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|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p align="center"> <b>PPX-BOI DEPARTMENT</b><br/> <b>BHARAT HEAVY ELECTRICALS LIMITED</b><br/> <b>HEEP: HARDWAR-249 403 (Uttarakhand)</b><br/> <b>FAX: +91 1334 226084/226462</b><br/> <b>TEL: +91 1334 28 5834/4175</b> </p> | <p> <b>ENQUIRY NO. B/4222/2016/5151V/1</b><br/> <b>PACKAGE: Condenser Air Evacuation Package</b><br/> <b>PROJECT: 2X800 MW Uppur &amp; 1X800 MW North Chennai</b><br/> <b>DATE OF ISSUE OF ENQUIRY: 02/06/2017</b><br/> <b>ENQUIRY DUE DATE: 01/07/2017</b> </p> |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Index of Technical PQR & Technical Documents**

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**PRE-QUALIFICATION REQUIREMENTS**

Bidder is required to meet the pre-qualification requirements (PQR) for supply of Condenser Air Evacuation Package as per criteria stipulated below. Further, Bidder to furnish documents/ details as per Annexure-1, 2, 3, 4&5 (as applicable), along with the technical offer for proven criteria stipulated below.

| <b>Pre-Qualification Requirements</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Vendors Confirmation<br/>Indicating page no.<br/>where documents<br/>are placed</b> |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 1.0                                   | Bidder/Vendor (Qualified Equipment manufacturer) should have designed, manufactured, tested and commissioned as per HEI- performance standard for "Condenser Air Evacuation package" (Liquid ring Vacuum Pump package) and supplied "Condenser Air Evacuation package", for at least two (2) number Purchase orders (P.Os) and having Free dry Air Capacity 40 SCFM or higher at 1" Hg (abs) and ITD not more than 13.3 deg C.<br>"Condenser Air Evacuation package" supplied against at least one P.O should be in successful operation for a period not less than one (1) year, as on date of submission of bid. |                                                                                        |
| 2.0                                   | The Indian bidder can offer referred equipment in clause 1.0, provided that it has technical collaboration or valid licensing agreement for design, engineering, manufacturing, testing and supply of such equipment in India from a manufacturer who meets the requirements stipulated at clause 1.0 above. Indian Bidder should have executed at least one P.O of Vacuum pump package having Free dry Air Capacity 30 SCFM or higher at 1" Hg (abs) and ITD not more than 13.3 deg C, which is in successful operation for a period not less than one year, as on date of submission of bid.                     |                                                                                        |
| 2.1                                   | Before taking up the manufacturing of such equipment, the Indian bidder should have created manufacturing and testing facilities at its works as per Collaborator/Licensors design, manufacturing and quality control system for such equipment duly certified by Collaborator/Licensors.                                                                                                                                                                                                                                                                                                                          |                                                                                        |
| 2.2                                   | Further, the Collaborator/Licensors should have provided all design, design calculation, manufacturing drgs and should have provided technical and quality surveillance assistance and supervision during manufacturing, testing & commissioning of equipment.                                                                                                                                                                                                                                                                                                                                                     |                                                                                        |
| 3.0                                   | An Indian JV/ Subsidiary company formed for manufacturing, testing and supply of equipment in India can offer referred equipment in clause no 1.0, provided that it has a valid collaboration or licensing agreement for design, engineering, manufacturing & testing of such equipment in India with a qualified equipment manufacturer who meets the requirements stipulated at clause 1.0 above.                                                                                                                                                                                                                |                                                                                        |
| 3.1                                   | Indian Bidder should have executed at least one P.O of Vacuum pump package having Free dry Air Capacity 30 SCFM or higher at 1" Hg (abs) and ITD not more than 13.3 deg C, which is successfully commissioned at project site.                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                        |
| 3.2                                   | In addition, the Indian JV/ subsidiary Company and qualified equipment manufacturer shall furnish DJU (Deed of Joint Undertaking) in which executants of the DJU shall be jointly and severally liable for the successful performance of the equipment. JV should be maintained for a lock-in period of min 7 years from the date of bid opening.                                                                                                                                                                                                                                                                  |                                                                                        |
| 3.3                                   | Before taking up the manufacturing of such equipment, the Indian bidder should have created manufacturing and testing facilities at its works as per Collaborator/Licensors design, manufacturing and quality control system for such equipment duly certified by Collaborator/Licensors.                                                                                                                                                                                                                                                                                                                          |                                                                                        |
| 3.4                                   | Further, the Collaborator/Licensors should have provided all design, design calculation, manufacturing drgs and should have provided technical and quality surveillance assistance and supervision during manufacturing, testing & commissioning of equipment.                                                                                                                                                                                                                                                                                                                                                     |                                                                                        |

*[Signature]*  
29/05/17  
gaurav Kant

*[Signature]*  
29/5/17

**Documents/Details to be submitted for proven criteria mentioned in clause 1.0, 2.0 & 3.0 of PQR:****A. For Clause 1.0 of PQR : Qualified Equipment Manufacturer**

Bidder to submit following documents in support of above confirmation:

- Copies of Un-price purchase orders (P.Os).
- Test certificates for performance test of complete package for capacity & power Vs Suction pressure, duly co-relating PO No. / Serial no of Package. This Test certificate should be issued by third party inspection agency or acceptance by Customer/end user.
- Shipping/dispatch document in support of supply of Vacuum pump packages against P.Os at sl no (a).
- Copy of end user certificate issued on letter head as per Annexure-2 for successful operation for one year for at least one P.O given at sl no (a).
- Details of Equipment as per Annexure-3.
- Details of Questionnaire as per Annexure-4.

**B. For Clause 2.0 of PQR**

- Bidder to furnish documents mentioned against clause no. A (a), (b) & (c) of above to meet the requirements stipulated at clause 1.0 above for Qualified Equipment Manufacturer.
- MOU/ certificate of collaboration/ licensing agreement for design, engineering, manufacturing, testing and supply of referred equipment in India.
- Copy of Un-price purchase order (PO).
- Copy of end user certificate issued on letter head as per Annexure-2.
- Details of Equipment as per Annexure-3.
- Details of Questionnaire as per Annexure-4.
- Bidder to furnish certificate in support of clause no 2.1 & 2.2 from the collaborator/ licensor/ Qualified Equipment Manufacturer.

**C. For Clause 3.0 of PQR:**

- Bidder to furnish documents mentioned against clause no. A (a), (b) & (c) of above to meet the requirements stipulated at clause 1.0 above for Qualified Equipment Manufacturer.
- Details of Subsidiary/JV Company as per Annexure-5.
- Copy of Un-price purchase order (PO).
- Copy of commissioning certificate signed by customer, duly co-relating P.O No. / Serial no of Package.
- Details of Equipment as per Annexure-3.
- Details of Questionnaire as per Annexure-4.
- Bidder to furnish certificate in support of clause no 3.3 & 3.4 from the collaborator/ licensor/ Qualified Equipment Manufacturer.

**Note:**

If the Design Parameters, Guaranteed Figures, Equipment Features etc., are not clearly brought out in the bid or not supported by the information required as per specification, or have not been considered in bidder's offer, in accordance with specification requirements of reliability, availability, operability and maintainability of the equipment, then BHEL has right to reject the bid (s).

*Shiva Kant*  
29/05/17

*28/5/17*

ANNEXURE-2

Date:

TO WHOM SOEVER IT MAY CONCERN

This is to certify that M/s XXXXX have Designed, Engineered, Manufactured and supplied Condenser Air Evacuation package (Vacuum pump package), model no XXXXX having free dry Air Capacity XXXX SCFM at 1''Hg-a and at ITD XXXX deg C for our XXXXX Plant(Unit/Rating/City/Country), under our Purchase Order No. XXXXX dated XXXX.

The Vacuum pump package was commissioned on dated XXXXX and is in successful operation without any problem since commencement of operation.

Name of the Organization :

Address :

Signature :

Name of the Signatory :

Designation :

Phone No :

Date of issue :

Seal & Stamp of the  
Organisation :

**Note:** *If Customer's letter head is in language other than English then translation in English shall be written below header.*

**ANNEXURE-3: DETAILS OF EQUIPMENT**

Bidder's Name and Address :  
XXXXXXX

To  
BHEL, HEER, RANIPUR,  
Haridwar-249403

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| S. No. | Item Description |
|--------|------------------|
|--------|------------------|

---

**CONDENSER AIR EVACUATION PACKAGE  
(VACUUM PUMP PACKAGE)**

- |      |                                                                                                                                                    |        |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 1.0  | Name, Address, Telephone No. of manufacturer                                                                                                       |        |
| 2.0  | Name of the Station and its Location                                                                                                               |        |
| 3.0  | Client Name and its Address, Fax No. & Tel.Nos.                                                                                                    |        |
| 4.0  | Name and Designation of the responsible person in Client's Organisation                                                                            |        |
| 5.0  | Contract No. & Date                                                                                                                                |        |
| 6.0  | Capacity in MW of Unit and No. of Units                                                                                                            |        |
| 7.0  | Starting Date of Work/<br>Date of Order                                                                                                            |        |
| 8.0  | Scheduled Date of Completion                                                                                                                       |        |
| 9.0  | Actual Date of Completion                                                                                                                          |        |
| 10.0 | Date of Commissioning of System/Package                                                                                                            |        |
| 11.0 | Whether the System/Equipments are in Successful Operation for a minimum period of one (1) year prior to the date of Techno-Commercial bid opening. | Yes/No |
| 12.0 | Date of Commencement of Successful Operation                                                                                                       |        |

Signature of authorized signatory.....

| S. No. | Item Description                                                                                       |
|--------|--------------------------------------------------------------------------------------------------------|
| 13.0   | Brief Scope of Work                                                                                    |
| 14.0   | Brief Technical Particulars of the System/Package/Equipments :                                         |
|        | (i) Designed by                                                                                        |
|        | (ii) Manufactured by                                                                                   |
|        | (iii) Type (Liquid Ring Type or any other type)                                                        |
|        | (iv) Make / Model No.                                                                                  |
|        | (v) Number per T.G. Unit                                                                               |
|        | (vi) Rated free Dry Air Capacity in SCFM [at 25.4 mm Hg (abs) Suction Pressure at 21.1°C] of each Pump |
|        | (vii) Hogging Capacity of each Pump (at 254mm Hg (abs) Suction Pressure in SCFM                        |
|        | (viii) I.T.D. (deg.C)                                                                                  |
|        | (ix) Temp. of Cooling Water to Vacuum Pump Heat Exchanger (deg.C)                                      |
|        | (x) Type of Heat Exchanger (Shell & Tube Type/Plate Type)                                              |
|        | (xi) No. of Stages                                                                                     |
|        | (xii) Whether Air Ejector is provided or not                                                           |
|        | (xiii) Impeller Material                                                                               |

Signature of authorized signatory.....

| S. No. | Item Description                                                                           |        |
|--------|--------------------------------------------------------------------------------------------|--------|
|        | (xiv) Casing Material                                                                      |        |
| 15.0   | Are these Condenser Air<br>Evacuation Pumps running<br>with Steam Turbine Generator Sets   | Yes/No |
| 16.0   | <b><u>Motor</u></b><br>i. Type<br>ii. Manufacturer<br>iii. Rating<br>iv. Origin of country |        |

Signature of authorized signatory.....

**Name of Equipment / Item / Process with Model/ Type/ Rating / Capacity/ Size/ Tonnage etc. (As applicable):**

**Trade Name of Product (if any) :** \_\_\_\_\_

1. **Name of Proposed Sub-Supplier:** \_\_\_\_\_

**Website:** \_\_\_\_\_

2. **Address of Regd. Office:**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Details of contact person:**

Name \_\_\_\_\_

Mobile no. \_\_\_\_\_

Desig. \_\_\_\_\_

E-mail: \_\_\_\_\_

3. **Branch/ Liaison office in Delhi/NCR**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Details of contact person:**

Name \_\_\_\_\_

Mobile no. \_\_\_\_\_

Desig. \_\_\_\_\_

E-mail: \_\_\_\_\_

**Weekly off day** \_\_\_\_\_

4. **Address of Works where  
Item is being manufactured**

\_\_\_\_\_

\_\_\_\_\_

**Details of contact person:**

Name \_\_\_\_\_

Mobile no. \_\_\_\_\_

Desig. \_\_\_\_\_

E-mail: \_\_\_\_\_

**5. Details of Proposed Works:**

- a. Year of Establishment of present works : \_\_\_\_\_
- b. Year of Commencement of Manufacturing at the above works : \_\_\_\_\_
- c. Details of change in works address in past, if any : \_\_\_\_\_
- d. Total Area / Covered Area : \_\_\_\_\_
- e. Details of covered area like no. of sheds, Area of each shed etc. \_\_\_\_\_
- f. Electric power- Connected load: \_\_\_\_\_  
Electric power- Stand by load & system: \_\_\_\_\_

**6. Annual Turnover & Profit in past three years** : \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**7. Do you have in-house Department for:**

- a) Design Yes/No
- b) Research & Development Yes/No
- c) Quality control/Inspection Yes/No
- d) After Sales Service Yes/No

**8. Shift works per day** One/Two/Three

**9. Present Manpower Status:**

| Division Status             | Graduate  |               | Diploma | Skilled | Un-Skilled | Remarks |
|-----------------------------|-----------|---------------|---------|---------|------------|---------|
|                             | Technical | Non-Technical |         |         |            |         |
| Design                      |           |               |         |         |            |         |
| Production                  |           |               |         |         |            |         |
| Quality Control/ Inspection |           |               |         |         |            |         |
| After Sales Service         |           |               |         |         |            |         |

- a. Organization chart of the proposed works is enclosed as Annexure: \_\_\_\_\_
- b Organization chart of QA / QC Deptt. is enclosed as Annexure: \_\_\_\_\_
- c. List of Qualified Welders with process etc. is enclosed as Annexure: \_\_\_\_\_
- d. List of Qualified NDT personnel with area of specialization is enclosed as Annexure: \_\_\_\_\_

**10. Brief details of items manufactured:**

| Sl. No. | Item & Material<br>(Type/Size/Rating/Model/<br>Capacity /Tonnage , as<br>applicable) | Installed<br>Capacity | Annual<br>Production<br>Capacity | Annual Production for last<br>Three years |    |     |
|---------|--------------------------------------------------------------------------------------|-----------------------|----------------------------------|-------------------------------------------|----|-----|
|         |                                                                                      |                       |                                  | I                                         | II | III |
|         |                                                                                      |                       |                                  |                                           |    |     |

**11. Details of foreign Collaboration, if any:**

| Sl.<br>No. | Product | Name & Address of<br>Collaborator | Collaboration |      |               |
|------------|---------|-----------------------------------|---------------|------|---------------|
|            |         |                                   | Scope         | Year | Valid<br>upto |
|            |         |                                   |               |      |               |

12. Type Test report for the proposed product (similar or higher rating )if applicable is enclosed as Annexure: \_\_\_\_\_
- 13 Approval / Certification by National / International standards / Accredited agency for the proposed product (if applicable) is enclosed as Annexure: \_\_\_\_\_
14. Statutory / mandatory certification for the proposed product (if applicable) is enclosed as Annexure: \_\_\_\_\_
15. Supply Experience list of the proposed product (similar or higher rating) is enclosed as Annexure: \_\_\_\_\_

[List shall include Item description, (Type/Size/Rating/Model/Capacity/Tonnage, as applicable), Customer name, Quantity, Year of Supply and Year of commissioning]

16. **End User's operational feedback certificate for the proposed product is enclosed as Annexure: \_\_\_\_\_**

17. **List of equipment & machinery specific to the proposed product is enclosed as Annexure: \_\_\_\_\_**

(List shall include name of equipment, capacity & nos. etc.)

