1709216(1)/2023/HEP-TXM20500 *For uploading along with enquiry*

Duly filled Technical Pre-Qualification Requirements to be submitted along with the offer by vendor

Ref No: TME/PQR/Stator Clamping Ring_IM3004 Rev.00 Dated: 27/09/2023

Technical Pre-Qualification Requirements (PQR) for "Clamping Ring for Stator"

Vendor should comply with the following clauses in order to qualify for supply of Clamping Ring for Stator (duly filled PQR shall be submitted along with the offer by vendor):

Cl. No.	Description	Vendor to comment	
		Complied / Not complied	Supporting relevant document to be submitted along with offer
1	Vendor shall supply "Clamping Ring for Stator" as per drawing no. mentioned in enquiry, without any deviation. Vendor shall ensure that "Clamping Ring for Stator" supplied conforms to quality requirements as per drawing & specification.	Yes/No	Not required.
2	Vendor should be a machinist with in-house machining facility and not a trader.	Machinist/ Trader	Not required.
3	Vendor should have past experience of successfully machining & supply of any steel component involving turning operation of minimum machining diameter of 489 mm, in preceding 2 years from date of enquiry. (Vendor to ensure that documents submitted against b) & c) shall correlate with the submitted P.O. copy).	Yes/No	a. PO copies. b. Drawing (highlighted with max. turning diameter) of supplied item. c. Supply proof i.e. invoice.
4	For verification of information furnished by vendor, additional documents, proofs etc. may be required by BHEL. Vendor to confirm providing the same.	Yes/No	Not required.

Notes:

1. Compliance of all the points in above T-PQR is mandatory. In absence of compliance of above, vendor's offer is liable to be rejected.
2. Information / compliance / documents submitted by vendor shall be authentic in all aspects. In case any deviation / false information / forged documents are observed, BHEL is free to initiate appropriate punitive proceeding against the supplier.

Date:

1709216(1)/2023/HEP-TXM20500 *For uploading along with enquiry*

Duly filled Technical Pre-Qualification Requirements to be submitted along with the offer by vendor

Ref No: TME/PQR/Rotor Clamping Ring_IM3004 Rev.00 Dated: 27/09/2023

Technical Pre-Qualification Requirements (PQR) for "Clamping Ring for Rotor"

Vendor should comply with the following clauses in order to qualify for supply of Clamping Ring for Rotor (duly filled PQR shall be submitted along with the offer by vendor):

Cl. No.	Description	Vendor to comment	
		Complied / Not complied	Supporting relevant document to be submitted along with offer
1	Vendor shall supply "Clamping Ring for Rotor" as per drawing no. mentioned in enquiry, without any deviation. Vendor shall ensure that "Clamping Ring for Rotor" supplied conforms to quality requirements as per drawing & specification.	Yes/No	Not required.
2	Vendor should be a machinist with in-house machining facility and not a trader.	Machinist/ Trader	Not required.
3	Vendor should have past experience of successfully machining & supply of any steel component involving turning operation of minimum machining diameter of 240 mm, in preceding 2 years from date of enquiry. (Vendor to ensure that documents submitted against b) & c) shall correlate with the submitted P.O. copy).	Yes/No	a. PO copies. b. Drawing (highlighted with max. turning diameter) of supplied item. c. Supply proof i.e. invoice.
4	For verification of information furnished by vendor, additional documents, proofs etc. may be required by BHEL. Vendor to confirm providing the same.	Yes/No	Not required.

Notes:

1. Compliance of all the points in above T-PQR is mandatory. In absence of compliance of above, vendor's offer is liable to be rejected.
2. Information / compliance / documents submitted by vendor shall be authentic in all aspects. In case any deviation / false information / forged documents are observed, BHEL is free to initiate appropriate punitive proceeding against the supplier.

Date:

BHARAT HEAVY ELECTRICALS LIMITED, BHOPAL
QUALITY CONTROL TRANSPORTATION
QUALITY ASSURANCE PLAN (QAP)

Ref.: TM12546 Rev. 05

QA Plan of fully finished components with no mandatory requirement of checking on 3D CMM, supplied on fully finish basis or labour basis
Part 1: Final inspection of the component before dispatch from vendor works (#)

Sl. No.	Name of the Process	Parameters of Inspection	Quantum of Check*		Mode of Inspection/ Equipment used	Drawing No./Spec./Std.	Acceptance Norms***	Requirement from supplier
			TP/Supplier	TPIA/QC**				
1.	Raw material	Applicable only in case order is executed on fully finish basis						
	a. If the raw material is casting.	Applicable QAP No.: QTM/QAP/VENDOR/13-14/001 (latest revision) [Only record verification of testing/checking parameters and verification of 3 test samples (keel blocks separately cast/integrally cast as per specification to be supplied along with consignment for testing at BHEL) as per raw material QAP to be done by TPI. No inspection/record verification for cast/rough machined dimensions as per casting QAP.]						
	b. If the raw material is fabrication/plate.	A) Applicable QAP No: QTM/QAP/FABRICATED ITEMS/VENDOR/18-19/01 (latest revision) [Only record verification of testing/checking parameters and verification of TC of plate used for fabrication of component (to be supplied along with consignment) as per raw material QAP to be done by TPI. No inspection/record verification for fabricated/rough machined dimensions as per fabrication QAP.] B) In case raw material is of high strength tensile plate, as per material specification; AA10122 /IS 2062:2011; Gr:E350BR, in addition to above A: 1) The Supplier shall furnish documents (invoice of procurement; financial details may be hidden) in support of establishing the quantity (in nos.), size and material specification of steel procured in correlation with nos. of components order to the supplier. 2) One test sample of size (Raw material plate thickness x 200mm x 250mm) per heat per heat treatment batch (taken from actual plate material) to be submitted to BHEL. Sample shall be duly punched (heat/heat treatment batch no.) by TPIA (after correlating heat/heat treatment batch no. from actual plate).						
	c. If the raw material is forging.	Applicable QAP No.: QTM/QAP/VENDOR/13-14/002 (latest revision) [Only record verification of testing/checking parameters and verification of 3 test samples (to be supplied along with consignment for testing at BHEL) as per raw material QAP to be done by TPI. No inspection/record verification for forge/rough machined dimensions as per forging QAP.]						
2.	Dimensions	Critical to quality (CTQ) dimensions as marked in drawing or else tolerated dimensions if CTQ dimensions are not marked in drawing	100%	10%	3D CMM / Gauges & Instruments	As per relevant BHEL drawing	As per relevant BHEL drawing	Dimensional report to be provided to BHEL
		Other machined & un machined dimensions	100%	5%	3D CMM / Gauges & Instruments	As per relevant BHEL drawing	As per relevant BHEL drawing	Dimensional report to be provided to BHEL

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बी.एच.ई.एल.भोपाल/B.H.E.L. BHOPAL

1709216(1)/2023/HEP-TXM20500

Sl. No.	Name of the Process	Parameters of Inspection	Quantum of Check*		Mode of Inspecion/ Equipment used	Drawing No./Spec./Std.	Acceptance Norms***	Requirement from supplier
			TP/Supplier	TPIA/QC**				
3.	Visual Inspection	Free from visual defect	100%	100%	Visual	-	Component to be free from any abnormality such as blow hole, pin hole, dent etc.	-
4.	Identification marking	· Identification marking at machining stage on the location shown in drawing or location may be taken from BHEL Engg. Dept.	100%	10%	Verification	As per relevant BHEL drawing/ specification TM12548	Identification marking as per BHEL drawing/spec. TM12548	-
5.	Paint (Visual, Dry paint thickness and Adhesive test)	TRP on machined surfaces & inorganic ethyl zinc silicate primer paint (specification AA56113) on other surfaces	100%	100% (Visual) & 10% per lot (DFT and Adhesion test)	Visual and Instruments	As per relevant BHEL Drawing/ specification TM94217 (Latest Rev)	As per relevant BHEL Drawing/ specification TM94217 (Latest Rev)	Report to be submitted for- • Visual • DFT • Adhesion
6.	Packing	Packaging suitability for transit & storage	100%	-	Visual	-	-	Each component shall be suitably packed & wrapped to avoid any damage to components during transit and ingress of water. Note: In case any damage to machined surface found during inspection at BHEL, job will be liable to be rejected.

