SPECIFICATION FOR ARMATURE PUNCHING & COMMUTATING POLE CORE PUNCHING FOR TRACTION MOTOR TYPE HS:15250A

1.0 **Scope :**

1.1 This specification covers the manufacture, testing, inspection, packing and supply of punching for:

(i) Armature main punching consisting of two items i.e Armature main punching to Drg. 14394060051, item 1 (Latest revision) & Armature end punching assembly in spot welded condition to Drg. No. 14394060051item 2 (Latest revision).
(ii) Commutating pole core punching to Drg. No.3439326052 (Latest revision).

SN	Item Name	Drawing No.	Material
01.	Armature main punching	14394060051, item 1 (Latest revision)	CRNO
02.	Armature end punching assly. in spot welded condition	14394060051,Item 2 (Latest revision).	CRC
03.	Commutating pole core punching .	3439326052(Latest revision)	CRNO

2.0 **Raw Material :**

2.1 **Raw Material for imported CRNO Steel Sheet** :
(Applicable for armature main punching and commutation pole core punching)

2.1.1 Non – oriented Magnetic Steel sheet and strip to JIS-C-2552' 2000 Gr.50A 470 with CS-1 Inorganic Film coating of C4 on both sides " OR" to DIN EN 10106 '96 Gr.M470-50A with inorganic coating on both sides.

The tenderers may quote the grade whichever is economical.

2.1.3 Firm (punching manufacturer) shall offer the raw-material to the authorized inspection authority i.e BHEL or his authorized representative at the premises of foreign manufacturer to verify the use of correct grade of steel sheets before shipment to the firm for manufacturing punching / commencing prototype/bulk manufacture. The supplier shall furnish copies of the original invoices of raw-material procurement along with TC of steel sheet supplier to the inspection authority.

2.2 Raw Material for indigenous CRNO Steel Sheet.

2.2.1 M/s SAIL's Material:

Punchings shall be made from CRNO sheet SAIL Gr.50 C470 as per IS:648 with C6 coating as per AISI and the coating thickness should be 1.5 to 2.5 micron on each side (total 3 to 5 micron) inorganic coating with 20% organic contents. Coating shall be able to withstand stress relief annealing at a temperature of a 800^0C and should be weldable & having good punch ability.

2.2.2 M/s Thyssenkrupp Electrical Steel India Pvt. Ltd.'s Material :

Punchings made from CRNO sheet 50C 470 as per IS:648 with a coating of C6U and coating thickness should be 1.5 to 2.5 micron on each side (total 3 to 5 micron) Inorganic coating with 20% organic contents. Coating shall be able to withstand stress relief annealing at a temperature of 800^0 C and should be weldable & having good punchability.

2.2.3 **Raw-material from other sources** :

Non-oriented Magnetic Steel Sheet and strip to CRNO Steel of Indian origin which should be equivalent to the imported materials in use – Non-oriented magnetic steel sheet and strip to JIS: C2552' 2000 Gr.50A 470 with CS-1 inorganic film coating of C4 on both sides "OR" to DIN EN 10106 '96 Gr. M470-50A with inorganic coating on both sides.

2.2.4 The inspection/testing will be done as per IS:648:1994, IS:649:1997 and (as is applicable) with their latest amendments.

2.3 **Raw material for Armature End Punching assembly in spot welded condition**:

Cold rolled carbon steel sheet to IS:513'94 Gr. 'O', Temper-SP (Skin passed), Surface finish Bright, surface type- Best surface. Material Raw material to be procured from sources like SAIL/TISCO/ESSSAR or other reputed steel manufacturers.

2.4 Firm (punching manufacturer) shall offer the raw material to the authorized inspection authority of BHEL to verify the use of correct grade of steel sheets having sourced from specified steel sheet supplier only before commencing prototype /bulk manufacture. The supplier shall furnish copies of original invoices of procurement along with TC of steel sheet supplier to the inspection authority.

3.0 Measurement of Stack Height : (Only for Armature Main Punching)

3.1 To improve the stacking factor and to obtain uniform stack height the punching shall be rotated by 90^0 during blanking stage, i.e before punching either manually or through motorized device with respect to key hole in the inner bore.

3.2 The supplier shall provide all the facilities including fixture for Armature main punching stack height measurement.

3.3 Stack height shall be 467.2 mm ± 1 mm after application of 40 Ton pressure for Armature main punching excluding Armature end punching assembly.

3.4 Height shall be measured along the circumferences at 12 points and value shall be recorded. The variation in height values shall not be more than ± 1 mm.

3.5 The sample size shall be 5% of the total offered lot rounded off to the next higher number.

4.0 **Prototype Inspection** :

4.1 The successful tenderer shall offer minimum one set of punchings required for manufacture of one motor for prototype inspection/testing to BHEL before under taking bulk production/supply.

