



PLANT PURCHASING SPECIFICATION

HY 19363

Rev. No. 02

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CARBON STEEL FORGINGS NORMALISED & TEMPERED

(ORDERING DESCRIPTION)

1.0 GENERAL:

The forging shall comply with the latest revision of ASTM A-266M Grade 2 and with the following additional requirements.

2.0 APPLICATIONS:

For centrifugal compressor components such as compressor casing, Counter Casing, end cover, diaphragm, nozzles etc.

3.0 CONDITION OF DELIVERY:

The forgings shall be supplied in normalized and tempered condition. Unless otherwise specified, the forgings shall be supplied in rough machined condition.

4.0 DIMENSIONS, TOLERANCES AND SURFACE FINISH:

The dimensions, tolerances and surface finish shall be as per the ordering drawing.

5.0 MANUFACTURE:

The steel melting and forging processes followed for the manufacture of the forgings shall be meeting the conditions specified in ASTM A 266 & ASTM A 788 (latest versions).

6.0 TEST SAMPLES:

Chemical Composition: One sample for each melt shall be analyzed for chemical composition.

Mechanical Properties: One integral tangential test sample shall be taken from the locations indicated in the Annexure I for each forging.

7.0 CHEMICAL COMPOSITION:

The steel shall conform to the chemical composition given below.

Element		C	Si	Mn	S	P
Heat Analysis (wt. %)	%Min	-	0.15	0.40	-	-
	%Max	0.25	0.35	1.05	0.025	0.025

Revisions: Modified Cl. 4.0, 5.0, 9.0 & 12.2 and added Cl. 11.0 and QAP.

Issued :
STANDARDS ENGINEERING & IPR
COORDINATION DEPARTMENT

Rev. No. 02

Amd. No.

Reaffirmed:

Prepared:

Approved:

Dt. of 1st Issue:

Dt. AUG. 2013

Dt.

Year:

Matls. Engg.

MNGR. (TSD)

AUG. 1989

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8.0 MECHANICAL PROPERTIES:

The mechanical properties of the test specimens selected as per Annexure I shall meet the following requirements.

Tensile Strength N/mm ²	0.2% Proof Stress N/mm ² , Min.	Elongation % L=50 mm, Min.	Reduction in Area, % Min.	Hardness BHN
485-655	250	20	33	137-197

9.0 NON-DESTRUCTIVE TEST:

Unless otherwise specified in the order, the forgings shall be tested for non-destructive testing in dispatch condition (i.e. final machined condition as per ordering drawing).

9.1 Ultrasonic Test: 100% volume of each forging shall be ultrasonically tested as per BHEL Standard AA0850118 and the unacceptable defects are (Class 2 of AA0850118) are as follows:

- Cracks, flakes, seams and laps.
- Defects giving indications larger than that from a 4 mm diameter equivalent flaw.
- Groups of defects with maximum indication less than that from a 4mm diameter equivalent flaw which cannot be separated at testing sensitivity if the back echo is reduced to less than 50%
- Defects giving indication of 2 to 4 mm diameter equivalent flaw separated by a distance less than four times the size of the larger of the adjacent flaws.

9.2 Magnetic Particle Test:

MPI shall be conducted on 100% area of each forging as per ASTM A 275. Cracks are not acceptable.

10.0 INSPECTION AT SUPPLIERS WORK:

BHEL representative shall have free access to all the areas of the manufacturer's works, where the manufacture of the forgings is carried out. All reasonable facilities shall be extended to him including labour where necessary.

BHEL representative shall be given sufficient advance intimation to witness the various processes, tests etc. Punching and identification of test coupons and forgings and execution of various tests shall be done in his presence. The test samples from forgings having integral test coupons (as required by Annexure I) shall not be detached / cut from the forgings before attestation / hard punching of BHEL inspector's stamp on the test coupons.

11.0 QUALITY PLAN:

- Vendor shall follow the Quality Plan Ref. QP No.: BHEL/HY19363 Rev. 02 attached as Annexure II unless the conditions stipulated in Cl. 11.2 & 11.3 mentioned below are applicable.
- In case Customer/ Project related additional requirements are applicable, vendor will be asked to submit a separate QP including such requirements.
- In case of new vendors or first time supplies according to drawings mentioned in BHEL enquiry, a separate QP shall be submitted for approval by BHEL.