18. **Process Flow Diagram indicating in-house & outsourced process enclosed as Annexure: \_\_\_\_\_**

19. **General manufacturing facilities available in-house:**

| Sl. No. | Description of machine                                             | Type /Capacity / Size / Rating etc as applicable | Number |
|---------|--------------------------------------------------------------------|--------------------------------------------------|--------|
| a)      | Material Handling<br>Mobile Crane<br>Fork Lift<br>Over Head Cranes |                                                  |        |
| b)      | Metal Cutting & Bending                                            |                                                  |        |
| c)      | Casting                                                            |                                                  |        |
| d)      | Forging                                                            |                                                  |        |
| e)      | Fabrication                                                        |                                                  |        |
| f)      | Welding                                                            |                                                  |        |
| g)      | Machining                                                          |                                                  |        |
| h)      | Heat Treatment                                                     |                                                  |        |
| i)      | Surface Cleaning<br>Sand Blasting<br>Shot Blasting<br>Pickling     |                                                  |        |
| j)      | Painting                                                           |                                                  |        |
| k)      | Metal Coating                                                      |                                                  |        |



**b. List of Testing & Inspection Facilities outsourced, if any with Source of testing and Description enclosed as Annexure: \_\_\_\_\_**

21. **Storage of finished goods (covered / open) :** \_\_\_\_\_

22 **List of the source / make with location of major raw material, bought out items and out sourced process enclosed as Annexure:** \_\_\_\_\_

23. **Quality management:**

23.1 **General**

23.1.1. Work Instruction for different processes available. (Y/N). \_\_\_\_

If yes, enclose list as Annexure \_\_\_\_\_

23.1.2. Evaluation system for raw material/bought out item's supplier is available. (Y/N) \_\_\_\_\_

23.1.3. Records generated during inspection maintained & available for review (Y/N) \_\_\_\_\_

23.1.4 Statistical quality control techniques used (Y/N) \_\_\_\_\_

23.1.5 ISO certificate for the works available (Y/N). \_\_\_\_ If yes, enclose copy as Annexure \_\_\_\_\_

23,2 **Corrective action**

23.2.1 Specifically confirm whether System for identification & disposition of Non Conformity in the process / product is available. (Y/N) \_\_\_\_\_

23.2.2 Specifically confirm whether System for Customer complains & their satisfactory disposal is available. (Y/N) \_\_\_\_\_

23.3. **Documentation Control**

23.3.1 Procedure available for documentation control (Y/N) \_\_\_\_

23.4. **Control of Inspection, Measuring & Testing equipments.**

23.4.1 Procedure for calibration of testing & measuring instrument available. (Y/N) \_\_\_\_

24. **Any Special Information:** \_\_\_\_\_

26. I CERTIFY THAT THE INFORMATION SUPPLIED HEREIN (INCLUDING ALL PAGES ATTACHED) IS CORRECT TO THE BEST OF MY KNOWLEDGE.

SEAL

M/S. \_\_\_\_\_

PLACE \_\_\_\_\_

DATE \_\_\_\_\_

SIGNATURE \_\_\_\_\_

NAME \_\_\_\_\_

DESIGNATION \_\_\_\_\_

MOBILE NO \_\_\_\_\_

EMAIL \_\_\_\_\_

LIST OF ENCLOSURE:

**Certification by Main Supplier:** Above information have been verified and found in order / minor changes which have been marked and initialed on this form itself / observed the following discrepancies.

Name : \_\_\_\_\_ Designation : \_\_\_\_\_ Signature : \_\_\_\_\_ Date : \_\_\_\_\_

**NOTE :**

1. COLUMN SHALL NOT BE LEFT UNFILLED..IN CASE OF NOT APPLICABLE / NOT AVAILABLE, THE SAME SHALL BE INDICATED IN THE PROVIDED SPACE.
2. IN CASE PROVIDED SPACE IS NOT ADEQUATE, INFORMATION SHALL BE PROVIDED AS AN ATTACHMENT.
3. PRODUCT CATALOGUE FOR THE PROPOSED EQUIPMENT/ITEM/PROCESS,IF AVAILABLE, SHALL BE ENCLOSED

ANNEXURE-5

| S. No.                                                                                            | Item Description                                                                                                                                                                                                                                                                                                 |
|---------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Details of Subsidiary/JV Company<br/>proposed for manufacturing of<br/>Vacuum pump package</b> |                                                                                                                                                                                                                                                                                                                  |
| 1.0                                                                                               | Name and Address with Telephone<br>Number of the Indian Subsidiary /<br>JV Company proposed for<br>manufacturing of .....<br>(Name of the equipment).                                                                                                                                                            |
| 2.0                                                                                               | Name and Address with Telephone No.<br>of the promoter(s) of the Subsidiary/<br>JV Company                                                                                                                                                                                                                       |
| 3.0                                                                                               | % of the Equity held by the<br>promoter(s)                                                                                                                                                                                                                                                                       |
| 4.0                                                                                               | Equity lock in period (from the date of<br>incorporation of JV)                                                                                                                                                                                                                                                  |
| 5.0                                                                                               | Name and Address with Telephone<br>No. of a promoter of Subsidiary /<br>JV Company formed<br>who meets the requirement<br>of Clause 1.0.                                                                                                                                                                         |
| 6.0                                                                                               | M/s. .... (the subsidiary/<br>JV Company) has a collaboration or<br>valid licensing agreement with M/s .....<br>(subsidiary/JV promotor) for design,<br>Engineering, Manufacturing & Supply<br>of ..... (Name of the<br>equipment) in India.<br>(Please furnish details of collaboration/<br>licensing agreement |



Signature of authorized signatory.....

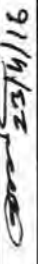
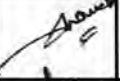
| S. No. | Item Description                                                                                     |
|--------|------------------------------------------------------------------------------------------------------|
| 7.0    | If equity held by the Qualified Equipment Manufacturer                                               |
| 8.0    | Whether equity held directly or indirectly ?                                                         |
| 9.0    | If indirectly then furnish the relationship tree alongwith all relevant subsidiaries holding company |
| 10.0   | Please furnish the committment for lock in period as per requirement                                 |
| 11.0   | Bidder to furnish documentry evidence \ in support of above date                                     |

|       |   |                     |
|-------|---|---------------------|
| Date  | : | (Signature).....    |
| Place | : | (Printed Name)..... |
|       |   | (Designation).....  |
|       |   | (Common Seal).....  |

Signature of authorized signatory.....

|                                                                                                                                                                                                                       |  |                                                                                                                                                    |  |                                                   |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------------------------|--|
| दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                   |  | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR)                                                |  | HE 57016                                          |  |
| SUPERSEDES<br>INVENTORY<br>NO.                                                                                                                                                                                        |  |                                                                                                                                                    |  | पृष्ठ 1 का 27<br>Page 1 of 27                     |  |
| COPYRIGHT AND CONFIDENTIAL<br>The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company. |  | <div style="text-align: center;"> <p><b>TECHNICAL SPECIFICATION<br/>FOR<br/>CONDENSER AIR EVACUATION PACKAGE<br/>UNIT (VACUUM PUMP)</b></p> </div> |  |                                                   |  |
| स्वत्साधिकार एवं गोपनीय<br>इस दस्तावेज में दी गई सूचना भारत हेवी एलेक्ट्रिकल्स लिमिटेड की संपत्ति है इसका प्रयोग एवं प्रकाशन केवल के बिना की जा सकती है अन्यथा इसे दंडित किया जायेगा।                                 |  |                                                                                                                                                    |  |                                                   |  |
| दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                   |  | नाम<br>NAME                                                                                                                                        |  |                                                   |  |
| दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                   |  | दिनांक एवं हस्ताक्षर<br>SIGNATURE & DATE                                                                                                           |  |                                                   |  |
| TSX                                                                                                                                                                                                                   |  | DEEPAK                                                                                                                                             |  | अनुवादक TRANSLATED BY                             |  |
| QAX                                                                                                                                                                                                                   |  | S.K. CHAUHAN                                                                                                                                       |  | निर्माणकर्ता WORKED BY                            |  |
| सहमत विभाग<br>AGREED DEPTT.                                                                                                                                                                                           |  | VISHNU SHASTRI                                                                                                                                     |  | जांचकर्ता CHECKED BY                              |  |
| SUPERSEDES                                                                                                                                                                                                            |  | DATE & SIGNATURE                                                                                                                                   |  | पर्यवेक्षणकर्ता SUPERVISED BY                     |  |
| REV.NO.                                                                                                                                                                                                               |  | 03                                                                                                                                                 |  | स्वीकृति<br>APPROVED : S.K.BAVEJA, AGM (HXE&PED); |  |
| Dt.                                                                                                                                                                                                                   |  | 18/04/2016                                                                                                                                         |  | जारी<br>ISSUED : TSX                              |  |
| CHANGE ADVICE<br>NO.                                                                                                                                                                                                  |  | HXE-16-02                                                                                                                                          |  | दिनांक<br>DATE : 28/09/93                         |  |

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| दिनांक एवं हस्ताक्षर<br>SIGN & DATE |                                                                                                                                     | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                           | HE 57016                                |            |
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| मासिक सूची संख्या<br>INVENTORY NO.  | सुपरसेड्स<br>INVENTORY                                                                                                                                                                                               | <p><b>1.0 SCOPE :</b></p> <p>This specification covers the design, manufacture, inspection, performance testing, painting and packing of mechanical vacuum pumps along with drive-motor, control &amp; instrumentation and accessories. The vacuum pumps are to be used for evacuation of air and other non-condensable gases with associated water vapour, from surface type steam condenser for power plant application, during hogging and holding operations.</p> <p><b>2.0 CODES AND STANDARDS :</b></p> <p>The design, manufacture, inspection, performance testing, painting and packing of main pump and accessories should be proven and as per HEI-Performance Standard for Liquid Ring Vacuum Pumps. Sizing of the main pump shall be as per HEI – Standards for Steam Surface Condensers, unless otherwise specified in the Annexure.</p> <p><b>3.0 DESIGN REQUIREMENTS :</b></p> <p>3.1 The mechanical vacuum pumps and accessories shall be used for continuous duty, to create and maintain vacuum by removing air and other non-condensable gases with associated water vapour, from the steam condenser during the power plant operation. Final selection should consider compatible operation of the condenser and the pump over the full range of anticipated condenser operating-pressures as indicated in the Condenser Performance Curves enclosed in the Annexure. The selection of design parameters for vacuum pump and its accessories and condenser design conditions are given in the Annexure.</p> <p>3.2 The pumps shall be of single stage or two stage liquid ring type with suitable compression ratio, to meet the conditions specified in the Annexure and the Condenser Performance Curves, ensuring no cavitations under all operating conditions. Bidder shall indicate the arrangement being offered to avoid cavitation.</p> <p>3.3 The pump shall be of liquid ring design with both the stages (if it is a two-stage pump) mounted on a common shaft. The unit shall require no external lubrication and shall not be damaged by slugs of water and entrained gases.</p> <p>3.4 Each pump unit with the accessories shall be furnished as a package unit mounted on a common steel base plate.</p> <p>3.5 The pumps shall be connected to its motors by flexible couplings. All couplings shall have suitable rigid steel coupling guards having closed ends and anchored to the base plate.</p> <p>3.6 Each vacuum pump unit shall include, but not be limited to ,the items listed under 'SCOPE OF SUPPLY' in Appendix-D and indicated on the 'SYSTEM FLOW DIAGRAM' at Appendix-A.</p> <p>The bidder shall furnish his flow diagram covering complete scope of supply.</p> |                           |                                         |            |
| मासिक सूची संख्या<br>INVENTORY NO.  | स्वत्वाधिकार एवं गोपनीयता<br>The information on this document is the property of Bharat Heavy Electricals Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company. | REV. NO: .03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | निर्माणकर्ता<br>WORKED BY | SHAVEZ KHAN                             | 18/04/2016 |
| दिनांक एवं हस्ताक्षर<br>SIGN & DATE | दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | जांचकर्ता<br>CHECKED BY   | SHIVA KANT                              | 18/04/16   |

