraulic press and laser cutting machine in this case vendor shall submit the alternative source details.</li> <li>Vendor shall submit the complete manufacturing process plan for Fr-6 Cap, Combustion.</li> <li>Vendor should confirm complete compliance to following BHEL specifications                HY12763 - Raw material specification, Hastelloy-X (3.15MM thick nominal).                HY0230261-List of applicable standards on limits fits and tolerances.</li> <li>Development of tooling for fabrication and templates for Inspection of Fr6 Cap, Combustion is in vendor scope. Template shall be submitted to BHEL for approval.</li> </ol>		

	<p>vii. It shall be the responsibility of supplier to thoroughly understand the work scope and all documentation needed to complete the work. Prior to initiation of any manufacturing activity, the applicable drawing shall be jointly reviewed by SG Engineering, BHEL Hyderabad and supplier to document any discrepancies in the drawing.</p> <p>viii. First piece qualification of Fr6 Cap, Combustion to be carried out by BHEL, after first piece approval vendor to manufactured the balance quantity.</p> <p>ix. New vendors, who are interested to participate and to do business with BHEL, shall get registered with BHEL after technical scrutiny.</p> <p>x. BHEL representative shall have free entry and access to all areas where the manufacture/machining of Transition piece body is carried out. All reasonable facilities shall be extended to him including labour wherever necessary.</p> <p>xi. BHEL representative shall be given sufficient advance intimation to verification/witness the various process, tests, etc</p> <p>xii. “The offers of the bidders who are on the banned list and also the offer of the bidders, who engage the services of the banned firm shall be rejected. The list of banned firms is available on BHEL website “www.bhel.com”.</p>		
3.	<p><b>Documents to be submitted by vendor.</b></p> <p>a. Manufacturing Process Plan, Inspection and Quality Plan</p> <p>b. Tooling drawings</p> <p>c. Inspection template drawings</p> <p>d. Test certificates</p> <p>e. FPQ documentation and Major BHEL witness points</p> <p>f. Deviation if any, to be furnished clearly.</p>		