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उप प्रबंधक/Dy. Manager
क्यू.टी.एम.विभाग/QTM Division
बी.एच.ई.एल.,भोपाल/BHEL, BHOPAL

Notes:

1) All test records checked by TP, TPIA/QC (dully signed & sealed) as per above QAP requirement shall be submitted along with consignment.
2) Final acceptance will be based on inspection at BHEL, Bhopal.
3) (*) Quantum of inspection shall be in line with QAP unless otherwise mentioned in the drawing.
4) (**) Job shall be randomly selected from offered lot, the quantum of check (min. 1 no.) from the offered lot to be checked by TPIA or QC. (e.g.: If lot size is 2 then minimum one no. is to be checked).
5) (***) Sample inspection of component does not mean that the supplier will not meet drawing & specification requirements in remaining components. In case any defect / non-conformance is observed at any stage (during processing or before and after fitment in any job), the same is liable to be rejected and same shall be replaced immediately by the supplier at BHEL or BHEL Customer site (wherever deficiency is observed and necessary penal action will be taken as per BHEL norms.

Part II: Requirement of clearance of 1st lot from BHEL:

1) First lot of item shall be supplied for quality inspection at BHEL Bhopal and supply of subsequent lots shall be undertaken only after clearance of first lot by BHEL Bhopal.
2) Vendor has to initiate the supplies as per PO delivery only. Delay in supply of first lot of components or rejection of components due to any non-conformity/ quality deficiency shall not be considered as reason for delay in supply of components in subsequent deliveries as per PO delivery requirement.
3) Initial clearance of 1st lot of items does not absolve the supplier from supply of items as per drawing and specification requirement in subsequent lots.

Meaning of Legends: '#' - Supplier to submit test certificates & reports of above mentioned parameters.

Abbreviation: TPIA –BHEL appointed third Party Inspecting Agency, T P – Task Performer / Supplier.

Prepared by:	Approved by:		Issued by:
गजेन्द्र सिंह राठौर/G.S.RATHORE उप प्रबंधक/Dy. Manager क्यू.टी.एम.विभाग/QTM Division बी.एच.ई.एल.,भोपाल/B.H.E.L.,BHOPAL QTM	मनीष वर्मा/MANISH VERMA वरि.उप महाप्रबंधक (सीपी.)/Sr.DGM(Design) टी.एम.ई. विभाग/TME Division बी.एच.ई.एल.,भोपाल/BHEL, BHOPAL ME	देवेन्द्र बन्छोर / DEVENDRA BANCHHOR वरि. उप महाप्रबंधक / Sr. Dy. General Manager टी. एक्स. एम. विभाग / T. X. M. Division बी.एच.ई.एल., भोपाल / BHEL, BHOPAL TXM	गजेन्द्र सिंह राठौर/G.S.RATHORE उप प्रबंधक/Dy. Manager क्यू.टी.एम.विभाग/QTM Division बी.एच.ई.एल.,भोपाल/B.H.E.L.,BHOPAL QTM	अमित सेन / AMIT SEN इंजीनियर / Engineer क्यू.टी.एम.विभाग/Q.T.M. Division बी.एच.ई.एल.,भोपाल/B.H.E.L.,BHOPAL QTM

BHARAT HEAVY ELECTRICALS LIMITED, BHOPAL
QUALITY CONTROL TRANSPORTATION
QUALITY ASSURANCE PLAN (QAP)

QA Plan for fabricated/ rough machined fabricated components no.: QTM/QAP/FABRICATED ITEMS/VENDOR/18-19/01 REV.03 Dt.: 19.09.2023

Part 1: Final inspection of the component before dispatch from vendor works (#)

Sl. No.	Name of the Process	Parameters of Inspection	Quantum of Check*		Mode of Inspection/ Equipment used	Drawing No./Spec./Std.	Acceptance Norms***	Requirement from supplier
			TP/Supplier	TPIA/QC**				
1.	Melt analysis	Chemical Composition	TC per heat /heat treatment batch **(TC of NABL accredited lab /Plate manufacturer)**	100% TC to be verified	Spectrometer / Wet analysis method	As per BHEL drawing/ specifcation	As per BHEL drawing/ specification	A) Supplier shall provice TC (as per relevant specification) from NABL accredited lab/ plate manufacturer. In case plate manufacturer TC is provided, invoice of procurement (financial details may be hiden) shall be provided in support of plate manufacturer name. B) In case of high tensile strength plate (as per material specification; AA10122/ IS 2062:2011; Gr:E350BR). The supplier shall provide following documents and test sample, in addition to above (point A):
2.	Mechanical Testing	Mechanical properties mentioned in the BHEL drawing/ specification	TC per heat /heat treatment batch **(TC of NABL accredited lab /Plate manufacturer)**	100% TC to be verified	Mechanical testing Equipment	As per BHEL drawing/ specifcation	As per BHEL drawing/ specification	

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बी.एच.ई.एल./B.H.E.L, BHOPAL

1709216(1)/2023/HEP-TXM20500

											1) **Documents:** The Supplier shall furnish documents (invoice of procurement (financial details may be hidden) & other relevant documents) in support of establishing the quantity (in nos.), size and material specification of steel procured in correlation with nos. of components ordered to the supplier 2) **Test Sample:** One test sample of size (Raw material plate thickness x 20mm x 250mm) per heat per heat treatment batch (taken from actual plate material) to be submitted to BHEL. Sample shall be duly punched (heat/heat treatment batch no.) by TPIA (after correlating heat/heat treatment batch no. from actual plate).
3.	Stress Relieving	Soaking temperature/ soaking time	100%	100% TC to be verified	Temperature recorder/ Time Temperature charts	As per BHEL drawing/ specification	As per BHEL drawing/ specification	SR repot to be provided to BHEL along with time temperature graph.			

QA Plan for fabricated/ rough machined components no.: QTM/QAP/FABRICATED ITEMS/VENDOR/18-19/01 REV.03 DT.:19.09.2023

Sl. No.	Name of the Process	Parameters of Inspection	Quantum of Check*		Mode of Inspection/ Equipment used	Drawing No./Spec./Std.	Acceptance Norms***	Requirement from supplier
			TP/Supplier	TPIA/QC**				
4.	Shot/Sand Blasting	Uniformity of cleaning	100%	-	Visual	As per BHEL drawing	Surface free from extraneous material and deposits	Report of shot/ sand blasting to be provided to BHEL
5.	Non Destructive Tests (NDT)	NDT tests (DP/MPI/UT) as mentioned in the BHEL drawing/ specification	100% or Sampling percentage as mentioned in the BHEL drawing/ specification	20%	NDT equipment	As per BHEL drawing/ specification	As per BHEL drawing/ specification	NDT report to be provided to BHEL along with consignment
6.	Identification marking	Identification marking by punching on component on the location shown in drawing or location may be taken from BHEL Engg. Dept.	100%	100%	Visual	As per BHEL drawing/ specification TM12548	Identification marking as per BHEL drawing/spec. TM12548	Identification marking report to be submitted by vendor
7.	Dimensional Inspection	Fabrication Dimensions	All drawing dimension of 100% component	All drawing dimensions of 10% component	Instrument	As per BHEL drawing	**1) a) In case order is as per fabrication drawing:** As per BHEL drawing. **b) In case order is as per rough m/cd drawing:** As per BHEL drawing along with concentricity less than 1mm.	Dimensional witness report to be provided to BHEL
		Rough machined dimensions	All drawing dimension of 100% component	All drawing dimensions of 20% component				

QA Plan for fabricated/rough machined fabricated components no.: QTM/QAP/FABRICATED ITEMS/VENDOR/18-19/01 REV.03 Dt:19.09.2023

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Sl. No.	Name of the Process	Parameters of Inspection	Quantum of Check*		Mode of Inspection/ Equipment used	Drawing No./Spec./Std.	Acceptance Norms***	Requirement from supplier
			TP/Supplier	TPI/A/QC**				
7.	Dimensional Inspection	Rough machined dimensions	All drawing dimension of 100% component	All drawing dimensions of 20% component	Instrument	As per BHEL drawing	2) Centre line on each job should be marked to ensure the fabricated rough m/cd dimensions as per the fabrication rough m/cd drawing requirement.	Dimensional witness report to be provided to BHEL
8	Paint (Visual, Dry paint thickness and Adhesion test)	Inorganic ethyl zinc silicate primer paint (specification AA56113) on fabricated component.	100%	100%(Visual) & 10% per lot (DFT and adhesion test)	Visual and Instruments	As per relevant BHEL Drawing/ specification TM94217 (Latest Rev)	As per relevant BHEL Drawing/ specification TM94217 (Latest Rev)	Report to be submitted for- • Visual • DFT • Adhesion