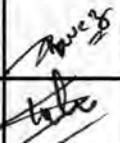
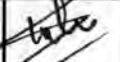
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| दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR) |                                          | HE 57016<br>पृष्ठ 3 का 27<br>Page 3 of 27 |                                                                                                                                                                                                  |
| सुपरसेड्स<br>INVENTORY                                                                                                                                                                                              | <p>Out of the scope of supply, Vacuum pump, Vacuum pump Motor &amp; Seal water recirculation pump are critical sub system for which Pre-Qualification Requirements(PQR) need to be complied.</p> <p>a) <u>Vacuum pump</u>: Bidder/Vendor should have designed, manufactured, tested and commissioned as per HEI- performance standard for "Condenser Air Evacuation package" (Liquid ring Vacuum Pump package) and supplied at least two (2) nos of "Vacuum pump" having Free dry Air Capacity 30 SCFM or higher at 1" Hg (abs) and max ITD 13.3 deg C, for two different Thermal Power Plants with units rating of 500 MW or above.</p> <p>"Condenser Air Evacuation package" should be in successful operation for a period not less than two (2) years, as on date of submission of bid.</p> <p>b) <u>Vacuum pump motor</u>: The model/type/size/rating of motor offered should be satisfactorily operating for at least two year in power plants (500MW or higher capacity) at two different locations.</p> <p>Vendor to submit credentials of motor supplier meeting above PQR for BHEL review/approval.</p> <p>c) <u>Seal water Recirculation pump with Motor</u>: The model/type/size/rating of Recirculation pump offered should be satisfactorily operating for at least two year in power plants (500MW or higher capacity) at two different locations.</p> <p>Vendor to submit credentials of Recirculation pump supplier meeting above PQR for BHEL review/approval.</p> <p>3.7 Provision shall be made in the design of the equipment to prevent loss of vacuum by flow of atmospheric air back into the condenser upon shut down of the pump.</p> <p>3.8 The design pressure to be considered for the cooling water circuit is 5.0 kg/sq.cm (g) and for the make-up water circuit as 45 kg/sq.cm (g).</p> <p>The source of make-up and sealing water is D.M. water.</p> <p>3.9 It shall be sufficient for the owner to connect air and water terminal points to a common Terminal Block and the wiring to the motor's terminal boxes.</p> <p>Shut down drains must be terminated at one point with valve.</p> <p>3.10 All components, including spares and spare-assemblies, (if any) of all the pumps and accessories, shall be completely interchangeable.</p> <p>3.11 The Condenser Air-evacuation unit shall perform continuously, without exceeding the noise level of 85 dBA at a distance of 1.0 metre from the unit for a surrounding of the inside of a turbine hall. Silencer shall be provided if required.</p> <p>The vibration levels of the pump unit shall conform to ISO 10816-3, Group-2: Zone-A (Criteria for assessing mech. Vibration of machines).</p> <p>3.12 The materials of construction of all the parts including all accessories shall be suitable to the fluids being handled/ used. The source of cooling water shall be as given in the Annexure. The materials of construction shall not be inferior to that specified in the clause 4.0.</p> <p>3.13 Provision shall be made in Heat Exchanger to permit access to tubes without disturbing CW piping connections. Tube size shall not be less than 5/8 inch.</p> <p>3.14 Impeller Tip speed to be kept in range of 13-22 m/sec.</p> <p>3.15 Pipe fittings: not less than Schedule 40</p> <p>3.16 NPS (Nominal pipe size) for make-up line to be kept as 1", schedule 40.</p> <p>3.17 In case of Air Ejector with Vacuum pump, total package power consumption with Ejector operation and without Ejector operation shall be furnished.</p> <p>3.18 The tapping for "Level Indicator" &amp; "Level Switch" for separator tank of vacuum pump should be separate and both (LS &amp; LS) should work independently.</p> <p>3.19 The counter flanges, Gaskets etc for flanged connections shall be in the scope of supplier.</p> <p>3.20 Inlet suction connection shall be provided horizontal</p> |                                                                                                     |                                          |                                           |                                                                                                                                                                                                  |
| COPYRIGHT AND CONFIDENTIAL<br>The information on this document is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                     |                                          |                                           |                                                                                                                                                                                                  |
| स्वत्वाधिकार एवं गोपनीय<br>इस दस्तावेज में दी गई सूचना भारत हेवी एलेक्ट्रिकल लिमिटेड की संपत्ति है। इसका प्रयोग एवं प्रकाशकता के बिना ही किसी भी रूप में कदापि न किया जाये।                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                     |                                          |                                           |                                                                                                                                                                                                  |
| दिनांक एवं हस्ताक्षर<br>SIGN & DATE<br>                                                                                          | 23/4/16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                     |                                          |                                           |                                                                                                                                                                                                  |
| सामग्री की सूची<br>INVENTORY NO.<br>P-5770                                                                                                                                                                          | REV. NO: 03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                     | निर्माणकर्ता<br>WORKED BY<br>SHAVEZ KHAN | जांचकर्ता<br>CHECKED BY<br>SHIVA KANT     |  18/4/2016<br> 18/4/16 |



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| निर्माणकर्ता<br>SIGN & DATE                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)</b><br><b>PRODUCT PURCHASE SPECIFICATION</b><br><b>(HEEP: HARIDWAR)</b> |                                       | <b>HE 57016</b> |         |
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| SUPERSEDES<br>INVENTORY                                                                                                                                                                                              | <b>5.0 INSTRUMENTS :</b> <p>a) All instrument shall be suitable for 0-55 deg.C, 0-95% RH and degree of protection IP55.</p> <p>b) Accuracy for pressure /temp. gauges shall be +1% of full scale deflection.</p> <p>c) Temperature element shall be 4 wire PT-100,duplex ,conforming to DIN:437600 or equivalent. Thermowells shall be of SS-316.</p> <p>d) Solenoid valves shall be single coil for all applications.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                   |                                       |                 |         |
| COPYRIGHT AND CONFIDENTIAL<br>The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company | <b>6.0 CONTROL AND INTERLOCK REQUIREMENTS:</b> <p>Automatic Turbine Run up System (ATRS) is being used by Purchaser for the turbine. Pump supplier has to supply all necessary fittings and accessories to enable ATRS to carry out following operations: All process signals from the switches and transmitters etc. (in pump supplier's scope) will be fed to ATRS and command/ signals from ATRS shall be fed to the pump, motors, solenoids etc. (in pump supplier's scope) for carrying out required operations. For further details, refer ATRS/ VACUUM PUMP INTERFACE diagram at Appendix-B.</p> <p>Bidder shall provide all the required instruments, devices, out puts, interfacing equipment etc. as required for completeness of his system and as required to make it compatible with the purchaser's ATRS. The exact requirement shall be finalised with the successful bidder while finalising the logic diagram.</p> <p>The following operations shall be carried out through ATRS:</p> <p>a) Hogging operation for quick evacuation of condenser during turbine start up, up to a predetermined Vacuum.</p> <p>b) Automatic change over from hogging to holding operation at the preset vacuum.</p> <p>c) Automatic starting of the stand by unit in the event of fall in vacuum to a preset value. The range of pressure/vacuum switches and transmitters selected should be suitable for the condenser operating condition.</p> <p>d) Control of anti-cavitation arrangement (Air Ejector) shall be through ATRS (DCS). Vendor to furnish logic and control curves for air ejector operation through DCS. The operation of the cooling water inlet/outlet valves shall be manual (not in pump supplier's scope). All pneumatic valves shall have limit switches for open and closed positions. All switches shall be of 2-SPDT contacts. Repeatability for switches to be <math>\pm 0.5\%</math>.</p> |                                                                                                                   |                                       |                 |         |
| स्वतंत्रता एवं गोपनीय<br>इस दस्तावेज में दी गई जानकारी भारत भारती लिमिटेड का संपत्ति है, इसका प्रयोग अन्य उद्देश्य के लिए बिना भारत भारती लिमिटेड की लिखित अनुमति के नहीं किया जा सकता है।                           | <b>7.0 DRIVE MOTOR:</b> <p>7.1 Drive motors shall be furnished and mounted by the bidder on the pump unit and the complete assembly shipped as one unit. The horse power of the motor shall not be less than 110% of the maximum BHP required at the pump end.</p> <p>7.2 Drive motors shall comply with the specification in Appendix – C.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                   |                                       |                 |         |
| निर्माणकर्ता<br>SIGN & DATE                                                                                                                                                                                          | <b>8.0 QUALITY REQUIREMENTS:</b> <p>The vendor shall prepare &amp; submit detailed Quality Plan in the format prescribed, enclosed with the enquiry, for all items/ components/ equipment being manufactured/ supplied by the vendor.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                   |                                       |                 |         |
| INVENTORY NO.<br>P.5778                                                                                                                                                                                              | REV. NO.: .03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | निर्माणकर्ता<br>WORKED BY<br>SHAVEZ KHAN                                                                          | जांचकर्ता<br>CHECKED BY<br>SHIVA KANT | 12/4/2016       | 18/4/16 |

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| BHEL<br>भारतीय भारती<br>भारतीय भारती                                                                                                                                                                                 | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | HE 57016<br>पृष्ठ 6 का 27<br>Page 6 of 27 |
|                                                                                                                                                                                                                      | <p>The Quality Plan will set out various stages of manufacture, the quality practices &amp; procedures to be followed by them, the relevant reference documents/ standards, acceptance level, inspection records raised etc.</p> <p>The Quality Plan shall be approved by the owner. The owner shall identify customer-hold-points on the final Quality Plan beyond which work shall not proceed without owner's consent in writing. An indicative program of inspection/ test, envisaged by BHEL is given below. This is however not intended to form a comprehensive inspection &amp; testing program, as it is the vendor's responsibility to draw-up &amp; carry out necessary checks from operation, safety and reliability point of view.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                           |
| COPYRIGHT AND CONFIDENTIAL<br>The information on this document is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company. | <p><b>9.0 ROUTINE TESTS:</b></p> <p>9.1 Following minimum tests shall be carried-out:</p> <ol style="list-style-type: none"> <li>All rotating parts of pumps shall be dynamically balanced as per ISO: 1940, G 6.3.</li> <li>Shafts shall be subjected to Ultra-Sonic test. After finish machining, shaft shall be subjected to Magnetic Particle or Dye-Penetrate test. Reference &amp; acceptance norms for NDT to be informed for our review / approval.</li> <li>Pump casings &amp; Heat Exchanger shall be subjected to hydraulic test at 1.5 Times the design pressure or twice the maximum operating pressure for 30 minutes, no leakage allowed.</li> <li>Pump Casing &amp; Impellers shall be subjected to MPE / DPT. Finished pump rotor shall be subjected to dynamic balancing. The complete package shall be subjected to hydraulic pressure and leakage test and shop tested to check inter locks and functional requirements.</li> <li>Each pump shall be tested at supplier's works at full speed and load conditions to demonstrate successful operation and performance in accordance with the design requirements.</li> <li>Functional test of the package for demonstrating that the requisite functions/ interlocks are being performed by the pump and all the accessories.</li> <li>Tests to demonstrate ability to meet the guaranteed performance (refer clause-V of Appendix-D). The tests must be conducted at rated speed and with its corresponding motor. Bidder to submit correction curves, based upon actual test data, if tests are not conducted at rated conditions.</li> <li>Dry Air performance test at 1", 2" &amp; 3" Hg (a) to prove the capacity at guaranteed conditions to be carried out.</li> <li>Type &amp; routine tests for motor as per Appendix-C.<br/>In case type tests on motor duly witnessed by third party have already been carried out then the test reports shall be furnished to BHEL along with the bid for information.</li> <li>Complete equipment and all accessories are subject to visual inspection and witnessing of performance tests by BHEL or its representative at bidder's works. For which at least 45-days advance notice shall be given by the bidder. Complete testing schedule must be furnished within 30 days of letter of intent.</li> <li>The minimum inspection and testing requirement shall conform to the relevant codes/ standards, whether or not specifically mentioned in the specification. The bidder shall give full consideration to the observations of the inspecting agency regarding acceptance of workmanship and or equipment.</li> <li>Completeness of Vacuum pump package to be ensured before shipment of Vacuum pump package.</li> </ol> <p>9.2 <b>TEST REPORT:</b> All test reports shall include applicable acceptance criteria, i.e. the test result and the acceptable value or range. This is to help in reviewing/approving the test results/test reports.</p> |                                           |
| REV. NO: .03                                                                                                                                                                                                         | निर्माणकर्ता<br>WORKED BY<br>SHAVEZ KHAN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | जांचकर्ता<br>CHECKED BY<br>SHIVA KANT     |
| INVENTORY NO.<br>PS 778                                                                                                                                                                                              | 18/4/2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 18/4/16                                   |