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12.0 TEST CERTIFICATE:

12.1 The supplier shall furnish five copies of the test certificate (in English) giving the following details shall be furnished.

- a) BHEL Order No:
- b) HY 19363 Rev.02
- c) Item description
- d) Drawing No.
- e) Melt No.
- f) Forging No.
- g) Results of Heat & Product Analysis
- h) Results of all the tests stipulated in this specification

12.2 The test certificates shall be signed by the chief of inspection/Chief Metallurgist of the supplier and attested by BHEL representative.

12.3 If specified in the drawing/ purchase order, the test certificate shall be furnished in IBR form III C.

13.0 PRESERVATION, MARKING AND PACKING:

13.1 The following details shall be hard punched clearly on each forging:

- a) Supplier's Name
- b) BHEL Order No:
- c) HY 19363 Rev.02
- d) Drawing No.
- e) Melt No.
- f) Forging No.
- g) BHEL Inspector's Stamp.

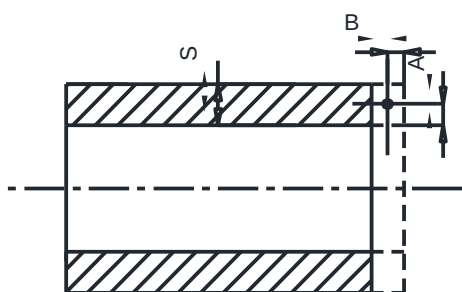
13.2 The forgings shall be protected with suitable rust preventive coating before packing and despatch.

13.3 The forgings shall be suitably packed to prevent from damage and corrosion during transit. In the case of imported forgings, the packing shall be seaworthy.

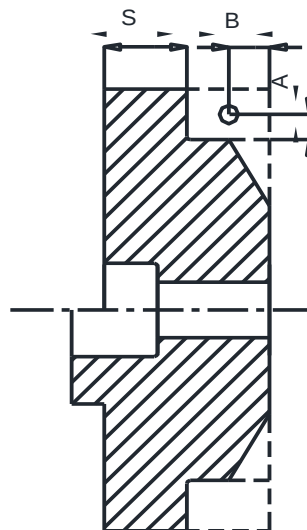
14.0 REJECTION AND REPLACEMENT:

In the event of the forging proving defective in the course of further processing at BHEL, the same shall be rejected notwithstanding any previous acceptance. The supplier shall replace any rejected forging at his own cost, and the rejected forging shall be returned after all the commercial conditions are satisfied.

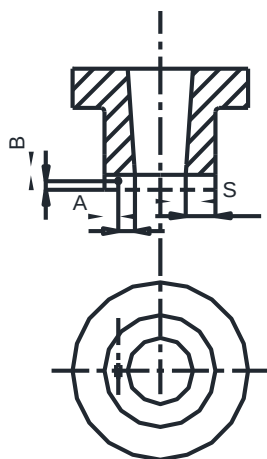
Annexure I (Integral test piece Location Plan)



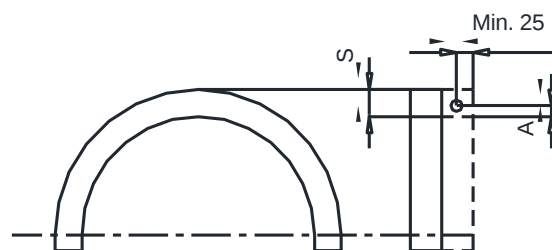
a) Casing Forging



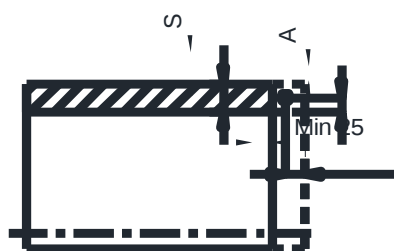
b) End cover Forging



c) Nozzle Forging



d) Half Diaphragm Forging



e) Half Counter casing Forging

For values of	
$S \leq 50$	$S \geq 50$
A	$\frac{1}{2}S$
	$\frac{1}{4}S$ (Min 25)