जी.एस.राठौर / G.S. RATHORE
उप प्रबंधक / Dy. Manager
क्यू.टी.एम. विभाग / QTM Division
बी.एच.ई.एल.-भोपाल / BHEL- BHOPAL

Notes:

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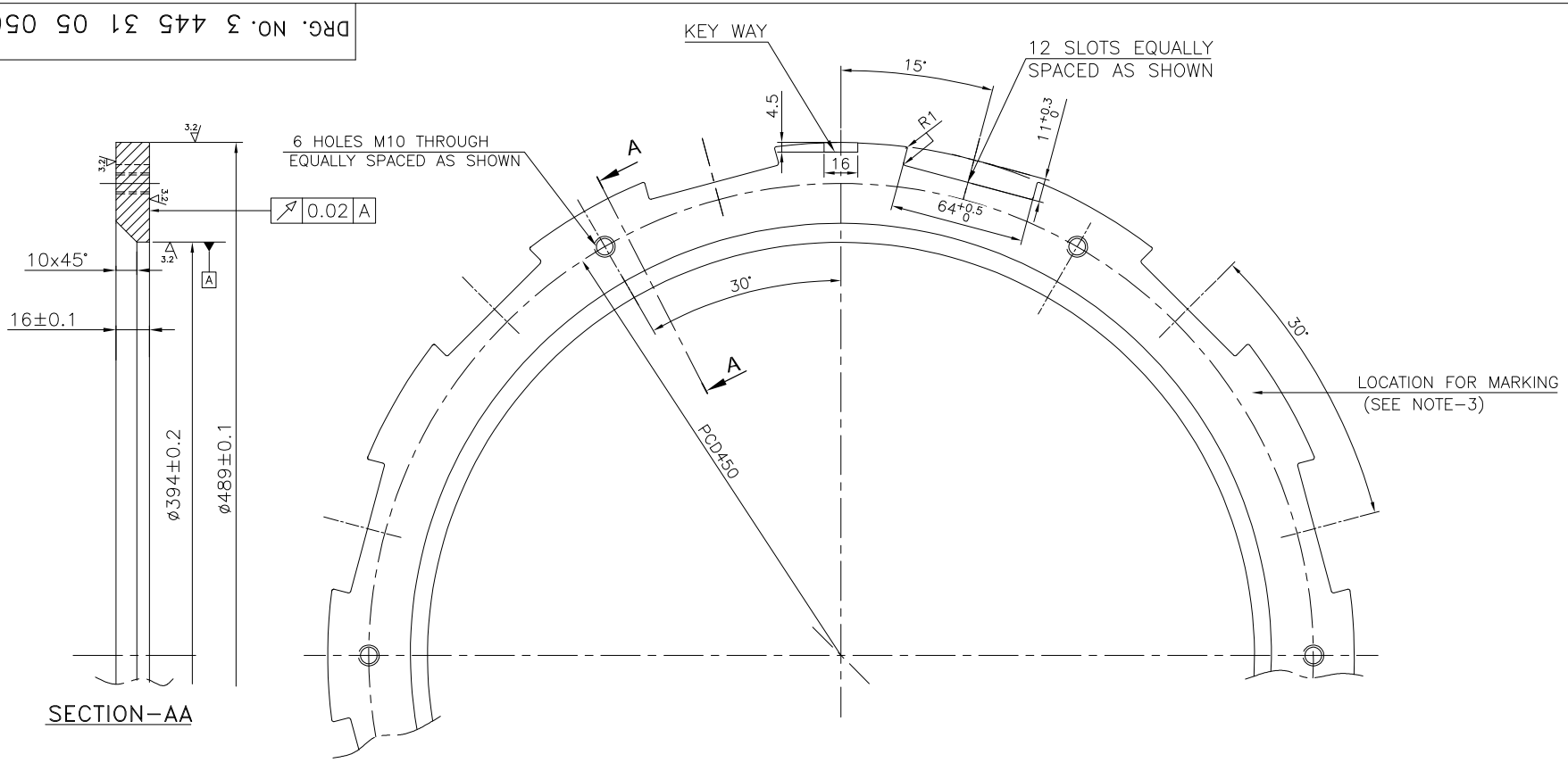
Meaning of Legends: '#' - Supplier to submit test certificates & reports of above mentioned parameters.
Abbreviation: TPIA –BHEL appointed third Party Inspecting Agency, T P – Task Performer / Supplier.

Prepared by:	Approved by:			Issued by:
गजेन्द्र सिंह राठौर/G.S. RATHORE उप प्रबंधक/Dy. Manager क्यू.टी.एम.विभाग/QTM Division बी.एच.ई.एल.,भोपाल/B.H.E.L, BHOPAL QTM	19/09/23 मनीष वर्मा / MANISH VERMA वरि.उप महाप्रबंधक (अभि.)/Sr.DGM(Design) टी.एम.ई. विभाग/ TME Division बी.एच.ई.एल., भोपाल/BHEL, BHOPAL TME	20/09/23 देवेन्द्र बन्छोर / D.K. BANCHHOR वरि. उप महाप्रबंधक / Sr. Dy. General Manager टी. एक्स. एम. विभाग / T. X. M. Division बी.एच.ई.एल., भोपाल / BHEL, BHOPAL TXM	गजेन्द्र सिंह राठौर/G.S. RATHORE उप प्रबंधक/Dy. Manager क्यू.टी.एम.विभाग/QTM Division बी.एच.ई.एल.,भोपाल/B.H.E.L, BHOPAL QTM	अमित सेन / AMIT SEN अभियंता / Engineer क्यू. टी. एम. विभाग / Q.T.M. Division बी.एच.ई.एल.,भोपाल/B.H.E.L, BHOPAL QTM

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 3 445 31 05 056



REF. DRG. NO.

SIGN. & DATE

INVENTORY NO.

NOTES:-

1. SHARP EDGES & EXTRA MATERIAL TO BE REMOVED AFTER FLAME CUT.
2. STATOR END PLATE SHALL BE STRAIGHTENED.
3. PUNCH MARKING TO BE DONE AT THIS LOCATION AS PER SPECIFICATION TM12548.
4. QUALITY CHECKING TO BE DONE AS PER QAP NO. TM12546 (LATEST REVISION).
5. TEMPORARY RUST PREVENTIVE (TRP) AS PER AA55152 TO BE APPLIED ON MACHINED SURFACES.

	RAW WT.-15.7KG		001	RING 25TK.x ø500 ODx ø385 ID				AA10119		Kg	8.6
VAR 00	REMARKS	VAR NO.	ITEM NO.	DESCRIPTION	STD.	DRAWING NO.	IT.NO.	MATL. CODE	A C	UNIT	UNIT WT.
CARD TYPE 3 — 28				28 — CARD TYPE 1			VAR	MATL. SPCN.			QTY.

28 — CARD TYPE 2

GS ZONE

ADDITIONAL INFORMATION

STATUS OF DRAWING

DISTRIBUTION OF PRINTS
TME- 1 TAM- 4
TNX- 1

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: IM3004AZ

BHARAT HEAVY ELECTRICALS LTD. BHOPAL

	NAME	SIGN	DATE	NO. OF VAR.
DRN	A.JHARIA		15.09.23	
CKD	ABSH		16.09.23	
APPD	A.S.		16.09.23	

REV.	DATE	ALTERED / CHECKED / APPD.