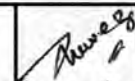
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| दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)</b><br><b>PRODUCT PURCHASE SPECIFICATION</b><br><b>(HEEP: HARIDWAR)</b> |                                          | <b>HE 57016</b><br>पृष्ठ 8 का 27<br>Page 8 of 27 |                                                                                                                                                                                                  |
| SUPERSEDES<br>INVENTORY<br>सामग्री सूची संख्या में<br>अधिवर्धित नहीं है                                                                                                                                                                                                | <p>14.2 <b>RECOMMENDED SPARES:</b><br/>         Bidder shall give separate offer for the recommended maintenance spares for five years of normal operation, considering one set (two pump-units), two sets and three sets basis respectively. Quantity recommended must be indicated separately according to the no. of sets under consideration. Details of spares, with item-wise price break-up, must be given with the offer.</p> <p>14.3 <b>MANDATORY SPARES:</b><br/>         Bidder to quote unit price of the spares, if listed in the Annexure.<br/> <b>NOTE:</b> Selected spares, out of 14.2 &amp; 14.3 above, may be ordered simultaneously with the main order, or at a later date, as may be decided by BHEL.</p> <p>14.4 Each spare item shall be properly identified and marked as per spare order list and dispatched in a separate packing box marked "SPARES".</p> <p>15. <b>GUARANTEES:</b><br/>         The bidder shall meet the guaranteed performance requirements as specified in clause-V of Appendix-D.</p> <p>16. <b>PACKING:</b><br/>         Condenser Air Evacuation unit must be suitably packed to avoid any damage during handling and transport. Packing must be sea-worthy to avoid any damage /corrosion to all the parts during sea shipment. All the loose items should be properly tacked. Details of handling the package shall be clearly indicated on the packing box.<br/>         Packing list, clearly indicating the items to be shipped in each package, must be sent to BHEL, 2 months in advance. All the loose items and the items likely to be loosened during transit, should be listed separately, to ensure completeness of supply.<br/>         Two copies of the packing list must be put at safe places, one inside the package and the other outside the package. Two copies of approved O&amp;M manual must be put at safe place inside the package.</p> |                                                                                                                   |                                          |                                                  |                                                                                                                                                                                                  |
| COPYRIGHT AND CONFIDENTIAL<br>The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company                                                   | <p>17.0 <b>AFTER SALES SERVICE:</b></p> <p>17.1 To resolve the Vacuum pump related issues, vender to visit site two times in two years after expiry of guarantee period, free of cost. Each visit shall be of two days.</p> <p>17.2 Bidder to indicate clearly the specific arrangement made by him for after sales service in India.</p> <p>17.3 Bidder shall offer supervision for commissioning of Vacuum Pump package. The supervision work shall be applicable for the first time commissioning of the Vacuum Pump package for each TG set. Service Engineer of the vendor should directly visit site, for which visit date shall be finalized with Purchase/Commercial /Site. For successful commissioning of Vacuum pump package, vender to supervise at site for four working days per Vacuum pump package free of cost.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                   |                                          |                                                  |                                                                                                                                                                                                  |
| स्वत्व अधिकार एवं गोपनीय<br>यह दस्तावेज भारत भारती उपकरण लिमिटेड की संपत्ति है। इसका प्रयोग अन्य किसी भी उद्देश्य के लिए बिना लिखित अनुमति के नहीं किया जा सकता है। इस दस्तावेज में शामिल की गई जानकारी को बिना लिखित अनुमति के किसी भी तृतीय पक्ष को नहीं देना चाहिए। | <p>18.0 <b>DATA / DOCUMENT REQUIRED WITH THE BID:</b><br/>         Bidder shall invariably furnish six prints of the following documents in English language:</p> <p>18.1 General arrangement drawing of vacuum pump package, showing overall dimensions, maintenance clearances required mounting and connection details, weights: empty/operating/ flooded/ motor/ bare pump, list of items with their location in the package unit, foundation bolts and their grouting details etc.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                   |                                          |                                                  |                                                                                                                                                                                                  |
| दिनांक एवं हस्ताक्षर<br>SIGN & DATE<br>                                                                                                                                             | REV. NO.: 03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                   |                                          |                                                  |                                                                                                                                                                                                  |
| सामग्री सूची संख्या<br>INVENTORY NO.<br>P-5778                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                   | निर्माणकर्ता<br>WORKED BY<br>SHAVEZ KHAN | जांचकर्ता<br>CHECKED BY<br>SHIVA KANT            |  18/4/2016<br> 18/4/16 |

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| निमांक एवं दिनांक<br>SIGN & DATE<br><br>सापेक्ष सूची संख्या<br>INVENTORY NO.<br>P-5770 |  | <b>उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)</b><br><b>PRODUCT PURCHASE SPECIFICATION</b><br><b>(HEEP: HARIDWAR)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             | <b>HE 57016</b><br>पृष्ठ 9 का 27<br>Page 9 of 27                                                 |            |
|                                                                                        |                                                                                  | <p>18.2 Sectional arrangement drawing of the pump showing all components with their material specification numbers etc.</p> <p>18.3 Flow diagram indicating terminal points and scope of supply with all the Equipments/instruments/switches/valves etc. being supplied.</p> <p>18.4 Logic diagram showing sequence of operation, with the conditions to be fulfilled, from initial start to stand by pump start and stop.</p> <p>18.5 Appendix-D &amp; E duly filled in for the pump &amp; the motor data respectively.</p> <p>18.6 Performance Characteristic curves:<br/>           a) Dry air Capacity of pump (saturated with water vapor at 4.17 deg.C under cooling) vs. Suction Pressure, at rated speed and different ITDs at and around the rated ITD (saturation temperature corresponding to suction pressure minus CW inlet temperature to the Heat Exchanger).<br/>           b) Suction pressure vs. cooling water inlet temperature to heat exchanger, for different air leakage rates, covering at least 2.5 times the design air handling capacity of the pump at 1"Hg abs. suction pressure.<br/>           c) Power consumption vs. suction pressure at rated ITD.<br/>           d) Time vs Vacuum, while evacuating the volume specified in the Annexure.<br/>           e) Dry air performance test curves and seal water temp. correction curves.<br/>           f) Hogging performance curve.<br/>           g) Holding performance curve.</p> <p>18.7 Saturated air test results and visual cavitation test result with procedure and scheme, if such tests are already carried out on proposed size &amp; model pump.</p> <p>18.8 Wiring diagram for all devices connected to the terminal box feedback to ATRS and control signals from ATRS, clearly showing the break-up of the scope of supply between the bidder and the purchaser (refer Appendix-B).</p> <p>18.9 Bill of materials of all instruments (instrument schedule) along with the manufacture's catalogues and data sheets for critical item and also the recommended set point.</p> <p>18.10 Complete list of feeder loads (power supply requirements for various drives) including solenoid valves.</p> <p>18.11 List of startup, recommended and mandatory (if specified in the Annexure) spares, with unit price and quantity installed per pump.</p> <p>18.12 Quality Plan on BHEL format along with the testing procedures.</p> <p>18.13 Operation &amp; control philosophy of vacuum pump package, including all control, interlocks &amp; etc.</p> <p>18.14 Data as asked in PQR for Vacuum pump, Vacuum pump Motor &amp; Seal water recirculation pump.</p> <p><b>19.0 DATA / DOCUMENT AFTER AWARD OF ORDER :</b></p> <p>19.1 Following final data/ documents are required within 3-weeks after the placement of order in 15-copies and 3 CD ROMs per project duly incorporating BHEL comments:--</p> <p>19.1.1 General arrangement drawing of the pump unit, along with a reproducible, as per clause 18.1 above.</p> <p>19.1.2 Sectional arrangement drawing as per clause 18.2 above.</p> <p>19.1.3 Flow diagram as per clause 18.3 above.</p> <p>19.1.4 Logic diagram as per clause 18.4 above.</p> <p>19.1.5 Appendix-D &amp; E , duly filled in, for the pump &amp; the motor data respectively.</p> <p>19.1.6 Characteristic curves:<br/>           a) Performance characteristic curves as per clause 18.6 above.<br/>           b) Motor characteristic curves as per clause V of Appendix-E.</p> <p>19.1.7 General arrangement drawing of the motor indicating overall dimensions, weights (rotor, total), fixing details, rotor removal space etc.</p> |             |                                                                                                  |            |
| REV. NO.: 03                                                                           |                                                                                  | निर्माणकर्ता<br>WORKED BY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | SHAVEZ KHAN | जांचकर्ता<br>CHECKED BY                                                                          | SHIVA KANT |
|                                                                                        |                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |             | <div style="text-align: right;">             18/4/2016<br/>             18/4/16           </div> |            |

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| दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                   |  | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                          | HE 57016<br>पृष्ठ 10 का 27<br>Page 10 of 27 |                      |
| सुपरसेड्स<br>INVENTORY                                                                                                                                                                                                | सामग्री सूची नम्बर को<br>अतिरिक्तित्व करण है                                     | 19.1.8 Foundation drawing clearly indicating loads on each foundation bolt (due to weight and dynamic loads), pocket size, foundation bolt etc., grouting required etc.<br>19.1.9 Instrument schedule along with manufacture's catalogues and data sheets.<br>19.1.10 List of feeder loads as per clause 18.10 above.<br>19.1.11 General and sectional arrangement drawing of seal water recirculation pump & heat exchanger.<br>19.1.12 Wiring diagram as per clause 18.8 above.<br>19.1.13 General arrangement drawing and wiring diagram of anti-cavitation device (if provided)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                          |                                             |                      |
| COPYRIGHT AND CONFIDENTIAL<br>The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company. |                                                                                  | <b>NOTE:</b> Exchange of technical information from the date of receipt of quotation till placement of order may warrant changes in drgs./ data furnished during the bid, in such event "preliminary data/ document" shall be furnished as per clause 19.0 above in 3-copies for our review/ comments /approval within 2-weeks of LOI. Final data/ documents (in 20-copies) to be supplied subsequently as per clause 19.0 above, after incorporating our comments, if any.<br>19.1.14 To assess progress at different stages of manufacturing, testing & dispatch of equipment/major parts/ spares, L2 network shall be furnished.<br>19.1.15 Thermal design calculation for Heat exchangers: Vender should furnish Thermal design calculation for Heat exchangers.<br>19.1.16 Hogging capacity calculation for Vacuum pump package.<br>19.1.17 Holding capacity calculation at 1", 2", & 3" Hg-a for Vacuum pump package.<br>19.1.18 Performance test calculation at 1", 2", & 3" Hg-a.<br>19.2.0 <b>Quality assurance document package :</b><br>Following certificates /inspection reports, NDT reports (in 3-copies per pump) are required after test. Equipment should be dispatched only after acceptance of the test certificates.<br>19.2.1 Material test certificates of Pump casing, shaft, impeller, sleeves of main pump, tubes, shell and water boxes of heat exchanger including Chemical, Mechanical, NDT& Hydro test as applicable.<br>19.2.2 Hydraulic test certificates of main and seal water pump heat exchanger, valves etc.<br>19.2.3 Performance test results of Seal water recirculation pump.<br>19.2.4 Performance test readings along with test set up and procedure for main vacuum pump with correction curves/factors and calculation to prove the capacity of the pump.<br>19.2.5 Test result of main Motor as per appendix C.<br>19.2.6 Test certificate for Seal water recirculation pump motor.<br>19.2.6 Test certificates of all switches, solenoid valves, all valves, calibration certificates of all instruments.<br>19.2.7 Other Certificates/ Reports required as per approved quality plan: |                                          |                                             |                      |
| स्वसाक्षिकार एवं गोपनीय<br>इस दस्तावेज में दी गई प्रकृत जानकारी केवल लोडिंग/उपकरण निर्माण/सिस्टम की जानकारी है इसका प्रयोग एवं प्रसारण अन्य किसी भी प्रकार से बिना लिखित अनुमति के किये जाने पर दंडित होगा।           |                                                                                  | 19.3 <b>Installation Operation and maintenance instructions:</b><br>a. Following shall be mentioned on first page of O & M manual.<br>i) Project Name Vacuum Pump serial number.<br>ii) First time commissioning shall be done by vendor representative in presence of BHEL site representative.<br>iii) Site to inform BHEL Haridwar well in advance for arranging of vendor visit for commissioning of Vacuum pump package.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                          |                                             |                      |
| दिनांक एवं हस्ताक्षर<br>SIGN & DATE<br>23/4/16                                                                                                                                                                        |                                                                                  | REV. NO: 03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | निर्माणकर्ता<br>WORKED BY<br>SHAVEZ KHAN | जांचकर्ता<br>CHECKED BY<br>SHIVA KANT       | 18/4/2016<br>18/4/16 |
| सामग्री सूची नम्बर<br>INVENTORY NO.<br>P-5778                                                                                                                                                                         |                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                          |                                             |                      |

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| BHEL<br>भारतीय भारी विद्युत निगम लि.<br>BHEL<br>भारतीय भारी विद्युत निगम लि.                                                                                                                                         | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  | HE 57016                        |  |
|                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  | पृष्ठ 11 का 27<br>Page 11 of 27 |  |
| SUPERSEDES<br>INVENTORY<br>मासूमि सूची संख्या को<br>अधिलिखित करना है                                                                                                                                                 | b. Pre commissioning check list shall be included at start of the Vacuum pump O & M manual.<br>c. Bidder shall furnish one CD ROMS of IOM for pump, motor & all the accessories under his scope clearly indicating the models and sizes supplied with the unit, for each site/ BHEL contract for BHEL approval.<br>d. Bidder shall furnish 20 copies & 3 CD ROM's of approved O & M manual per project.<br>e. Two copies of the approved O & M manual, shall be sent along with Vacuum pump package.                                                                                                   |  |                                 |  |
| COPYRIGHT AND CONFIDENTIAL<br>The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company | <b>20.0 ADDITIONAL TECHNICAL INFORMATION:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |                                 |  |
|                                                                                                                                                                                                                      | 20.1 APPENDICES: The following appendices, as referred in subsequent pages of this specification, are the integral part of this specification and shall be complied with fully:<br>APPENDIX – A : System Flow Diagram<br>APPENDIX – B : ATRS – Vacuum Pump Interface<br>APPENDIX – C : Induction Motor Specification<br>APPENDIX – D : Vacuum Pump Data Sheet & characteristics curves<br>APPENDIX – E : Motor Data Sheet & characteristics curves                                                                                                                                                     |  |                                 |  |
| स्वत्वाधिकार एवं गोपनीय<br>इस दस्तावेज में की गई प्रतियां भारत की भारी विद्युत निगम लि. की संपत्ति हैं। प्रत्येक प्रतिका प्रतिलिखित करने से किसी भी तरह प्रयोग को कि इसकी के लिए से हानिकारक हो न किता               | <b>20.2 ANNEXURE:</b><br><br>The technical requirements relating to specific design conditions, water-chemistry, special material requirements of client, capacity or any other special requirement from the client shall be supplied as "ANNEXURE".<br>This information would vary from contract to contract and shall be treated as integral part of this specification .<br>To avoid any ambiguity, all the sheets of the ANNEXURE for each order/ contract shall be identified as under:<br>ANNEXURE to HE57016 SHEET ----- OF -----<br>( -----*----- ) * name of project shall be indicated here. |  |                                 |  |
|                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |                                 |  |
| SIGN & DATE<br>23/4/16                                                                                                                                                                                               | REV. NO: .03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |                                 |  |
| मासूमि सूची संख्या<br>INVENTORY NO.<br>P-5778                                                                                                                                                                        | निर्माणकर्ता<br>WORKED BY<br>SHAVEZ KHAN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  | 18/4/2016                       |  |
|                                                                                                                                                                                                                      | जांचकर्ता<br>CHECKED BY<br>SHIVA KANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  | 18/4/16                         |  |