4.2. Any shortcoming/defect in the design and workmanship of the punching shall be pointed out to the supplier after prototype tests to enable him to incorporate necessary improvements before bulk supply.

4.3. Any testing and approval by the purchaser of the design, drawing and prototype shall in no way absolve the supplier of his responsibilities under the terms and conditions of the contract.

4.4. Routine inspection of the punchings shall be carried out only after the approval of prototype sample.

4.5. The manufacture shall provide all the necessary facilities at their works/premises for prototype and routine inspection.

5.0. MARKING :

Manufacturer shall punch a small notch for identification at the place designated by BHEL after the P.O. is placed.

6.0. **PACKING :**

6.1 One TM set of each punching item shall be packed in individual separate box to facilitate set wise issue and receipt at BHEL.

6.2 Packing must be suitable to withstand loading/unloading and transit shocks.

6.3 The punchings shall be coated with anti-rust varnish/ compound after inspection on the outer cutting edges only to prevent rusting.

6.4 Packing shall be made water proof to prevent rain water ingress .

6.5 Suppliers will have to replace punchings in case of transit damage or rusting due to moisture.

6.6 To prevent displacement (sliding) of the punchings stack, within the box during transition, all the punchings shall be properly secured in position by passing adequate no. of bolts (studs through existing holes of the punchings stack and tightening with nuts with the top and bottom sides of packing box. Two cords indicating description of punchings, Drg/Specn Nos, PO reference, No. of items and quantity per set as well as weight duly signed by BHEL,s inspection authority shall be tagged one inside and another outside of the wooden box. To distinguish between imported and indigenous material, firm must mention clearly "IMPORTED" for imported material and " INDIGENOUS" for indigenous material in bold letter on and inside the box of material.

7.0 **Deviation :**

While submitting the offer, the tenderer shall furnish a list of deviations. If any, from this specification and relevant drawings. Even if the tenderer has no particular deviation in their offer, a Nil statement shall be submitted.

8.0. **TESTING FACILITIES** :

In case of test facilities are not available with the punching manufacturer the test specified in clause 2.2.4 are to be ensured from OEM. for this purpose test certificate from OEM must be produced at the time of inspection .To identify the proper grade of steel it is the responsibility of the firm to call for raw material inspection before commencing prototype bulk manufacture . The inspection wing shall arrange for raw material inspection at their earliest. The inspector shall ensure the proper grade. by physical verification of TC and affixed sticker on the cover which provide coil number, production batch and the weight of the coil "OR" OEM may print steel grade at an interval of one meter throughout the coil.

9.0 **DIMENSION AND TOLERANCES:**

9.1 Dimension: The dimensions shall be as per relevant drawings.

(A) ARMATURE MAIN PUNCHNG:

	Specified value	Mode of checking
1.	I/D Ø150.0 +0.04/+0.0 ----------	By plug gauge, Go/No. go.
2.	Key width 20 +0.032/+0.0 ----------	By plug gauge, Go/No. go.
3.	18 Vent. Holes Ø 25 +0.1/+0.0 ----------	By plug gauge, Go/No. go .
4.	18 Vent. Holes Ø 30 +0.1/+0.0----------	By plug gauge, Go/No. go.
5.	Slot dimension: (i) 8.85 +0.05/+0.0 (ii) 9.5 +0.1/+0.0 (iii)43.3+0.1/+0.0	By shadowgraph M/c & Slip gauge.
6.	Slot profile : (i) 4.8766 +0.1/+0.0 (ii) 3.689 +0.1/+0.0 (iii) 1.1876 +0.1/+0.0 (iv) Angle 60°& 30°	By shadowgraph M/c & profile projector

7. Sheet thickness — By Digital micrometer.

(a) Sheet thickness: The nominal thickness of the sheet is 0.50 mm . thickness shall be measured 40 mm away from the edge. (Applicable for armature main punching & Commutating pole core punching).

(b) Sheet tolerance: The permissible tolerance shall be ± 0.04 mm for nominal thickness of 0.50 mm in both the direction i.e. perpendicular and the direction of rolling .

(B)) ARMTURE END PUNCHING ASSLY IN SPOT WELDED CONDITION:
Dimensions of Armature end punching Assly. in spot welded condition shall be measured similar to above method as per drawing 14394060051. Sl. No. 1 to 6 as per (A) Armature main punching .

1.(a) Sheet thickness: The nominal thickness of the sheet is 0.8 mm it should be measured by digital micrometer.
(b) Sheet tolerance: The permissible tolerance shall be ± 0.06 mm.