DEPT.	GRADE OF UN.TOL.		SCALE	WEIGHT(K.G.)	REF.TO ASSY.DRG.	ITEM NO.	NO.OF ITEM
T.M.E. CODE 405	AA0230208 GR- 'M'		NTS	-	34453305051	003	001

TITLE: CLAMPING RING FOR STATOR

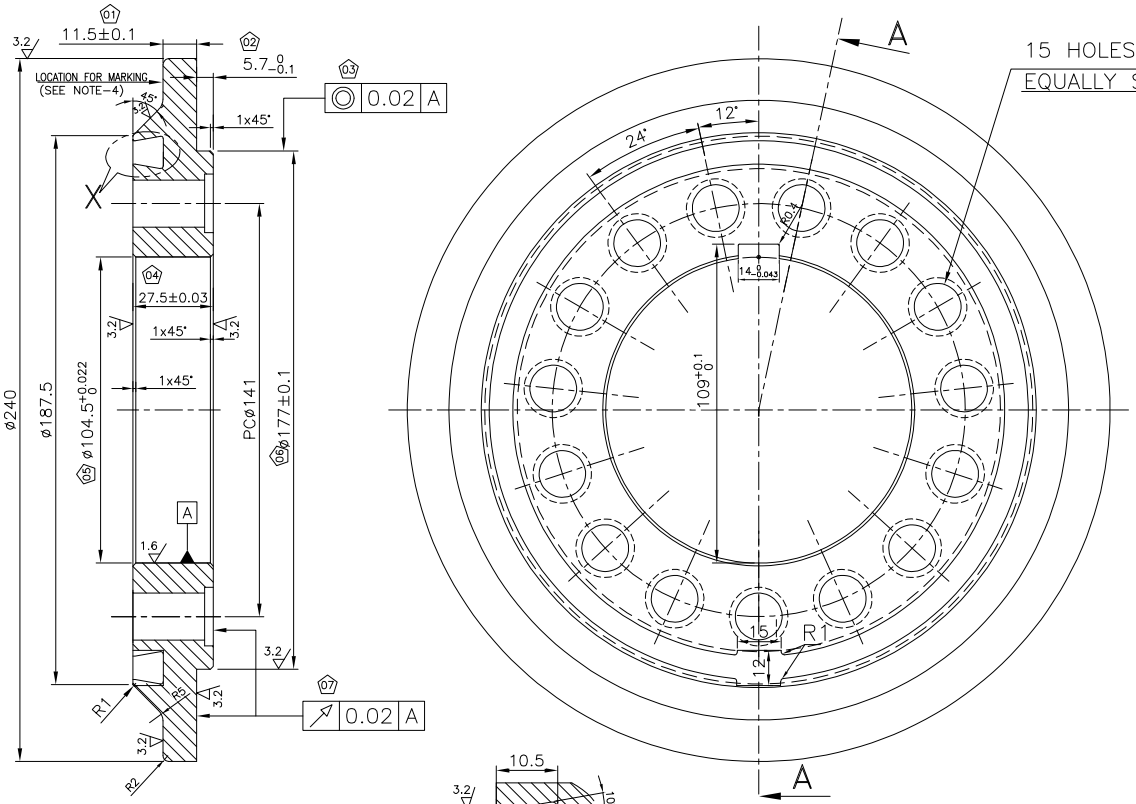
DRAWING NO. 3 445 31 05 056 REV. 00

SHT. NO. 01 NO. OF SHT. 01

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 3 445 45 05 057



SECTION–AA

VIEW–X

NOTES:–

1. BEFORE MACHINING, PLATE TO BE ULTRASONICALLY TESTED TO AA0850120.
2. ALL SHARP EDGES TO BE CHAMFERED TO 0.2–0.3x45°.
3. ALL 07 NOS. '' ⬠ '' MARKED DIMENSIONS ARE CRITICAL TO QUALITY(CTQ) & SL.NO. OF CTQ DIMENSIONS ARE INSCRIBED IN ⬠ e.g. ⑦.
4. PUNCH MARKING TO BE DONE AT THIS LOCATION AS PER SPECIFICATION TM12548.
5. QUALITY CHECKING TO BE DONE AS QAP NO. TM12546 (LATEST REVISION).
6. TEMPORARY RUST PREVENTIVE (TRP) AS PER AA55152 TO BE APPLIED ON MACHINED SURFACES.

	RAW WT.–12.1KG		001	RING 36TK.xø250 ODx ø90 ID				AA10122		Kg	4.7		
VAR 00	REMARKS	VAR NO.	ITEM NO.	DESCRIPTION	STD.	DRAWING NO.	IT.NO.	MATL. CODE	A C	UNIT	UNIT WT.	GS	ZONE
							VAR	MATL. SPCN.			QTY.		
CARD TYPE 3 — 28				28 — CARD TYPE 1			28 — CARD TYPE 2						

ADDITIONAL INFORMATION

STATUS OF DRAWING

DISTRIBUTION OF PRINTS
TME– 1 TXM– 4
TNX– 1

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: IM3004AZ

BHARAT HEAVY ELECTRICALS LTD. BHOPAL

	NAME	SIGN	DATE
DRN	A.JHARIA		15.09.23
CKD	ABSH		16.09.23
APPD	A.S.		16.09.23

NO. OF VAR.

REV.	DATE	ALTERED / CHECKED / APPD.

DEPT. T.M.E.	GRADE OF UN.TOL.	SCALE	WEIGHT(K.G.)	REF.TO ASSY.DRG.	ITEM NO.	NO.OF ITEM
CODE 405	AA0230208 GR– 'M'	NTS	4.7	24454505051	006	001

TITLE: CLAMPING RING FOR ROTOR

DRAWING NO. 3 445 45 05 057 REV. 00

SHT. NO. 01 NO. OF SHT. 01

REF. DRG. NO. | SIGN. & DATE | INVENTORY NO.

1709216(1)/2023/HEP-TXM20500

भेएच ई एल BHEL	REAFFIRMATION -NOTIFICATION	AA 085 01 20 Rev. No. 01

AA 085 01 20 : STRAIGHT BEAM ULTRASONIC EXAMINATION OF STEEL PLATES FOR PRESSURE VESSELS

This standard is "Reaffirmed 2002"

Please see Instructions on the reverse.

Ref :	Approved	Issued	Date	Cum.Sr.No.
Cl. 15.8.13 of MOM of WG-NDT	WG-NDT	CORP. R&D	15.01.2002	R 3096

	AMENDMENT - NOTIFICATION	AA 085 01 20 REV. No. 01
		PAGE 1 OF 2

AA 085 01 20:STRAIGHT BEAM ULTRASONIC EXAMINATION OF STEEL PLATES FOR PRESSURE VESSELS

1.0 PAGE 1 OF 3; Cl 1.2: Existing sentence is modified as follows:
"This standard is generally based on ASTM A 435."

2.0 Cl 3.0 APPARATUS:
Clause 3.0 is replaced as given below:

"3.0 EQUIPMENT CHARACTERISTICS:

3.1 Frequency range:
The ultrasonic equipment shall be suitable for operating at frequencies within the range of 0.5 to 6 MHz.

3.2 Sensitivity:
The sensitivity of the equipment shall be tested to ensure that the number of full screen back wall echoes is not less than that given below, when the appropriate probe is placed on the metallised surface of plastic insert of the Indian Standard reference block (IS:4904)/IIW block.

..... contd.

Please see instructions on the reverse.

Ref:	Amd. No.	Approved	Issued	Date	Cum. Sr. No.
Cl:10.2.6 of MOM	01	WG-NDT	CORP. R&D	15.1.96	A 1823

AMENDMENT - NOTIFICATION

AA 085 01 20 REV. No. 01

Frequency, MHz	Min.No. of full screen back wall echoes
1	5
2	4
4 to 6	2

3.3 Resolution:
The resolution of the equipment and probe combined shall be such as to show separately indications of the three grooves in the IIW-VI block."

3.4 Transducer;
The transducer shall be 20-30mm dia or 25.4mm square. The test shall be performed by one of the following methods:
a)Direct contact b)Immersion c)Liquid column coupling."

3.0 PAGE 2 OF 3; Cl 5.4: Last line is modified as below:
"couplant such as oil or water shall be used."

4.0 Cl 6.1: Add the following sentence at the end of existing para:
"Total loss of back reflection means loss of back reflection upto 5% of screen height."

5.0 Cl 6.2 & 6.3: Clause 6.2 is deleted.
Clause 6.3 is renumbered as 6.2.

Please see instructions on the reverse.

Ref:	Amd. No.	Approved	Issued	Date	Cum. Sr. No.
Cl:10.2.6 of MOM	01	WG-NDT	CORP. R&D	15.1.96	A 1823

STRAIGHT BEAM ULTRASONIC EXAMINATION OF STEEL PLATES FOR PRESSURE VESSELS

1.0 SCOPE:

1.1 This standard covers the examination procedures and acceptance standards for straight beam, pulse echo, ultrasonic, examination of rolled carbon and alloy steel plates, 12.5 mm and above in thickness, of fully killed, pressure vessel quality. It was developed to assure delivery of steel plates free of gross internal discontinuities such as pipe, ruptures or laminations and is to be used whenever the corporate purchasing specification states that the plates are to be subjected to ultrasonic examination.