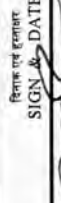
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| सामग्री सूची संख्या<br>INVENTORY NO.<br>P-5778                                    |  | दिनांक एवं हस्ताक्षर<br>SIGN & DATE<br>23/4/16                                               |  | स्वत्वाधिकार एवं गोपनीय<br>इस प्रलेख में दी गई सूचना भारत हेवी एलेक्ट्रिकल्स लिमिटेड की सम्पत्ति है इसका प्रयोग एवं अव्यवस्थापन के बिना किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाय। |  | COPYRIGHT AND CONFIDENTIAL<br>The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company |  | सामग्री सूची संख्या को अधिकृत करता है<br>SUPERSEDES INVENTORY |  | दिनांक एवं हस्ताक्षर<br>SIGN & DATE |  |
| REV. NO.: 03                                                                      |  | <div>CONDENSER AIR EVACUATION SYSTEM</div> <div></div>                                       |  |                                                                                                                                                                                                            |  |                                                                                                                                                                                                                      |  |                                                               |  |                                     |  |
| निर्माणकर्ता<br>WORKED BY<br>जांचकर्ता<br>CHECKED BY<br>SHAVEZ KHAN<br>SHIVA KANT |  | SYSTEM FLOW DIAGRAM                                                                          |  |                                                                                                                                                                                                            |  |                                                                                                                                                                                                                      |  |                                                               |  |                                     |  |
| 18/4/16                                                                           |  | APPENDIX-A                                                                                   |  |                                                                                                                                                                                                            |  |                                                                                                                                                                                                                      |  |                                                               |  |                                     |  |
| 18/4/2016                                                                         |  | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br>PRODUCT PURCHASE SPECIFICATION<br>(HEEP: HARIDWAR) |  |                                                                                                                                                                                                            |  |                                                                                                                                                                                                                      |  |                                                               |  |                                     |  |
|                                                                                   |  | HE 57016<br>पृष्ठ 12 का 27<br>Page 12 of 27                                                  |  |                                                                                                                                                                                                            |  |                                                                                                                                                                                                                      |  |                                                               |  |                                     |  |

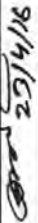
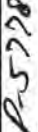
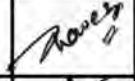
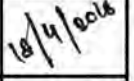
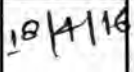
|                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                     |                                          |                                                                                                 |  |
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| चिह्न एवं दिनांक<br>SIGN & DATE                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR) |                                          | HE 57016                                                                                        |  |
|                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                     |                                          | पृष्ठ 13 का 27<br>Page 13 of 27                                                                 |  |
| सुपरसेड<br>INVENTORY                                                                                                                                                                                                                       | <div style="display: flex; justify-content: space-between;"> <div> <b>ITEM DESCRIPTION</b> </div> <div> <b>APPENDIX-A</b> </div> </div> <ol style="list-style-type: none"> <li>1. VACUUM PUMP, 2-STAGE (OR 1-STAGE)</li> <li>2. MOTOR</li> <li>3. COUPLING</li> <li>4. FOUNDATION BOLT+NUT+WASHER</li> <li>5. SEPARATOR</li> <li>6. LOW LEVEL SWITCH WITH ISOLATION VALVE</li> <li>7. HIGH LEVEL SWITCH WITH ISOLATION VALVE</li> <li>8. MAKE UP WATER INLET VALVE (SOLENOID VALVE -24VDC)-SINGLE COIL</li> <li>9. MAKE UP WATER BY PASS VALVE</li> <li>10. LEVEL INDICATOR WITH ISOLATION VALVE</li> <li>11. OVER FLOW SYPHON LOOP</li> <li>12. SYSTEM INLET VALVE WITH OPEN/CLOSE LIMIT SWITCH</li> <li>13. PRESSURE TRANSMITTER FOR INLET VALVE OPERATION.</li> <li>14. PRESSURE TRANSMITTER FOR STAND BY PUMP OPERATION.</li> <li>15. PRESSURE INDICATOR WITH VALVE (VACUUM GAUGE)</li> <li>16. SEAL WATER FLOW SWITCH CUM INDICATOR</li> <li>17. AIR FLOW METER (ROTAMETER)</li> <li>18. AIR OUTLET CHECK VALVE WITH HANDLE</li> <li>19. JUNCTION BOX (REFER DRG.NO.)</li> <li>20. TEMPERATURE INDICATOR</li> <li>21. AIR EJECTOR (IF APPLICABLE)</li> <li>22. TEMPERATURE SWITCH</li> <li>23. PRESSURE INDICATOR</li> <li>24. PLC FOR EJECTOR (IF APPLICABLE)</li> <li>25. HEAT EXCHANGER</li> <li>26. SEAL WATER PUMP WITH MOTOR</li> <li>27. SOLENOID VALVE (24VDC) FOR INLET VALVE (SINGLE COIL)</li> <li>28. PR. TRANSMITTER FOR EJECTOR (IF APPLICABLE)</li> <li>29. TEMP. TRANSMITTER FOR SEAL WATER FOR EJECTOR (IF APPLICABLE)</li> <li>30. BY-PASS VALVE FOR EJECTOR (IF APPLICABLE)</li> <li>31. MOTIVE AIR VALVE FOR EJECTOR (IF APPLICABLE)</li> <li>32. SOLENOID VALVE (24V DC) FOR EJECTOR (IF APPLICABLE)-SINGLE COIL</li> <li>33. SOLENOID VALVE (24V DC) FOR EJECTOR (IF APPLICABLE) -SINGLE COIL</li> <li>34. TEMPERATURE TRANSMITTER IN SUCTION LINE</li> <li>35. DUPLEX FILTER WITH DP SWITCH&amp;DPI</li> <li>36. TEMPORARY INLET SCREEN</li> <li>37. PRESSURE INDICATOR</li> <li>38. TAPPING FOR PRESSURE INDICATOR</li> <li>39. TEMPERATURE TRANSMITTER IN SEAL WATER LINE</li> <li>40. PRESSURE INDICATOR WITH VALVE</li> <li>41. AIR FILTER REGULATOR.</li> </ol> |                                                                                                     |                                          |                                                                                                 |  |
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| स्वत्वाधिकार एवं गोपनीय<br>इस दस्तावेज में दी गई प्रकृत प्रारण हेतु लैबोरिस्टिकल विनिर्देश की सम्पत्ति है इसका प्रयोग एवं प्रसारण केवल केवल के निर्देशों के बिना ही किया जा सकता है अन्यथा इसके उपयोग से किसी भी तरह का नुकसान हो सकता है। |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                     |                                          |                                                                                                 |  |
| चिह्न एवं दिनांक<br>SIGN & DATE<br>23/4/18                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                     |                                          |                                                                                                 |  |
| सामग्री सूची संख्या<br>INVENTORY NO.<br>125728                                                                                                                                                                                             | REV. NO: 03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                     | निर्माणकर्ता<br>WORKED BY<br>SHAVEZ KHAN |  18/4/2018 |  |
|                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                     | जांचकर्ता<br>CHECKED BY<br>SHIVA KANT    |  18/4/18   |  |

|                                      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |                                                                                                                                                                                                            |  |                                                                                                                                                                                                                      |  |                                                                 |  |                                     |  |
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| सामग्री सूची संख्या<br>INVENTORY NO. |  | दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  | स्वत्वाधिकार एवं गोपनीय<br>इस प्रलेख में दी गई सूचना भारत हेवी एलेक्ट्रिकल्स लिमिटेड की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग जो कि कंपनी के हित में हानिकारक हो न किया जाए। |  | COPYRIGHT AND CONFIDENTIAL<br>The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company |  | सामग्री सूची संख्या को अधिकृतित करता है<br>SUPERSEDES INVENTORY |  | दिनांक एवं हस्ताक्षर<br>SIGN & DATE |  |
| P-5778                               |  | 22/4/16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |                                                                                                                                                                                                            |  |                                                                                                                                                                                                                      |  |                                                                 |  |                                     |  |
| REV. NO.: 03                         |  | <div>ATRS/VACUUM PUMP INTERFACE</div> <div>APPENDIX-B</div> <div><div>CONTROL ROOM</div><div>CONTROL EQUIPMENT ROOM</div><div>TURBINE HALL</div><div>Vendor's scope</div></div> <div><div>ATRS Console insert with push button stations</div><div>Manual command to start/stop Sequence control</div><div>Manual command to start/stop Pump/valve</div><div>Status check - back of Pump/valve</div><div>ALARM WINDOWS</div><div>(A)</div><div>on/off Pump (command)</div><div>on/off sol.valve (command)</div><div>on/off Make up sol.valve (command)</div><div>on/off Recir pump (command)</div><div>on/off Pump (check back)</div><div>on/off sol.valve (check back)</div><div>on/off Makeup sol.valve (check back)</div><div>on/off Recir pump (check back)</div><div>(A)</div><div>Terminal Block</div><div>Alarm contacts 1COC each.</div><div>1COC for differential pressure across system inlet valve</div><div>1 COC for operator water level low</div><div>1 COC for system vacuum switch</div><div>1 COC for system inlet valve close</div><div>1 COC for system inlet valve open</div><div>MAIN PUMP (typ.)</div><div>RECIR. PUMP</div><div>sol.valve (typ.)</div><div>To system inlet valve</div><div>Makeup valve</div><div>MOTOR CONTROL CENTRE</div><div>220 V DC or AS SPECIFIED</div><div>415 V AC</div></div> <div><div>Legend : COC = Change over contact</div><div>Vaccum pump unit</div></div> |  |                                                                                                                                                                                                            |  |                                                                                                                                                                                                                      |  |                                                                 |  |                                     |  |
|                                      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |                                                                                                                                                                                                            |  |                                                                                                                                                                                                                      |  |                                                                 |  |                                     |  |
|                                      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |                                                                                                                                                                                                            |  |                                                                                                                                                                                                                      |  |                                                                 |  |                                     |  |
| निर्माणकर्ता<br>WORKED BY            |  | SHAVEZ KHAN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                                                                                                                                                                                            |  |                                                                                                                                                                                                                      |  |                                                                 |  |                                     |  |
| जांचकर्ता<br>CHECKED BY              |  | SHIVA KANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |                                                                                                                                                                                                            |  |                                                                                                                                                                                                                      |  |                                                                 |  |                                     |  |
| 18/4/16                              |  | 18/4/16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |                                                                                                                                                                                                            |  |                                                                                                                                                                                                                      |  |                                                                 |  |                                     |  |
|                                      |  | HE 57016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |                                                                                                                                                                                                            |  |                                                                                                                                                                                                                      |  |                                                                 |  |                                     |  |
|                                      |  | पृष्ठ 14 का 27                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |                                                                                                                                                                                                            |  |                                                                                                                                                                                                                      |  |                                                                 |  |                                     |  |
|                                      |  | Page 14 of 27                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                                                                                                                                                                                                            |  |                                                                                                                                                                                                                      |  |                                                                 |  |                                     |  |



# उत्पाद क्रय विनिर्देश (शीप : हरिद्वार) PRODUCT PURCHASE SPECIFICATION (HEEP: HARDWAR)

|                                                                                                                                                                                                                      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |                                       |  |
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| मी एम डी एल<br>                                                                                                                      |  | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  | HE 57016                              |  |
| SIGN & DATE<br>                                                                                                                    |  | पृष्ठ 15 का 27<br>Page 15 of 27                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |                                       |  |
| SUPERSEDES<br>INVENTORY                                                                                                                                                                                              |  | <b>APPENDIX-C</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |                                       |  |
| सामग्री सूची संख्या की<br>अधिकतम सीमा                                                                                                                                                                                |  | <b>INDUCTION MOTOR – SPECIFICATION</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                                       |  |
| COPYRIGHT AND CONFIDENTIAL<br>The information on this document is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company. |  | <b>1.0 SCOPE:</b><br><br>This specification covers the design, manufacture, painting, inspection and testing at vendor's / sub-vendor's works of three phase squirrel cage induction motor. These requirements shall however be read along with the requirements of the respective driven equipment being supplied under the specification.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |                                       |  |
| स्वत्व अधिकार एवं गोपनीय<br>इस प्रयोग से की गई प्रतियां भारत हीवी इलेक्ट्रिकल लिमिटेड की संपत्ति हैं प्रत्येक प्रतिय पर प्रकटपत्र रूप में किसी भी तरह प्रयोग को कि कंपनी के हित में हानिकारक हो न किया जाए।          |  | <b>2.0 CODES AND STANDARDS :</b><br><br>2.1 All motors shall conform to the latest applicable standards of IS and IEC, except where modified or supplemented by this specification.<br><br>2.2 Motors shall conform to the latest revisions of the following Indian Standards or equivalent IEC/ VDE Standards for the applicable motor type rating.<br><br>IS : 325 Specification for three phase induction motors.<br><br>IEC : 60034 Specification for three phase induction motors.<br><br>IS : 1231 Dimensions of three phase foot mounted induction motors.<br><br>IS : 2253 Types of construction and mounting of motors.<br><br>IS : 3202 Code of practice for climate proofing of electrical equipment.<br><br>IS : 4029 Guide for testing three phase induction motors.<br><br>IS : 4691 Degree of protection provided by enclosure for electrical machines.<br><br>IS : 4722 Specification of rotating electrical machines.<br><br>IS : 6362 Designation of method of cooling of rotating electrical machines<br><br>IS : 12075 Mechanical vibration of rotating electrical m/s.(IEC: 60034-14)<br><br>IS : 12065 Permissible limits of noise level for rotating electrical machines<br><br>IS : 12615 Induction motors-Energy efficient,three-phase, squirrel cage specification. (IEC:60034-30) |  |                                       |  |
| SIGN & DATE<br>22/4/16                                                                                                                                                                                               |  | 2.3 Other standards, which ensure equal or better quality than specified, may be acceptable, however differences are to be brought out clearly.<br>2.4 The design, manufacture, installation and performance of motors shall conform to the provision of latest India Electricity Act and Indian Electricity Rules. Nothing in these specifications shall be construed to relieve the contractor of this responsibility.<br>2.5 Degree of protection for motors and cable-boxes shall be IP54 or Better.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |                                       |  |
| सामग्री सूची संख्या<br>INVENTORY NO. 25778                                                                                                                                                                           |  | REV. NO: .03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  | निर्माणकर्ता<br>WORKED BY SHAVEZ KHAN |  |
|                                                                                                                                                                                                                      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  | जांचकर्ता<br>CHECKED BY SHIVA KANT    |  |
|                                                                                                                                                                                                                      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  | 18/4/16                               |  |