B min. 25

ANNEXURE II

VENDOR'S NAME & ADDRESS			QUALITY PLAN					QP No.: BHEL/ HY 19363 Rev. 02 Page 1 of 2					
			Customer		BHEL ENQ. No.			BHEL Spec. HY 19363 Rev. 02 PAGE 5 of 6					
			Project		Date								
			Drawing No.										
SL No.	Process	Characteristics	Class	Type of check	Quantum of Check	Reference Document	Acceptance Norms	Format of Record	* D	Agency			Remarks
										P	W	V	
1.0	Raw Material Inspection												
	Ingots & blooms	Steel making process	Major	Verification of Steel Mill's certificate	Each Ingot	HY 19363 Rev. 02	HY 19363 Rev. 02	Steel Mill's Test certificate	√	2	--	1	
		Check analysis	Major	Spectro analysis of samples drawn	1 sample per heat	HY 19363 Rev. 02	HY 19363 Rev. 02	Internal report		2	--	1	
2.0	Forging	Forging steps to be followed	Major	Dimensions as per process plan	--	Forging supplier	Internal	Logbook		2	-	1	Reduction ratio to be specified in the TC
3.0	Heat treatment (normalizing, tempering & stress relieving)	Heat treatment parameters like time, temperature etc.	Critical	Verification	All HT cycles followed	HY 19363 Rev. 02	HY 19363 Rev. 02	HT charts	√	2	--	1	TPIA shall verify the calibration certificates of the furnaces used
4.0	Test piece marking	Location of test specimen	Major		Each forging	HY 19363 Rev. 02	HY 19363 Rev. 02	--		2	1	-	
5.0	Mechanical testing	Tensile & yield strength, Hardness,% Elongation & RA	Major	Physical testing	Each forging	HY 19363 Rev. 02	HY 19363 Rev. 02	Test report	√	2	1	-	
6.0	Product Analysis	Chemical composition	Critical	Chemical analysis	1 sample per melt	HY 19363 Rev. 02	HY 19363 Rev. 02	Spectro report	√	2	1	-	
7.0	Non- destructive testing												
7.1	Ultrasonic testing	Internal soundness	Critical	UT testing	Each forging	HY 19363 Rev. 02	HY 19363 Rev. 02	UT report	√	2	1	-	

RESTRICTED USE



VENDOR'S NAME & ADDRESS			QUALITY PLAN					QP No.: BHEL/ HY 19363 Rev. 02 Page 2 of 2						
			Customer		BHEL ENQ. No.			BHEL Spec. HY 19363 Rev. 02 PAGE 6 of 6						
			Project		Date									
			Product											
SL No.	Process	Characteristics	Class	Type of check	Quantum of Check	Reference Document	Acceptance Norms	Format of Record	*	D	Agency			Remarks
											P	W	V	
7.2	Magnetic particle inspection	Sub surface defects	Critical	MPI	100% surface of each forging	HY 19363 Rev. 02	HY 19363 Rev. 02	MPI report	√		2	1	-	
8.0	Dimensional inspection	Dimensions	Major	Dimensional checking	Each forging	As per Drawing.	As per Drawing.	Dimen-sional report	√		2	1	-	
9.0	Identification & punching	Stamping of identification marks on the forgings	Major	Physical verification and correlation with test certificates	Each forging	HY 19363 Rev. 02	HY 19363 Rev. 02	--	-		2	-	1	
10.0	Completeness of documents, test certificates, HT charts etc.		Major	Verification	Each forging	BHEL Drawing & spec.	BHEL Drawing & spec.	Endorse-ment of all docum-ents by			2	-	1	Including copy of approved MPP, if applicable
11.0	Preservation & Packing		Major	Visual	Each forging	BHEL Drawing & spec.	BHEL Drawing & spec.				2		1	

Legend: P Perform; W Witness; V Verification; Indicating 1 for BHEL or BHEL nominated Inspection agency & 2 for vendor/sub vendor as appropriate against each process/characteristic under P, W & V columns. * For items marked √ (tick) in column D, test certificates shall be submitted to BHEL for records.

Signature of the supplier with Company Stamp
(To be submitted along with the technical offer)

RESTRICTED USE