1.2 This standard is generally based on ASTM A 435 - 1982 (Reapproved 1987).

2.0 PERSONNEL REQUIREMENT:

Personnel performing non-destructive examination and evaluation shall be qualified to the recommended practice SNT-TC-1A or any other recognised practice.

3.0 APPARATUS:

3.1 The manufacturer shall furnish suitable ultrasonic equipment and qualified personnel necessary for performing the test. The equipment shall be of the pulse echo straight beam type. The transducer shall be 20 to 30 mm diameter or 25.4 mm square. The test shall be performed by one of the following methods, direct contact, immersion or liquid column coupling.

4.0 TEST CONDITIONS:

4.1 The examination shall be conducted in an area free from operations that interfere with proper functioning of the equipment.

4.2 The plate surface shall be sufficiently clean and smooth to maintain a reference back reflection from the opposite side of the plate at least 50% of full scale during scanning.

4.3 The surface of plates inspected by this method may be expected to contain a residue of oil or rust or both. Any specified identification which is removed when grinding to achieve proper surface smoothness shall be restored.

5.0 PROCEDURE:

5.1 Ultrasonic examination shall be made on either major surface of the plate. Acceptance of defects in close proximity may require inspection

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01	NOV. '92	CORP. R&D	TIRUCHY	CORP. R&D	NOV. '78

from the second major surface. Plates ordered in the quenched and tempered condition shall be tested following heat treatment.

5.2 A nominal test frequency of 2 to 4 MHz is recommended. Thickness, grain size or microstructure of the material and the nature of the equipment or method may require a higher or lower test frequency. However, frequencies, less than 1 MHz may be used only on agreement with BHEL. A Clear, easily interpreted trace pattern should be produced during the examination.

5.3 Conduct the examination with a test frequency and instrument adjustment that will produce a minimum 50 to a maximum 75% of full scale reference back reflection from the opposite side of a sound area of the plate.

5.4 Scanning shall be continuous along perpendicular grid lines on nominal 230 mm centres, or at the manufacturer's option, shall be continuous along parallel paths, transverse to the major plate axis, on nominal 100 mm centres, or shall be continuous along parallel paths parallel to the major plate axis, on 75 mm or smaller centres. A suitable couplant such as water, soluble oil, or glycerine shall be used.

5.5 Scanning lines shall be measured from the center or one corner of the plate. An additional path shall be scanned within 50 mm of all edges of the plate on the scanning surface.

5.6 Where grid scanning is performed and complete loss of back reflection accompanied by continuous indications is detected along a grid line, the entire surface area of the square adjacent to this indication shall be scanned continuously. Where parallel path scanning is performed and complete loss of back reflection accompanied by continuous indications is detected, the entire surface area of 230 x 230 mm square centred on this indication shall be scanned continuously. The true boundaries where this condition exists shall be established in either method by the following technique: Move the transducer away from the centre of the discontinuity until the heights of the back reflection and discontinuity indications are equal. Mark the plate at a point equivalent to the centre of the transducer. Repeat the operation to establish the boundary.

6.0 ACCEPTANCE STANDARD:

6.1 Any discontinuity indication causing a total loss of back reflection which cannot be contained within a circle, the diameter of which is 75 mm or one half of the plate thickness, whichever is greater is unacceptable.

6.2 BHEL representative may witness the test.

6.3 Acceptable adjacent discontinuity indications shall be separated from each other by a distance equal to or larger than the larger of the adjacent discontinuity indications unless the adjacent defects can be contained in a circle of diameter equal to the acceptance standard for a single defect.

CORPORATE STANDARD

7.0 MARKING:

7.1 Plates accepted in accordance with this specification shall be identified by stamping UT: AA 085 01 20 or in some other manner adjacent to marking required by the relevant corporate purchasing specification.

8.0 SUPPLEMENTARY REQUIREMENTS:

8.1 Any supplementary requirements according to ASTM A 435, if required, will be specified in the purchase order.

1709216(1)/2023/HEP-TXM20500

	CORPORATE PURCHASING SPECIFICATION	AA10119
		Rev No.15
		PREFACE SHEET

STRUCTURAL STEEL - WELDABLE QUALITY

(PLATES, SECTIONS, STRIPS, FLATS AND BARS)

FOR INTERNAL USE ONLY

REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Equivalent/Comparable Standards:

1) IS: 2062 – 2011 : Grade: E250- BR (With impact test)
2) DIN EN 10025-2:2005 : Grade: S275JR

Suggested/Probable Suppliers and Grades:

Refer Plant Vendors List

User Plants and Replaced Plant Specifications/References:

1) HEP, BHOPAL :
2) HEEP, HARDWAR :
3) HPEP, HYDERABAD :

Revisions: Clause No. 1, 3, 5 & 8 revised (as per MOM of 38th MRC meeting), Clause 10 added			APPROVED: INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(S&GPS)		
Rev No.15	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
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STRUCTURAL STEEL - WELDABLE QUALITY
(PLATES, SECTIONS, STRIPS, FLATS AND BARS)

ORDERING DESCRIPTION

1.0 GENERAL:

The material shall conform to IS 2062 – 2011, E250-Gr.BR (with mandatory Impact Test) or DIN EN 10025-2:2005, Gr. S275JR and comply with following additional requirements.

2.0 APPLICATION:

For general engineering purposes, suitable for welding.

3.0 CONDITION OF DELIVERY:

3.1 Bars & Sections shall be supplied in Hot rolled in straight lengths without twists and bends.

3.2 The material shall be supplied as per IS: 2062 – 2011, E250 Gr.BR (with mandatory Impact Test) or as per DIN EN 10025-2:2005 Gr. 275JR.

3.3 Any other additional requirement as per BHEL Purchase order.

4.0 DIMENSIONS AND TOLERANCES:

4.1 Sizes:

Material shall be supplied to the dimensions specified in BHEL Order.

4.2 Tolerances:

The tolerances on hot rolled material shall comply with IS: 1852 or any other equivalent national standard.

4.3 Straightness for hot rolled bars:

Unless otherwise specified, the permissible deviation in straightness shall not exceed 5 mm in any 1000 mm length.

5.0 TEST SAMPLES:

The selection of test pieces for all tests like Chemical, Mechanical etc. shall be as per IS: 2062, E250-Gr.BR or DIN EN 10025-2, Gr. S275JR.

6.0 ULTRASONIC EXAMINATION:

Plates shall be ultrasonically examined in accordance with BHEL standard AA0850120 (or ASTM-A435) as detailed below and shall comply with the acceptance standards specified therein.

6.1 For plates above 40 mm thick:

Shall be ultrasonically examined unless when otherwise specified in order.

7.0 TEST CERTIFICATES:

Unless otherwise specified, three copies of test certificates shall be supplied.

In addition, the supplier shall ensure to enclose one copy of the test certificate along with their dispatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

AA10119 - Rev.No.15/ IS: 2062-Gr: BR (with mandatory Impact test) or DIN EN 10025-2, Gr. S275JR,

BHEL order No.

Melt No, Size & Quantity, Batch No with heat treatment details, Results of Chemical analysis,

Mechanical tests & NDT, Supplier's name, Identification No, TC No, Signature of Competent Authority, etc.

8.0 PACKING AND MARKING:

Plates shall be transported suitably to avoid damage during transit.

Each plate shall be marked with Melt No. Material grade and specification, BHEL Order No, Supplier's Name Identification No, Size & weight, on any one corner and encircled with paint preferably of white colour.

9.0 REJECTION AND REPLACEMENT

If the material does not comply with the requirements of this specification during receipt inspection at BHEL or if any defect is found during further processing of material, BHEL reserves the right to reject the whole consignment and the supplier shall replace the material free of cost. The rejected material shall be taken back by the supplier after fulfilling the commercial terms and conditions.