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| दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR) |                                          | HE 57016<br>पृष्ठ 16 का 27<br>Page 16 of 27                                           |                                                                                       |
| SUPERSEDES<br>INVENTORY<br>मासिकी सूची में<br>अतिरिक्त क्रमांक है                                                                                                                                                     | <p><b>3.0 <u>DRIVEN EQUIPMENT:</u></b></p> <p>a) Motors shall be rated for continuous duty (S1) for giving satisfactory operation for the application and duty as required by the driven equipment at all conditions of operation.</p> <p>b) Maximum continuous motor rating shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage &amp; frequency variations.</p> <p><b>4.0 <u>PERFORMANCE AND CHARACTERISTICS:</u></b></p> <p>4.1 Motors shall be capable of giving rated output without reduction in expected life span when operated continuously in the system having the following particulars.</p> <p>a) Rated voltage: 415 Volts (3 phase, 50 Hz)</p> <p>b) Variation in voltage + 10 %</p> <p>c) Variation in frequency + 5 %</p> <p>d) Combined voltage &amp; frequency variation 10 % (sum of absolute values)</p> <p>4.2 Motors shall be suitable for full direct on line starting. These shall be capable of starting and accelerating to rated speed along with the driven equipment without exceeding the acceptable winding temperature, even when the supply voltage is 80% of the rated voltage, the permissible voltage specified above.</p> <p>4.3 The locked rotor current shall not exceed 600% of rated full load current inclusive of tolerances.</p> <p>4.4 Motors shall be designed as to be capable of withstanding the voltage and torque stresses developed due to the difference between the motor residual voltage and incoming voltage equal to 150% of rated voltage during fast changeover of buses.</p> <p>4.5 Motors shall be capable of developing rated full load torque even when the supply voltage drops to 70% of rated voltage. Such operation is envisaged for a period of one second. The pull out torque of the motor to meet this requirement shall not be less than 205% of full load torque.</p> <p>4.6 Motors shall be designed to with stand 120% of rated speed for two minutes without any mechanical damage in either direction of rotation.</p> <p>4.7 Motors shall be capable of satisfactory operation of full load at a supply voltage of 80% of rated voltage for 5-minutes, commencing from not condition.</p> <p>4.8 The locked rotor withstand time under hot condition at rated voltage shall be at least 2.5 seconds more than the starting time.</p> <p>4.9 The ratio of locked rotor KVA at rating voltage to rated KW shall not exceed the following (without any further tolerance)</p> <p>a) Below 110 KW : 11.0</p> <p>b) From 110 KW up to 200 KW : 9.0</p> <p>4.10 Motors when started with the drive imposing its full starting torque under the specified supply voltage variations (see clause 4.1) shall be capable of withstanding at least two starts in succession under the specified conditions of load, torque and inertia, with the motor immolate at its normal running temperature. The motors shall also be suitable for three equally spread starts per hour under above specified supply conditions.</p> <p>4.11 Operational requirements: Starting Time:-<br/>For motors with starting time up to 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time. For motors with starting time more than 20 secs. and up to 45 secs at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than the starting time.</p> <p>4.12 Motor shall be energy efficient, Efficiency class-EFF2, conforming to IS:12615, or High efficiency (IE3) as per IEC:60034-30</p> |                                                                                                     |                                          |                                                                                       |                                                                                       |
| COPYRIGHT AND CONFIDENTIAL<br>The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                     |                                          |                                                                                       |                                                                                       |
| स्वाक्षरितकार एवं गोपनीय<br>इस प्रतीक से की गई प्रतियां भारत के ही एलेक्ट्रिकल लिमिटेड की संपत्ति हैं। इनका उपयोग एवं प्रसारण के बिना या बिना की प्रतियां को बिना कम्पनी के लिखित से अधिकार के ही न किया जाय।         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                     |                                          |                                                                                       |                                                                                       |
| दिनांक एवं हस्ताक्षर<br>SIGN & DATE<br>                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                     |                                          |                                                                                       |                                                                                       |
| मासिकी सूची संख्या<br>INVENTORY NO.<br>                                                                                            | REV. NO: 03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                     | निर्माणकर्ता<br>WORKED BY<br>SHAVEZ KHAN |  |  |
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## 5.0 INSULATION AND WINDINGS:

All insulated winding conductors shall be of copper. Class of insulation must be at least class – B. The winding shall be suitable for hot, humid, tropical climate with ambient temperature of 50.0 deg C. The insulation shall be given Non –hygroscopic oil resistant flame resistant fungicidal and tropical treatment as per IS: 3202.

## 6.0 TEMPERATURE RISE:(For Air Cooled motors)

The maximum permissible temperature rise over the ambient temperature of 50 deg.C shall be limited to 70 deg C, by resistance method, for class B insulation.

## 7.0 CONSTRUCTIONAL FEATURES:

- 7.1 The motor construction shall be suitable for easy disassembly and assembly. The enclosure shall be sturdy and shall permit easy removal of part of the motor for inspection /repairs.
- 7.2 Rotor shall be properly balanced so as to keep the vibration under running condition within the limits specified in relevant standards.
- 7.3 Rotors shall be so designed as to keep the combined critical speed with the driven equipment away from the running speed by at least 20%.
- 7.4 Two independent earthing points shall be provided on opposite side of the motor for bolted connection for owner's earthing conductor. Size of earthing conductor is to be specified.
- 7.5 Motors shall have drain plugs so located that they will drain water resulting from condensation or other causes from all pockets in the motor casing.
- 7.6 Motors weighing more than 25Kg. shall be provided with eye bolt lugs or other suitable means to facilitate lifting.
- 7.7 Motor shall be either TEFC (Totally enclosed fan cooled) or CACA (close Air circuit Air cooled) type.
- 7.8 Noise Level & Vibration Level shall be within limit as per IS: 12065 & IS: 12075 respectively. Motors shall withstand vibrations produced by the driven equipment.
- 7.9 System fault level may be considered as 50 KA RMS (max) for one second.
- 7.10 The spacing between gland plate and center of terminal stud shall be as follows:

Motor rating

### Dimension of terminal boxes

( min distance between centre of stud and gland plate in mm)

- |                             |     |
|-----------------------------|-----|
| a) Above 90 KW-upto 125 KW  | 331 |
| b) Above 125 KW-upto 200 KW | 203 |

## 8.0 BEARINGS:

- 8.1 Greased ball and/or roller bearings shall be of reputed make. The minimum standard life of bearings shall not be less than 30,000 working hours taking all motor and driven loads into account. These shall be pressure grease gun lubricated type, fitted with grease nipples and shall have relief device.
- 8.2 Bearing and their housings shall be so constructed that loss of grease and its creeping along the shaft into motor housing is prevented. It shall also prevent dirt and water from getting into the motor.

## 9.0 SPACE HEATERS:

- 9.1 Space heaters shall be provided for all motor above 30 KW capacity suitable for 240 Volt single phase, 50Hz, supply.
- 9.2 Terminals of the space heaters shall be brought out on a separate terminal box.

## 10.0 TERMINAL BOX AND LEADS:

- 10.1 Separate terminal box should be provided for each of the following:
- a) Stator leads
  - b) Space heaters

REV. NO: .03

निर्माणकर्ता  
WORKED BY

SHAVEZ KHAN

जांचकर्ता  
CHECKED BY

SHIVA KANT

12/4/2010

18/4/16

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| दिनांक एवं हस्ताक्षर<br>SIGN & DATE  |                                                                                                                                     | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | HE 57016                            |             |
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| सामग्री सूची संख्या<br>INVENTORY NO. | सामग्री सूची संख्या के अधिनीतिकरण क्रमांक है                                                                                                                                                                        | SUPERSEDES INVENTORY                                                                                | 10.2 Terminal boxes shall be of weather proof construction designed for outdoor service. To eliminate entry of dust and water, gaskets of neoprene or approved equivalent, shall be provided at cover joints and between box and motor frame.<br>10.3 Terminal box shall be suitable for both top and bottom entry of cables.<br>10.4 Unless otherwise approved, the terminal box shall be capable of being turned through 360 degree in steps of 90 degrees.<br>10.5 All 415 volts terminal boxes shall be suitable for receiving 1.1 KV grade PVC insulated, PVC sheathed cables conforming to IS-1554.<br>10.6 Suitable tinned brass compression type cable glands and cable lugs shall be supplied by the contractor to match owner's cables.<br>10.7 Marking of all terminals shall be in accordance with IS-4728.<br>10.8 Motor terminal box shall be supplied with cable glands of Nickel- Chromium plated brass, heavy duty, double compression, conforming to BS: 6121, cable lugs suitable for stranded Aluminium cable and non-magnetic gland plate.<br><b>11.0 RATING PLATES:</b><br>11.1 Rating plates shall be provided for all motors, giving the details as called in the relevant standard e.g. IS:325, for three-phase squirrel cage induction motor.<br>11.2 In addition to above, the rating plates shall indicate the following:<br>a) Temperature rise in deg.C under normal working conditions.<br>b) Phase sequence corresponding to the direction of rotation for the application.<br>c) Bearing identification number (in case of ball /roller bearing) and recommended lubricant.<br><b>12.0 TESTS:</b><br>12.1 Motors, after complete assembly shall be subjected to both type and routine tests as per IS:325 standards. If however, the motor being supplied is a standard one, type test results carried out earlier on prototype or on any other machine of the same frame size duly witnessed by third party shall be furnished along with the bid for BHEL informations.<br>12.2 In addition, the following tests shall also be carried out.<br>a) Motors shall be designed to withstand 1.2 times the maximum rated speed for 2 minutes duration as specified in IS: 325.<br>b) Measurement of vibration shall be carried out as specified in IS: 12075.<br>12.3 Results of routine tests and type tests in accordance with the relevant standards, on all motors, shall be furnished in 4 copies to BHEL for their scrutiny and approval.<br>12.4 Type Test (electrical Motor) : Type test reports, duly witnessed by third party for the tests as per IS or IEC standards (mentioned above) shall be submitted for LT-motors above 20KW. Type tests shall include IR, HV, No load run test & Degree of protection test.<br>12.5 <u>QA and Inspection (Electric motor) :</u><br>Visual /dimension: Y<br>Resistance measurement: Y<br>IR measurement before and after HV test: Y<br>HV test: Y<br>Reduced voltage no load running : Y<br>No load test: Y<br>Phase sequence, terminal marking and Direction of Rotation: Y<br>Vibration measurement: Y<br>Over speed test, 120% of rated speed, for 2 min: Y<br>SC test/ locked rotor test : Y |                                     |             |
| सामग्री सूची संख्या<br>INVENTORY NO. | स्वत्वाधिकार एवं गोपनीयता<br>इस दस्तावेज में दी गई जानकारी भारत हीवी इलेक्ट्रिकल्स लिमिटेड की संपत्ति है। इसका प्रसारण एवं प्रयोग के बिना इस दस्तावेज को किसी भी तृतीय पक्ष को देना या प्रसारित करना गैर कानूनी है। | दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                 | REV. NO.: 03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | निर्माणकर्ता<br>WORKED BY           | SHAVEZ KHAN |
| सामग्री सूची संख्या<br>INVENTORY NO. | दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                 | जांचकर्ता<br>CHECKED BY                                                                             | SHIVA KANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | दिनांक एवं हस्ताक्षर<br>SIGN & DATE | 18/4/2016   |