(C) COMMUTATING POLE CORE PUNCHING :

Specified value		Mode of checking
1. Hole Ø 16 +0.2	---------	By plug gauge, Go/No/go.
2. Breadth 20± 0.1		
3. 2.0+0.15/+0.05	--------	By shadowgraph M/C projector.
4. 5.0 +0.15/+0.05		
5. R 343.4	---------	By radius gauge/ template.
6. Sheet thickness	---------	By digital micrometer.

NB: Balance dimensions for all above items can be checked by suitable verniers /micrometers.

10.0 SLOT ALIGNMENT FOR ARMATURE MAIN PUNCHING:
Slot alignment to be checked in stacking condition by placing 4 stacking rulers at approx. 90^0 apart. The dimensions of stacking rulers are shown in fig. 1. The stacking rulers shall move inside the slots under slight pressure without any obstruction.

11.0 ROUTINE INSPECTION :
The following tests to be carried out during routine tests:
1. Raw material inspection : As per clause 2.0 before manufacture raw material verification will be done by BHEL , at firm premises .
2. Dimension checking : As per clause 9.1
3. Measurement of stack height: As per clause 3.0
4. Slot alignment as per clause 10.0.
5. Maximum specific total loss (watt per kg.) at 50 Hz and 1.5 T are to be checked at firm's premises, specified value in w/kg is 4.70 maximum.
(Applicable for Armature main punching & Commutating Pole Core Punching)

12.0 INFORMATION TO BE FURNISHED BY THE TENDEREES (FOR NEW SOURCES)

12.1 Clause wise comments have to be furnished by the tenderer. Vague comments like noted and understood are not acceptable . Compliance have to be clearly stated otherwise BHEL reserves the right to reject the offer.

12.2 QAP must be product specific as per ANNEXURE-1 (at page 7 of 7) general ISO documents need not to be submitted .

12.3 M&P and testing facilities available .

12.4 Latest ISO certificate from NABCB approved body.

12.5 Source and grade of raw material.

13.0 Commutating pole core punching can be manufactured from residual excess raw material arising out after production of armature main punching.

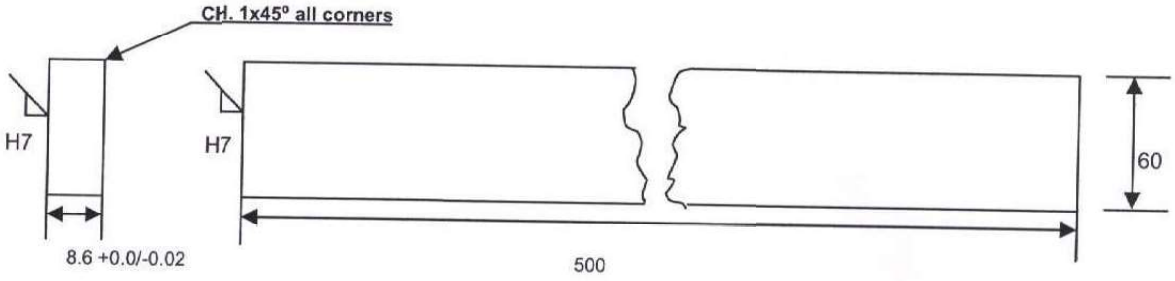

Fig 1. View of stacking ruler (material case hardened steel)

14.0 This specification is equivalent to CLW spec no **4TMS.095.035 rev.02.**

Annaxure-1

QAP to be submitted by the vendor shall cover the following aspects:

1. Index page.
2. Copy of ISO 9001 certificate from NABCB registered body.
3. Organisation log sheet of the personnel manning only the quality control set up.
4. Qualification log sheet of the personnel manning only the quality control set up.
5. List of M&P and Testing facilities .

Process flow chart indicating step by step process of manufacture of an item or a amily of items for which the process is same.

7. details of sub.-venders:-

Name of item	Sub-vendors	ISO status	Inspection plan of sub vendor

The sub-vendor has all the requisite infrastructure of manufacturing and testing facilities preferably under one roof.

Periodical inspection schedule for sub-vendor is being followed strictly by the primary vendor.

The sub-vendor has at the requisite infrastructure of manufacturing and testing facilities preferably under one roof.

8. Quality Assurance System-Inspection and testing plan with formats to be filled up for :-

- Incoming material .
- process control.
- product control.

This must be furnished in the following format :-

Subject /product /process	Sample size & its frequency of inspection	Parameters of inspection	Mode of Inspn. Equipment used	Acceptance limit/criteria /specified Value as per Drg./specn.	Format no. where record will be kept

9. Gauging scheme in the format for each operation gauges should be mentioned . if used.

NOTE:- 1. Sample formats used for recording must be submitted.
2. General ISO 9001 documents not to submitted in QAP.
3. Firm must not depend only on TC for incoming material.
4. Record of SN (8) above shall be checking during inspections at firm's premises .
5. QAP has to be specified for each product based on relevant specification /drg.