10.0 REFERRED STANDARDS (Latest publications including amendments):

1) IS: 1852 2) ASTM - A435 3) AA0850120

1709216(1)/2023/HEP-TXM20500

	CORPORATE PURCHASING SPECIFICATION	AA 101 22
		Rev. No. 15
		PREFACE SHEET

STRUCTURAL STEEL-HIGH TENSILE PLATES, FLATS & BARS

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE SHEET BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. GERMAN	: DIN EN 10025-2:2004 Gr: S355 J2 G3 Mat. No. 1.0577
2. INDIAN	: IS: 2062-2006 Grade E350 (Fe 490)

Suggested/Probable Suppliers And Grades:

Refer Plant Vendors List

User Plant References:

1.	BHOPAL	:	PS 10541
2.	JHANSI	:	PS 10541
3.	HEEP, HARDWAR	:	0500.009, HW10181
4.	HYDERABAD	:	HY 021 02 99, HY10591
5.	TRICHY	:	TDC 0:301

Revisions :	APPROVED :
CL.32.7 of MOM of MRC-S&GPS	INTERPLANT MATERIAL RATIONALISATION COMMITTEE-MRC (S&GPS)

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	CORPORATE PURCHASING SPECIFICATION	AA 101 22
		Rev. No. 15
		PAGE 1 OF 4

STRUCTURAL STEEL - HIGH TENSILE PLATES, FLATS & BARS

1.0 GENERAL:

This specification governs the quality requirements of High Tensile Structural Steel Plates where guaranteed weldability is required.

2.0 APPLICATION :

Steel intended for use in structures where enhanced mechanical properties are required and where saving in weight can be effected due to their greater strength.

3.0 CONDITION OF DELIVERY :

Plates shall be supplied in the normalized condition or in an equivalent condition obtained by normalizing rolling.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

Material shall comply with the requirements of DIN EN 10025-2:2004, Gr: S355J2G3 (Material Number 1.0577) or the equivalent grade of latest version.

The supply of the material as per IS:2062-2006 Grade E350 (Fe 490) (latest version) meeting the requirement of clause 3.0, 5.0, and 12.0 of this specification is also acceptable.

5.0 DIMENSIONS AND TOLERANCES :

5.1 Dimensions :

5.1.1 Sizes

Material shall be supplied to the dimensions specified on BHEL Order.

5.1.2 Length :

Unless otherwise specified, hot rolled bars and sections shall be supplied in 3 to 6 metres length.

5.2 Tolerances:

The tolerances on dimensions for plates shall comply with DIN EN 10029.

6.0 MANUFACTURE:

Material shall be manufactured from fully killed (FF) steel having a Carbon Equivalent (melt analysis) of:

0.45 max. for plates upto & incl. 30 mm thick

0.47 max. for plates above 40 mm thick upto & incl. 150 mm thick.

0.49 max for plates > 150mm & ≤ 250 mm thick.

7.0 FREEDOM FROM DEFECTS :

All finished steel shall be well and cleanly rolled to the dimensions, sections and weights specified. The finished material shall be free from cracks, surface flaws, laminations; rough, jagged and imperfect edges and internal & surface defects.

8.0 CHEMICAL COMPOSITION:

The melt analysis of steel and the permissible variation in the composition of the material from the melt analysis shall be as follows:

Element	Percent, max.	Permissible variation, percent, maximum
Carbon		
Upto&Incl 40mm thick	0.20	0.03
Above 40mm thick	0.22	0.02
Silicon	0.55	0.05
Manganese	1.60	0.10
Sulphur	0.025	0.010
Phosphorus	0.025	0.010
Copper	0.55	0.050

Note :

1. Total Aluminum: 0.020%, minimum.
2. Micro-alloying elements like niobium, boron, titanium and vanadium may be added by the manufacturer to achieve the mechanical properties specified.
3. Carbon Equivalent (CE) based on melt analysis shall be calculated as per following formula :

$$CE = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$$

9.0 TEST SAMPLES:

Test samples shall be selected and prepared in accordance with DIN EN 10025. One tensile test piece per 40 tonnes or part thereof shall be selected from finished steel from each melt for each class of products.

10.0 MECHANICAL PROPERTIES (On longitudinal test samples) :

i) Tensile :

The test pieces shall show the following properties, when tested in accordance with IS: 1608 / DIN EN 10025.

Nominal thickness, mm	Tensile strength N/mm², min.	Yield strength N/mm², min.	Elongation on 5.65 √So gauge length, percent, min.
From 5 to 16	470-630	355	22
Over 16 to 40	470-630	345	22
--- 40 to 63	470-630	335	21
--- 63 to 80	470-630	325	20
---- 80 to 100	470-630	315	20
---- 100 to 150	450-600	295	18
---- 150 to 200	450-600	285	17
---- 200 to 250	450-600	275	17
---- 250 to 400	450-600	265	17

ii) Impact :

The "Choppy Impact test" shall be carried out in accordance with DIN EN 10045-1/IS-1757 at (-20^0C). The impact values achieved shall be as follows.

Nominal thickness (mm)	Impact strength (KCV) (2mm 'V' notch)
< 16	Note (1)
16 ≥ to ≤ 150	27 Joules
150 > to ≤ 250	27 Joules

Note :

(1) Impact test is not required for plates below 16 mm.

The average value of the three test results shall meet the specified requirement. One individual value may be the below minimum average value specified, provided that it is not less than 2/3 rd of the same.

11.0 PROTECTIVE COATING :

Plates upto 10 mm thick shall be applied with a suitable rust preventive coating for overseas shipping only.

12.0 ULTRASONIC EXAMINATION:

Plates above 40mm shall be ultrasonically examined in accordance with BHEL standard AA 085 01 20 (or ASTM A435 / EN10160) and shall comply with the acceptance norms specified therein.

13.0 OPTIONAL:

PRESERVATION:

If specified in order, all plates shall be applied with a suitable rust preventive to avoid pitting.

14.0 TEST CERTIFICATES:

Unless otherwise specified, three copies of test certificates shall be supplied.

In addition, the supplier shall ensure to enclose one copy of the test certificate along with their despatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

(i) AA 101 22-Rev. No.15, DIN EN 10025 Gr. S355J2G3, Matl. No. 1.0577.

(ii) BHEL order No, Melt No, Size & Quantity, Batch No with heat treatment details, Results of Chemical analysis, Mechanical tests & NDT, Supplier's name, Identification No, TC No, Signature of Competent authority, etc.

15.0 PACKING AND MARKING:

Plates shall be transported suitably to avoid damage during transit.

For plates below 10 mm thick, each pile (preferably of 16 mm plates) and each plate 10 mm thick and over shall be marked with Melt No., AA 101 22, BHEL Order No, Supplier's Name, Identification No, Size & weight, on any one corner and encircled with paint preferably of white colour.

15.0 REFERRED STANDARDS (Latest Publications including amendments):

1. IS : 1608	2. IS: 2062	3. DIN EN 10025
4. DIN EN 10029	5. DIN EN 10045-1	6. AA 085 01 20
7. ASTM A435	8. EN10160	9. IS: 1757

1709216(1)/2023/HEP-TXM20500

	CORPORATEPURCHASINGSPECIFICATION	AA55152
		Rev No.03
		PREFACE SHEET

RUST PREVENTIVE SOLUTION, CLEAR (TRP)

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Equivalent/Comparable Standards

INDIAN : IS: 1154-2000

User Plants and Replaced Plant Specifications/References

1) BHOPAL : HE1609
2) HEEP, HARIDWAR : HE1709
3) HPEP, HYDERABAD : HE1709

Revisions:			**APPROVED**: INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(CPO+NM)		
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	CORPORATE PURCHASING SPECIFICATION	AA55152
		Rev No. 03
		PAGE 1 of 2

RUST PREVENTIVE SOLUTION, CLEAR (TRP)

1 GENERAL

This specification governs the quality requirements of temporary rust preventive solution, clear (TRP) used for the protection of various ferrous components. Normally this material provides protection upto six months and thereafter requires reapplication, if necessary.

2 APPLICATION

Depending upon components and their sizes, the rust preventive can be applied by brush, dip or spray. A liberal coat is desirable for adequate protection. The surface to be coated with anti rust solution should be absolutely clean and free from rust.

3 REMOVAL

This TRP can be removed by cotton cloth soaked in white spirit to BHEL specification AA 56701.

4 COLOUR

Brown

5 COMPLIANCE WITH NATIONAL STANDARDS

The material shall comply with the requirements of the following national standards and also meet the requirements of this specification.

IS: 1154 - 2000: Temporary Corrosion Preventive, Fluid, Soft Film, Solvent deposited, Water displacing

6 COMPOSITION

The composition shall be based on wool fat and other corrosion inhibitors.

7 TEST SAMPLES

Half a litre of sample shall be taken for testing and approval.

8 PROPERTIES

When tested in accordance with the relevant clauses of BHEL standard AA0850001, the test sample shall show the following properties:

8.1 Consistency

65 ± 10 seconds in Ford Cup No.4 at 27± 0.5°C

8.2 Drying Time

Tack free in 16 hours, shall remain soft to facilitate removal when not required.