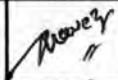
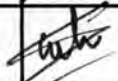
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| BHEE<br>श्री एम डी एम                                                                                                                                                                                                | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  | HE 57016                        |                      |
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| SIGN & DATE<br>SUPERSEDES<br>INVENTORY<br>मासिक सूची में<br>शामिल करना है                                                                                                                                            | <b>APPENDIX-D</b><br><b>VACUUM PUMP : DATA SHEET &amp; CHARACTERISTICS CURVES</b><br>(To be filled in & submitted with the bid)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |                                 |                      |
| COPYRIGHT AND CONFIDENTIAL<br>The information on this document is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company. | <b>I GENERAL :</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |                                 |                      |
|                                                                                                                                                                                                                      | 1. Duty : Condenser Air Evacuation System<br>2. Type : Liquid Ring Type<br>3. Manufacturer's name :<br>4. Model No. :<br>5. Country of origin :<br>6. Quantity per unit :<br>7. Project :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                 |                      |
| मालिकाना हक का<br>दस्तावेज है                                                                                                                                                                                        | <b>II SCOPE OF SUPPLY :</b><br>(Refer system flow diagram at Appendix-A, for identification of various parts /components)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                 |                      |
|                                                                                                                                                                                                                      | 1. Vacuum Pump Yes<br>2. Main drive motor with space heater Yes<br>3. Coupling with coupling-guard Yes<br>4. Combined base plate (with foundation bolts, nuts, shims, washers) Yes<br>5. Air water separator Yes<br>6. Water level gauge (on separator) Yes<br>7. Rotameter with isolating valve Yes<br>8. Check valve at separator outlet (with silencer, if required) Yes<br>9. High & low level switches for alarm/ annunciation Yes<br>10. Seal water make-up solenoid valve Yes<br>11. Seal water float operated over flow valve/ overflow drain loop Yes<br>12. System inlet valve Yes<br>13. Pressure Transmitters (inlet & outlet of butterfly valve) Yes<br>14. Pressure Transmitter for stand by pump operation Yes<br>15. Vacuum gauge with valve Yes<br>16. Air ejector system Yes/No<br>17. Anti-cavitation device with control Yes<br>18. Instrument air filter - regulator Yes<br>19. Seal water recalculation pump with motor Yes<br>20. Heat exchanger (shell & tube type) Yes/No<br>(Tube O.D. shall not be less than 5/8")<br>21. Heat Exchanger (Plate Type) Yes/No<br>22. Pressure gauge with valve Yes/No<br>23. Seal water Flow indicator meter Yes<br>(for seal water flow measurement)<br>24. Seal water flow switch Yes<br>25. Seal water temperature switch Yes<br>26. Temperature gauge with thermo well Yes<br>(at all the four terminals of the heat exchanger)<br>27. Terminal box Yes<br>28. Necessary valves/piping/ instruments etc. Yes<br>(to make the system complete)<br>29. Companion flanges with gaskets, fasteners etc. Yes<br>(for purchaser's terminal points)<br>30. Strainer in seal water line Yes |  |                                 |                      |
| REV. NO.: .03                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  | निर्माणकर्ता<br>WORKED BY       | SHAVEZ KHAN          |
| INVENTORY NO.<br>P-5778                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  | जांचकर्ता<br>CHECKED BY         | SHIVA KANT           |
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| दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                  |  | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | HE 57016                        |           |
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| सामग्री सूची संख्या<br>INVENTORY NO.                                                                                                                                                                                 | सामग्री सूची संख्या को<br>अतिरिक्त करना है                                       | SUPERSEDES<br>INVENTORY                                                                             | 31. Temperature transmitter in suction line Yes<br>32. Temperature transmitter in seal water line Yes<br>33. Inlet screen in suction line Yes<br>34. Pressure gauge with valve after R/C pump Yes<br>35. Duplex filter with DPI and DPS Yes/No<br>36. Items not included above (list the items)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                 |           |
| COPYRIGHT AND CONFIDENTIAL<br>The information on this document is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company. |                                                                                  |                                                                                                     | <b>III DESIGN AND PERFORMANCE :</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                 |           |
| स्वत्वाधिकार एवं गोपनीयता<br>इस दस्तावेज में दी गई जानकारी भारत भारती लिमिटेड का संपत्ति है। इसका प्रयोग<br>एवं प्रसारण केवल केवल के लिए ही किया जाना है।                                                            |                                                                                  |                                                                                                     | 1. Codes and Standards :<br>2. Capacity of Pump in free dry Air with Condenser operating at design Pressure of 1" Hg(abs) and sub-cooled to 4.17 deg.C below temperature corresponding to absolute suction Pressure at design vacuum ITD----- deg.C (SCFM-at 14.7 psia & 70 deg F). SCFM<br>3. Hogging capacity at 10" Hg-A at design condenser CW temperature.<br>a) At 15 dec C design condenser CW temperature SCFM<br>b) At 33 dec C design condenser CW temperature SCFM<br>4. Pump design Temperature: deg C<br>5. Pump design Pressure: kg/cm <sup>2</sup><br>6. Discharge Pressure: Atmospheric mbar<br>7. Blank-off suction pressure : (with Cooling water temperature at condenser design point as specified in the Annexure)<br>8. Power required at motor terminals :<br>a) Maximum KW<br>b) At pump design point (1"Hg abs. Suction pr.) KW<br>c) At condenser design point (as specified in Annexure) KW<br>9. Cooling water required: cu.m/ hr<br>10. Cooling water pressure drop: (across heat exchanger terminals) mwc<br>11. Sealing water flow: cu.m/ hr<br>12. Sealing water pressure drop: (across heat exchanger terminals) mwc<br>13. Pump down time: minutes<br>(with two pumps, c.w. temp. at Condenser design point & volume to be evacuated as specified in the Annexure)<br>14. Instrument air requirement with pressure:<br>15.0 Vacuum Pump:<br>15.1 No. of stages:<br>15.2 Pump rated speed: rpm<br>15.3 Rotor vane tip speed: m / sec<br>15.4 Rotor dia<br>15.5 Shaft dia :<br>15.6 Moment of inertia<br>a) Pump kg-sq.m<br>b) Pump Motor set: kg-sq.m<br>15.7 Pump starting torque: kg-m<br>15.8 Pump design torque:<br>15.9 Pump compression ratio. |                                 |           |
| दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                  | दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                              | REV. NO: 03                                                                                         | निर्माणकर्ता<br>WORKED BY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | SHAVEZ KHAN                     | 18/4/2016 |
| सामग्री सूची संख्या<br>INVENTORY NO.                                                                                                                                                                                 | सामग्री सूची संख्या<br>INVENTORY NO.                                             | REV. NO: 03                                                                                         | जांचकर्ता<br>CHECKED BY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | SHIVA KANT                      | 18/4/16   |

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| निर्माता का हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  | <b>उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)</b><br><b>PRODUCT PURCHASE SPECIFICATION</b><br><b>(HEEP: HARIDWAR)</b> |  | <b>HE 57016</b> |  |
| मासुकी सूची संख्या<br>INVENTORY NO.                                                                                                                                                                                   |  | SUPERSEDES<br>INVENTORY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  | पृष्ठ 21 का 27<br>Page 21 of 27                                                                                   |  |                 |  |
| COPYRIGHT AND CONFIDENTIAL<br>The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company. |  | <div> <div> 16.0 Seal water heat exchanger<br/> 16.1 Type<br/> 16.2 Range of CW inlet temp. :<br/> 16.3 Design ITD<br/> 16.4 Heat transfer area :<br/> At Pump design point (1" Hg-abs. suction pressure &amp; design ITD)<br/> 16.5 (A) Total heat load<br/> 16.6 (A) Heat exchanger terminal-temperatures;<br/> a. At cooling water inlet (considered)<br/> b. At cooling water outlet<br/> c. At seal water inlet<br/> d. At seal water outlet<br/> 16.7 (A) Heat transfer rate:<br/> At Condenser design point, as specified in the Annexure:<br/> 16.5 (B) Total heat load<br/> 16.6 (B) Heat exchanger terminal- temperatures;<br/> a. At cooling water inlet (considered)<br/> b. At cooling water outlet<br/> c. At seal water inlet<br/> d. At seal water outlet<br/> 16.7 (B) Heat transfer rate:<br/> 16.8 Design pressure<br/> a. Shell side;<br/> b. Tube side :<br/> 16.9 Test pressure<br/> a. Shell side:<br/> b. Tube side:<br/> 17.0 Seal water recalculation pump<br/> 17.1 Design capacity:<br/> 17.2 Total Developed Head at design capacity:<br/> 17.3 Shut off head:<br/> 17.4 Power absorbed (at motor terminals) :<br/> 17.5 Rated Speed<br/> 17.6 Motor rating </div> <div> Shell and tube<br/> As indicated in Annexure<br/> deg C<br/> sq.m<br/> kcal /hr<br/> deg C<br/> deg C<br/> deg C<br/> deg C<br/> kcal /hr-sq.m-deg C<br/> kcal/ hr<br/> deg C<br/> deg C<br/> deg C<br/> deg C<br/> kcal/ hr.sq.m deg.C<br/> kg /sq.cm(g)<br/> kg /sq.cm(g)<br/> kg /sq.cm(g)<br/> kg /sq.cm(g)<br/> cub m /hr<br/> mwc<br/> mwc<br/> KW<br/> rpm<br/> KW </div> </div> |  |                                                                                                                   |  |                 |  |
| स्वत्वधिकार एवं गोपनीय<br>इस दस्तावेज में दी गई जानकारी भारत भारती लिमिटेड का संपत्ति है। इसका प्रयोग अन्य उद्देश्य के लिए बिना भारत भारती लिमिटेड की लिखित अनुमति के किया नहीं जा सकता है।                           |  | <b>IV CONSTRUCTION FEATURES and MATERIAL OF CONSTRUCTION:</b><br><b>1. Vacuum Pump</b><br>a. Manufacturer<br>b. Model No.<br>c. No. of stages<br>d. Rotation (when viewed from drive end)<br>e. Bearings ( 1 <sup>st</sup> stage), No., type and size (each end)<br>f. Bearings (2 <sup>nd</sup> stage, if applicable), No., type and size(each end)<br>g. Suction connection size                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |                                                                                                                   |  |                 |  |
| निर्माता का हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                  |  | mm NB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                                                                                                   |  |                 |  |
| मासुकी सूची संख्या<br>INVENTORY NO.                                                                                                                                                                                   |  | REV. NO: .03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  | निर्माणकर्ता<br>WORKED BY                                                                                         |  | SHAVEZ KHAN     |  |
| मासुकी सूची संख्या<br>INVENTORY NO.                                                                                                                                                                                   |  | REV. NO: .03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  | जांचकर्ता<br>CHECKED BY                                                                                           |  | SHIVA KANT      |  |

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| दिनांक एवं हस्ताक्षर<br>SIGN & DATE  |                                                                                                                                    | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                           | <b>HE 57016</b>                 |           |
|                                      |                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                           | पृष्ठ 22 का 27<br>Page 22 of 27 |           |
| सामग्री सूची संख्या<br>INVENTORY NO. | सुपरसेड्स<br>INVENTORY                                                                                                                                                                                             | h. Discharge connection size mm NB<br>i. Casing material<br>j. Impeller material<br>k. Wearing sleeve material<br>l. Shaft material<br><b>2. Heat exchanger (shell &amp; Tube/Plate Type)</b><br>a. Manufacturer<br>b. Type of tubes Straight<br>c. No. of passes on tube side<br>d. Tube size (O/D x thickness x Length ) mm<br>e. Tube material<br>f. Tube plate material<br>g. Shell material<br>h. Water box (bonnet /Channel) material<br>i. Heat transfer area required & provided Sq.m<br><b>3. Seal water recirculation pump</b><br>a. Manufacturer<br>b. Type Centrifugal<br>c. Model<br>d. Casing material<br>e. Impeller material<br>f. Shaft material<br>g. Material of shaft sleeves ( if provided)<br>h. Mechanical seal material<br><b>4. Air Ejector (if provided)</b><br>a. Manufacturer<br>b. Suction size mm NB<br>c. Discharge size mm NB<br>d. Nozzle material<br>e. Diffuser material<br>f. Compression ratio<br><b>5. Coupling</b><br>a. Manufacturer<br>b. Type<br>c. Model<br><b>6. Space heaters</b><br>a. Manufacturer<br>b. Model No.<br>c. Wattage rating KW<br>d. Nos. each<br>e. Rated Voltage and No. of phases.<br><b>7. Air Water Separator</b><br>a. Manufacturer<br>b. Size, dia. x length and volume<br>c. Material |                           |                                 |           |
| सामग्री सूची संख्या<br>INVENTORY NO. | स्वत्वाधिकार एवं गोपनीय<br>The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company. | REV. NO: 03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | निर्माणकर्ता<br>WORKED BY | SHAVEZ KHAN                     | 18/4/2016 |
| सामग्री सूची संख्या<br>INVENTORY NO. | दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                | जांचकर्ता<br>CHECKED BY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | SHIVA KANT                | 18/4/16                         | 18/4/16   |

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| दिनांक एवं हस्ताक्षर<br>SIGN & DATE  |  | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             | <b>HE 57016</b>                 |            |  |
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| सामग्री सूची संख्या को<br>INVENTORY  | SUPERSEDES<br>INVENTORY                                                          | <div> <p>8. <b>Air flow meter (Rota meter)</b></p> <p>a. Manufacturer</p> <p>b. Type</p> <p>c. Model No.</p> <p>d. Range (must be at least 1.5 times the pump capacity at 76.0 mm Hg abs. suction pressure) <span style="float: right;">kg/ hr</span></p> <p>e. Size</p> </div> <div> <p>9. <b>Check Valve (at separator outlet)</b></p> <p>a. Manufacturer</p> <p>b. Model No.</p> <p>c. Size <span style="float: right;">mm NB</span></p> <p>d. Seat material</p> </div> <div> <p>10. <b>Seal water make up solenoid valve</b></p> <p>a. Manufacturer</p> <p>b. Model No.</p> <p>c. Size <span style="float: right;">mm NB</span></p> <p>d. Seat material</p> <p>e. Voltage</p> <p>f. wattage rating</p> </div> <div> <p>11. <b>Float operated seal water over flow valve (if provided)</b></p> <p>a. Manufacturer</p> <p>b. Model No.</p> <p>c. Size <span style="float: right;">mm NB</span></p> <p>d. Seat material</p> </div> <div> <p>12. <b>Duplex filter (if specified in the Annexure)</b></p> <p>a. Manufacturer</p> <p>b. Model No.</p> <p>c. Mesh size</p> <p>d. Valve seat material</p> <p>e. Baskets &amp; inserts material</p> <p>f. Pressure drop (at design CW flow) <span style="float: right;">mwc</span></p> </div> <div> <p>13. <b>Inlet butter fly valve</b></p> <p>a. Manufacturer</p> <p>b. Model No.</p> <p>c. Size</p> <p>d. Seat material</p> <p>e. Operating Pressure</p> <p>f. Valve body material</p> </div> <div> <p>14. <b>Gear box (if applicable).</b></p> <p>a. Manufacturer</p> <p>b. Model No.</p> <p>c. Nominal ration</p> <p>d. Special ration</p> <p>e. Diameter of input shaft</p> <p>f. Diameter of output shaft</p> </div> |             |                                 |            |  |
| सामग्री सूची संख्या<br>INVENTORY NO. | REV. NO.: 03                                                                     | निर्माणकर्ता<br>WORKED BY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | SHAVEZ KHAN | जांचकर्ता<br>CHECKED BY         | SHIVA KANT |  |