8.3 Flash Point

32°C, min. (Absolute temp)

8.4 Weight

9.1 ± 0.2 kg per 10 litres

Revisions:			**APPROVED**: INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(CPO+NM)		
Rev No.03	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:26-05-2012	Dt:	Year:2019	HEP, Bhopal	Corp.R&D	01-11-1982

8.5 Protection against corrosion at high temperature and humidity

To pass the test.

8.6 Salt spray corrosion test

100 hours

9 TEST CERTIFICATES

Three copies of test certificates shall be supplied along with each consignment, giving the following information:

In addition, the supplier shall ensure to enclose one copy of the test certificate along with the despatch documents to facilitate quick clearance of the material.

- AA55152, Rev. 03: RUST PREVENTIVE SOLUTION, CLEAR (TRP)
- BHEL Order No.
- Batch / Lot No.
- Supplier's/ Manufacturer's Name and Trade mark, if any
- Date of manufacture and expiry
- Test results of clause 8.

10 KEEPING PROPERTY

When stored in a covered dry place in the original sealed containers under normal temperature conditions, the material shall retain the properties prescribed in this specification for a period of not less than 12 months after the date of manufacture which shall be subsequent to the date of placing the order.

11 PACKING & MARKING

Unless otherwise specified, the material shall be supplied in 4 kg steel containers, which shall be leak free, dry and clean.

Each container shall marked with the following information:

- AA55152: RUST PREVENTIVE SOLUTION, CLEAR (TRP)
- BHEL Order No.
- Supplier's / Manufacturer's Name and Trade mark, if any
- Batch No. /Lot No.
- Date of manufacture and expiry
- Quantity supplied

12 ENVIRONMENTAL REQUIREMENTS

The supplier shall furnish Material Safety Data Sheet (MSDS) covering all information relating to human safety and environmental impacts of the hazardous materials particularly during their transportation, storage, handling and disposal along with each supply.

Each container shall be marked with corresponding symbol and minimum worded cautionary notice for flammable / corrosive / toxic / harmful / irritant and oxidizing etc. as applicable.

13 REFERRED STANDARDS (Latest Publications Including Amendments)

1) AA0850001
2) AA56701

GENERAL TOLERANCES – TOLERANCES FOR LINEAR AND ANGULAR DIMENSIONS WITHOUT INDIVIDUAL TOLERANCE INDICATIONS

0.0 GENERAL

When selecting the tolerance class, the respective customary workshop accuracy has to be taken into consideration. If smaller tolerances are required or larger tolerances are permissible and more economical for any individual feature, such tolerances should be indicated to the relevant nominal dimension(s).

General tolerance for linear and angular dimensions apply when drawings or associated specifications refer to this standard in accordance with clauses 3 and 4. If there are general tolerances for other International standards, reference shall be made to them on the drawings or associated specifications. For a dimension between an unfinished and a finished surface, e.g. of cast or forged parts, for which no individual tolerance is directly indicated, the larger of the two general tolerances in question applies, e.g. for castings, see ISO 8062, Castings - system of Dimensional Tolerances.

1.0 SCOPE

The standard is intended to simplify drawing indications and it specifies general tolerances for linear and angular dimensions without individual tolerance indications in four tolerance classes.

It applies to the dimensions of parts that are produced by metal removal or parts that are formed from sheet metal.

NOTE:

1) The concepts behind the general tolerancing of linear and angular dimensions are described in Annex-A.

2) These tolerances may be suitable for use with materials other than metals.

This standard only applies for the following dimensions which do not have an individual tolerance indication:

a) Linear dimensions (e.g. external sizes, internal sizes, step sizes, diameters, radii, distances, external radii and chamfer heights for broken edges).

b) Angular dimensions, including angular dimensions usually not indicated, e.g. right angles (90°), unless reference to IS: 2102 (Part 2) is made, or angles of uniform polygons.

c) Linear and angular dimensions produced by machining assembled parts.

It does not apply for the following dimensions:

a) Linear and angular dimensions which are covered by reference to other standards on general tolerances.

b) Auxiliary dimensions indicated in brackets.

c) Theoretically exact dimensions indicated in rectangular frames.

2.0 COMPLIANCE WITH STANDARDS

This standard is based on IS: 2102 (Part 1)-1993 (ISO 2768-1).

3.0 GENERAL TOLERANCES

3.1 Linear dimensions are given in Table 1 and 2.

3.2 Angular dimensions: General tolerance specified in angular units control only the general orientation of lines or line elements of surfaces, but not their form deviations.

The general orientation of the line derived from the actual surface is the orientation of the contracting line of ideal geometrical form. The maximum distance between the contacting line and the actual line shall be the least possible value (see IS: 12160).

The permissible deviations of angular dimensions are given in Table 3.

4.0 INDICATIONS ON DRAWINGS:

If general tolerances in accordance with this standard shall apply, the following information shall be indicated.

Example: AA0230208 m

5.0 REJECTION

Unless otherwise stated, work pieces exceeding the general tolerance shall not lead to automatic rejection provided that the ability of the work piece to function is not impaired (see clause A4).

6.0 NOTE:

6.1 For "permissible deviations for Un-toleranced dimensions of castings" refer AA0230402.

6.2 For "Tolerances and machining allowances for flame cutting" refer AA0621101.

6.3 For "General tolerances for welding construction for length and angles" refer AA0621104.

6.4 For "General tolerances for welded structures form and position" refer AA0621105.

Table 1 – Permissible deviations for linear dimensions except for broken edges
(external radii and chamfer heights, see table 2)

Values in millimetres

Tolerance class		Permissible deviations for basic size range							
Designation	Description	0.5[1] Up to 3	Over 3 Up to 6	Over 6 Up to 30	Over 30 Up to 120	Over 120 Up to 400	Over 400 Up to 1000	Over 1000 Up to 2000	Over 2000 Up to 4000
f	Fine	±0.05	±0.05	±0.1	±0.15	±0.2	±0.3	±0.5	-
m	Medium	±0.1	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2
c	Coarse	±0.2	±0.3	±0.5	±0.8	±1.2	±2	±3	±4
v	Very coarse	-	±0.5	±1	±1.5	±2.5	±4	±6	±8

1) For nominal sizes below 0.5 mm, the deviations shall be indicated adjacent to the relevant nominal size(s).

Table 2 – Permissible deviations for broken edges (external radii and chamfer heights)

Values in millimetres

Tolerance class		Permissible deviations for basic size range		
Designation	Description	0.5[1] up to 3	Over 3 up to 6	Over 6
f	fine	±0.2	±0.5	±1
m	medium			
c	coarse	±0.4	±1	±2
v	very coarse			

1) For nominal sizes below 0.5 mm, the deviations shall be indicated adjacent to the relevant nominal size(s)

Table 3 – Permissible deviations of angular dimensions

Tolerance class		Permissible deviations for ranges of lengths, in millimetres, of the shorter side of the angle concerned				
Designation	Description	Up to 10	Over 10 Up to 50	Over 50 Up to 120	Over 120 Up to 400	Over 400
f	fine	±1°	±0°30′	±0°20′	±0°10′	±0.5′
m	medium					
c	coarse	±1°30′	±1°	±0°30′	±0°15′	±0°10′
v	very coarse	±3°	±2°	±1°	±0°30′	±0°20′

Annex A
(informative)

Concepts behind general tolerancing of linear and angular dimensions

A.1 General tolerances should be indicated on the drawing by reference to this standard in accordance with clause 4.

The values of general tolerances correspond to tolerance classes of customary workshop accuracy, the appropriate tolerance class being selected and indicated on the drawing according to the requirement of the components.

A.2 Above certain tolerance values, there is usually no gain in manufacturing economy by enlarging the tolerance. For example, a feature having a 35 mm diameter could be manufactured to a high level of conformance in a workshop with "customary medium accuracy". Specifying a tolerance of ± 1 mm would be of not benefit in this particular workshop, as the general tolerance values of ± 0.3 mm would be quite adequate.

However, if, for functional reasons, a feature requires a smaller tolerance value than the general tolerance values, these should not be indicated adjacent to the dimension but should be stated on the drawing as described in clause 4. This type of tolerance allows full use of the concept of general tolerancing.

There will be "exceptions to the rule" where the function of the feature allows a larger tolerance than the general tolerances, and the larger tolerance will provide manufacturing economy. In these special cases, the larger tolerance should be indicated individually adjacent to the dimension for the particular feature, e.g. the depth of blind holes drilled at assembly.

A.3 Using general tolerances leads to the following advantages:

a) drawings are easier to read and thus communication is made more effective to the user of the drawing;

b) The design draughtsman saves time by avoiding detailed tolerance calculations as it is sufficient to know that the function allows a tolerance greater than or equal to the general tolerance;

c) The drawing readily indicates which feature can be produced by normal process capability, which also assists quality engineering by reducing inspection levels;

d) Those dimensions remaining, which have individually indicated tolerances, will, for the most part, be those controlling features for which the function requires relatively small tolerances and which therefore may require special effort in the production – this will be helpful for production planning and will assist quality control services in their analysis of inspection requirements;

e) Purchase and sub-contract supply engineers can negotiate orders more readily since the "customary workshop accuracy" is known before the contract is placed; this also avoids arguments on delivery between the buyer and supplier, since in this respect the drawing is complete.

These advantages are fully obtained only when there is sufficient reliability that the general tolerances will not be exceeded, i.e. when the customary workshop accuracy of the particular workshop is equal to or fine than the general tolerances indicated in the drawing.

The workshop should therefore

- Find out by measurements what is customary workshop accuracy is;
- Accept only those drawings having general tolerances equal to or greater than its customary workshop accuracy;
- Check by sampling that its customary workshop accuracy does not deteriorate.

Relying on underlined "good workmanship" with all its uncertainties and misunderstandings is no longer necessary with the concept of general geometrical tolerances. The general geometrical tolerances defines the required accuracy of "good workmanship".

A.4 The tolerance the function allows is often greater than the general tolerances. The function of the part is, therefore, not always impaired when the general tolerance is (occasionally) exceeded at any feature of the work piece. Exceeding the general tolerance should lead to a rejection of the work piece only if the function is impaired.

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Specification for Identification Marking of Traction Machines Components

1.0 Scope: This specification governs the requirements for identification marking of all components of traction machines (except electrical items, hardwares & bearings) either manufactured in-house or outsourced in raw material, semi-finished or fully finished condition.

2.0 Identification marking of components: The component manufacturer shall provide the identification marking depending upon the type of component (raw material/semi-finished castings, raw material/semi-finished forgings & fabricated components, fully finished components or sheet metal components) manufactured by it as per guidelines given below:-

A) CASTED COMPONENTS:

Sl. No.	Condition of supply	Identification marking requirement
1.	Castings/ semi-finished castings	**a) <u>Method of marking in castings:</u>** Each casting shall be **embossed & punched** on un-machined surface/ **etched** on machined surface legibly and indelibly with following details:- **i) Supplier's name initial , Heat no.** ← To be embossed. **(Example: SAIL/341)** **ii) xxxxx , MM-YY** ← To be embossed/punched on cast surface or etched on machined surface. 4 digits of date of manufacturing in MM-YY format Manufacturer's unique job serial no. **(Example: 00345/0319)** **b) <u>Method of marking in semi-finished castings:</u>** Each casting shall be **embossed & punched** on un-machined surface/ **etched** on machined surface legibly and indelibly with following details:- **i) Supplier's name initial , Heat no.** ← To be embossed. **(Example: SAIL/341)** **ii) xxxxx , MM-YY** ← To be embossed/punched on cast surface or etched on machined surface. 4 digits of date of manufacturing in MM-YY format Manufacturer's unique job serial no. **(Example: 00345/0319)** **c) <u>Size & location:</u>** For size and location of identification marks, supplier to take prior approval from BHEL unless otherwise specified in the drawing.

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2.	Machined castings on labour basis	**a) <u>Method of marking after finish machining:</u>** **i) When embossed marking is not removed:** In case the embossed marking is not removed during finish machining of the component, the component shall be punched with following details below the already existing embossed marking:- **Supplier's name intial , xxxxx , MM-YY** 4 digits of date of manufacturing in MM-YY format Manufacturer's unique job serial no. **(Example: SAIL/341)** ←Already embossed. **ABCD/00345/0319** ← To be punched.
		ii) When embossed marking is removed: In case the component is machined all over & the embossed marking is removed, the same shall be re-punched on fully finished component. Date of finish machining in MM-YY format & manufacturer's details shall be punched below the above punched marking as per details given below:- **Supplier's name intial , xxxxx , MM-YY** 4 digits of date of manufacturing in MM-YY format Manufacturer's unique job serial no. **(Example: SAIL/341)** ← To be punched. **ABCD/00345/0319** ← To be punched. **b) <u>Size & location:</u>** For size and location of identification marks, supplier to take prior approval from BHEL unless otherwise specified in the drawing.
3.	Fully finished casted components	**a) <u>Method of marking in finished components:</u>** **i) When embossed marking is not removed during machining:** Each component shall be **embossed & punched** on un-machined surface/ **etched** on machined surface legibly and indelibly with following details:- **Supplier's name initial , Heat no.** ← To be embossed/already embossed. **(Example: SAIL/341)** **xxxxx , MM-YY** ← To be embossed/punched. 4 digits of date of manufacturing in MM-YY format Manufacturer's unique job serial no. **(Example: 00345/0319)**

		ii) When embossed marking is removed during machining: In case the component is machined all over & the embossed marking is removed, the same shall be re-punched on fully finished component. Date of finish machining in MM-YY format & manufacturer's details shall be punched below the above punched marking as per details given below:- **Supplier's name intial , xxxxx , MM-YY** └ 4 digits of date of manufacturing in MM-YY format └ Manufacturer's unique job serial no. **(Example: SAIL/341)** ← To be punched. **ABCD/00345/0319** ← To be punched. **b) Size & location:** For size and location of identification marks, supplier to take prior approval from BHEL unless otherwise specified in the drawing.
B) FORGING / FABRICATED COMPONENTS:		
1.	Raw material/ semi-finished forgings and fabricated components	**a) Method of marking in forgings & fabrications:** Each component shall be **punched** legibly and indelibly with following details:- **Supplier's name initial , xxxxx , MM-YY , xxx** └ Heat no. └ 4 digits of date of manufacturing (forging/fabrication) in MM-YY format └ Manufacturer's unique job serial no. **(Example: SAIL/00345/0319/341)** **b) Size & location:** For size and location of identification marks, supplier to take prior approval from BHEL unless otherwise specified in the drawing.
2.	Machined forgings/ fabrications on labour basis	**a) Method of marking after finish machining:** **i) When punched marking is not removed:** In case the punched marking is not removed during finish machining of the component, the component shall be punched with following details below the already existing punched marking:- **Supplier's name intial , xxxxx , MM-YY** └ 4 digits of date of manufacturing in MM-YY format └ Manufacturer's unique job serial no. **(Example: SAIL/00345/0319/341)** ← Already punched. **ABCD/00345/0319** ← To be punched.

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		ii) When punched marking is removed: In case the component is machined all over & the punched marking is removed, the same shall be re-punched on fully finished component. Date of finish machining in MM-YY format & manufacturer's details shall be punched below the above punched marking as per details given below:- **Supplier's name intial , xxxxx , MM-YY** 4 digits of date of manufacturing in MM-YY format Manufacturer's unique job serial no. **(Example: SAIL/00345/0319/341)** ← To be punched. **ABCD/00345/0319** ← To be punched. **b) Size & location:** For size and location of identification marks, supplier to take prior approval from BHEL unless otherwise specified in the drawing.
3.	Fully finished forged/ fabricated components	**a) Method of marking in finished components:** Each component shall be **punched** on un-machined surface/ **etched** on machined surface legibly and indelibly with following details:- **Supplier's name initial / xxxxx / MM-YY / xxx** Heat no. 4 digits of date of manufacturing in MM-YY format Manufacturer's unique job serial no. **(Example: SAIL/00345/0319/341)** **b) Size & location:** For size and location of identification marks, supplier to take prior approval from BHEL unless otherwise specified in the drawing.
C) SHEET METAL COMPONENTS:		
1.	Sheet metal components	**a) Method of marking:** Each component shall be **etched** or **punched** as the case may be legibly with following details:- **Supplier's name initial , xxxxx , MM-YY** 4 digits of date of manufacturing in MM-YY format Manufacturer's unique job serial no. **(Example: SAIL/00345/0319)** **b) Size & location:** For etching/painting and size & location of identification marks, supplier to take prior approval from BHEL unless otherwise specified in the drawing.