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| दिनांक एवं हस्ताक्षर<br>SIGN & DATE            |                                                                                                          | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                          | HE 57016                                                                              |           |
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| सामग्री सूची संख्या<br>INVENTORY NO.<br>25728  | SUPERSEDES<br>INVENTORY<br>सामग्री सूची संख्या को<br>प्रतिस्थापित करना है                                                                                                                | <p>15. Gear oil (if applicable).</p> <ol style="list-style-type: none"> <li>Manufacturer</li> <li>Type</li> <li>Quantity:               <ol style="list-style-type: none"> <li>Quantity during Commissioning</li> <li>Quantity during Continuous running</li> </ol> </li> </ol> <p>V. GUARANTEED PERFORMANCE :</p> <ol style="list-style-type: none"> <li>Capacity of Pump in free dry Air with Condenser operating at design Pressure of 1" Hg(abs) and sub-cooled to 4.17 deg.C below temperature corresponding to absolute Suction Pressure at design vacuum ITD----- deg.C (SCFM-at 14.7 psia &amp; 70 deg F) SCFM</li> <li>Total Power consumption at motor terminals at condenser design point<br/>(including seal water pump) KW<br/>Bidder is liable to pay as penalty an amount /kw (if specified in the Annexure) for extra power consumption over the guaranteed value.</li> <li>Pump down time to evacuate vol. shown in the Annexure from atm. pressure to 10" Hg abs. Minutes</li> <li>Noise level dbA</li> <li>Vibration level mm/s</li> </ol> <p>VI. TESTS and INSPECTION :</p> <p>Will all the tests, inspection and test certificates, detailed in the specification be conducted /furnished. Yes / No</p> <p>If no, please furnish details of non-compliance.</p> <p>VII. WEIGHTS and SPACE REQUIREMENTS :</p> <ol style="list-style-type: none"> <li>Weights           <ol style="list-style-type: none"> <li>Complete package (dry) kg</li> <li>Complete package (operating) kg</li> <li>Pump alone kg</li> <li>Motor alone kg</li> <li>Heaviest component to be lifted in operation &amp; maintenance. kg</li> </ol> </li> <li>Floor space required mm</li> <li>Maintenance space required.</li> </ol> <p>VIII. CHARACTERISTICS CURVES: (as per clause no.18.6 )</p> |                                          |                                                                                       |           |
| दिनांक एवं हस्ताक्षर<br>SIGN & DATE<br>23/4/16 | स्वत्वधिकार एवं गोपनीय<br>इस प्रतीक से की गई सूचना भारत की एलेक्ट्रिकल लिमिटेड की संपत्ति है इसका प्रयोग एवं प्रसारण के बिना एलेक्ट्रिकल लिमिटेड की लिखित अनुमति के बिना नहीं किया जाये। | REV. NO: .03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | निर्माणकर्ता<br>WORKED BY<br>SHAVEZ KHAN |  | 18/4/2016 |
|                                                |                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | जांचकर्ता<br>CHECKED BY<br>SHIVA KANT    |  | 18/4/16   |

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| निका एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                                 |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR) |  | HE 57016                        |  |
| सुपरसेड्स<br>INVENTORY                                                                                                                                                                                                            |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |                                                                                                     |  | पृष्ठ 25 का 27<br>Page 25 of 27 |  |
| सामग्री सूची संख्या को<br>अधिकारित करना है                                                                                                                                                                                        |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |                                                                                                     |  | <b>APPENDIX-E</b>               |  |
| COPYRIGHT AND CONFIDENTIAL<br>The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company              |  | <b>MOTOR DATA SHEET &amp; GA dwg</b><br>(to be filled-in & submitted with the bid)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                                                                                     |  |                                 |  |
| स्वत्वाधिकार एवं गोपनीय<br>इस दस्तावेज में दी गई प्रकृत भारत हेवी एलेक्ट्रिकल लिमिटेड की संपत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप में किसी भी तरह का उपयोग जो कि इसकी या किसी अन्य व्यक्ति के हित में हानिकारक हो न किया जाए। |  | <b>I. GENERAL</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |                                                                                                     |  |                                 |  |
|                                                                                                                                                                                                                                   |  | 1. Manufacturer 1 _____<br>2. Equipment driven by motor 2 _____<br>3. Motor type 3 _____<br>4. KW rating 4 _____<br>5. Country of origin 5 _____<br>6. Project 6 _____<br>7. Quantity per unit 7 _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |                                                                                                     |  |                                 |  |
|                                                                                                                                                                                                                                   |  | <b>II. DESIGN AND PERFORMANCE</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |                                                                                                     |  |                                 |  |
|                                                                                                                                                                                                                                   |  | 1. Frame size 1 _____<br>2. Type of duty 2 _____<br>3. Type of enclosure and method of cooling 3 _____<br>4. Degree of protection 4 _____<br>5. Applicable standard to which motor generally conforms 5 _____<br>6. Type of mounting 6 _____<br>7. Direction of rotation as viewed from non-driving end 7 _____<br>8. Method of starting 8 _____<br>9. Standard continuous rating at 40.0 deg.C ambient temp. as per Indian Standard. (KW) 9 _____<br>10. Derated rating for specified ambient temp. of 50.0deg.C(KW) 10 _____<br>11. Maximum continuous load demand of driver equipment(KW) 11 _____<br>12. Rated voltage (Volts) 12 _____<br>13. Permissible variation of * 13 _____<br>a. Voltage a. _____<br>b. Frequency b. _____<br>c. Combined voltage and frequency c. _____<br>*(Not less than asked for in the specification)<br>14. Minimum permissible starting voltage (volts) * 14 _____<br>*(Not more than asked for in the specification)<br>15. Rated speed at rated voltage and frequency (rpm) 15 _____<br>16. Full load current (amps) 16 _____<br>17. No load current (amps) 17 _____<br>18. Power factor at 18 _____<br>a. 100% load a. _____<br>b. 75% load b. _____<br>c. 50% load c. _____<br>d. No load d. _____ |  |                                                                                                     |  |                                 |  |
| निका एवं हस्ताक्षर<br>SIGN & DATE<br>23/4/16                                                                                                                                                                                      |  | REV. NO: 03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  | निर्माणकर्ता<br>WORKED BY                                                                           |  | SHAVEZ KHAN                     |  |
| सामग्री सूची संख्या<br>INVENTORY NO.<br>P-57798                                                                                                                                                                                   |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  | जांचकर्ता<br>CHECKED BY                                                                             |  | SHIVA KANT                      |  |
|                                                                                                                                                                                                                                   |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |                                                                                                     |  | 18/4/16                         |  |

|                                                                                                                                                                                    |  |                                                                                                                                                                                                                     |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                |  |                                                                                                                                     |  | <b>उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)</b><br><b>PRODUCT PURCHASE SPECIFICATION</b><br><b>(HEEP: HARIDWAR)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  | <b>HE 57016</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
| सामग्री सूची संख्या<br>INVENTORY NO.                                                                                                                                               |  | SUPERSEDES<br>INVENTORY                                                                                                                                                                                             |  | पृष्ठ 26 का 27<br>Page 26 of 27                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
| सामग्री सूची संख्या को<br>अधिलिखित करना है                                                                                                                                         |  | COPYRIGHT AND CONFIDENTIAL<br>The information on this document is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company |  | 19. Efficiency at rated voltage and frequency at (%)<br>a. 100% load<br>b. 75 % load<br>c. 50% load<br>20. Starting current at (amps.)<br>a. 100% voltage<br>b. 80 % voltage<br>c. 100 % voltagetime<br>21. Starting time with minimum permissible voltage of 80% of rated voltage. (secs.) for<br>a. With out driven equipment coupled<br>b. With driven equipment coupled<br>22. Starting time with 100 % of rated voltage. (secs.) for<br>a. With out driven equipment coupled<br>b. With driven equipment coupled<br>23. Safe stall time with 110% of rated voltage (secs.) for<br>a. From hot condition<br>b. From cold condition<br>24. Safe stall time with 100 % of rated voltage (secs.) for<br>a. From hot condition<br>b. From cold condition<br>25. Torque (kg. Meter ) at<br>a. Starting (at minimum permissible voltage)<br>b. Pull up<br>c. Pull out<br>d. Rated load<br>e. Min accelerating torque available<br>26. Stator winding resistance per phase (ohms)<br>27. Flywheel moment of inertia (GD square) of motor (Kg—sq.m)<br>28. Size of earthing conductor<br>29. No. of permissible successive starts in hot condition.<br>30. Locked rotor KVA input<br>31. Locked rotor KVA /KW<br>32. Vibration<br>33. Noise – (one meter distance from the motor )<br>34. Speed switch<br>35. Insulation of bearing<br>36. Noise reducer<br>37. Grounding pads :<br>a. No and size on motor body<br>b. No on terminal box<br>38. Vibration pads<br>39. No of poles<br>40. Permissible number of equally spread starts per hour<br>a. No. of quick starts per hour when motor is hot.<br>b. No. of quick starts per hour when motor is cold. |  | 19 _____<br>a. _____<br>b. _____<br>c. _____<br>20 _____<br>a. _____<br>b. _____<br>c. _____<br>21 _____<br>a. _____<br>b. _____<br>22 _____<br>a. _____<br>b. _____<br>23 _____<br>a. _____<br>b. _____<br>24 _____<br>a. _____<br>b. _____<br>25 _____<br>a. _____<br>b. _____<br>c. _____<br>d. _____<br>e. _____<br>26 _____<br>27 _____<br>28 _____<br>29 _____<br>30 _____<br>31 _____<br>32 _____<br>33 _____<br>34 _____<br>35 _____<br>36 _____<br>37 _____<br>38 _____<br>39 _____<br>40 _____ |  |
| स्वतः अधिकार एवं गोपनीयता<br>इस दस्तावेज में दी गई सूचना भारत भारी यंत्रोद्योग निगम की संपत्ति है। इसका प्रयोग एवं प्रसारण केवल केवल के निर्देशों के बिना ही नहीं किया जा सकता है। |  | REV. NO.: 03                                                                                                                                                                                                        |  | निर्माणकर्ता<br>WORKED BY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  | SHAVEZ KHAN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                |  | सामग्री सूची संख्या<br>INVENTORY NO.                                                                                                                                                                                |  | जांचकर्ता<br>CHECKED BY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  | SHIVA KANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |
| 23/4/16                                                                                                                                                                            |  | 25798                                                                                                                                                                                                               |  | 18/4/2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  | 18/4/16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |

|                                                                                                   |                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                        |
|---------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                               |  | <b>उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)</b><br><b>PRODUCT PURCHASE SPECIFICATION</b><br><b>(HEEP: HARIDWAR)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>HE 57016</b><br><br>पृष्ठ 27 का 27<br>Page 27 of 27 |
| सामग्री सूची संख्या को<br>अधिष्ठापित करना है                                                      | SUPERSEDES<br>INVENTORY                                                          | 41. Motor paint shade. 41-----<br>42. Motor earthing point. 42-----<br>43. a) Heating time constant. 43-----<br>b) Cooling time constant.<br><b>III.CONSTRUCTIONAL FEATURESS</b><br>1. Stator winding insulation 1<br>a. Tropicalised insulation a.-----<br>b. Class & Type b.-----<br>c. Temperature rise over 50.0 deg.C ambient temp. (deg.C) c.-----<br>d. Stator winding connections d.-----<br>e. Number of terminals brought out e.-----<br>2. Type of terminal box for 2<br>a. Stator leads a.-----<br>b. Space heater b.-----<br>3. For main terminal box (suggestive) 3<br>a. Location a.-----<br>b. Entry of cables b.-----<br>c. Recommended cable size c.-----<br>d. Fault level KA /sec. d.-----<br>e. Lug for terminal inside terminal box<br>f. Cable glands<br>4. For Bearings (Drive end/Non-Drive end ) 4.<br>a. Type a.-----<br>b. Manufacturer b.-----<br>c. Size c.-----<br>d. Recommended lubricant d.-----<br>e. Guaranteed Life<br>5. Space heaters 5<br>a. Numbers a.-----<br>b. Location b.-----<br>c. Power requirement (KW) c.-----<br>6. Weight (Kg.) of 6<br>a. Motor stator a.-----<br>b. Motor rotor b.-----<br>c. Total motor c.-----<br>d. Overall dimension of motor d.----- |                                                        |
| <b>IV. GA DRAWINGS OF MOTOR &amp; TERMINAL BOX :</b>                                              |                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                        |
| <b>V. CHARACTERISTIC CURVES (AT 80 %, 100% &amp; 110 % OF RATED VOLTAGE)</b>                      |                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                        |
| 1. Current v/s speed<br>2. Torque v/s speed<br>3. Thermal with stand curve<br>4. Current v/s time |                                                                                  | Curve No.<br>1. -----<br>2. -----<br>3. -----<br>4. -----                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                        |
| सामग्री सूची संख्या<br>INVENTORY NO.<br><b>95778</b>                                              | REV. NO: 03                                                                      | निर्माणकर्ता<br>WORKED BY<br><b>SHAVEZ KHAN</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | जांचकर्ता<br>CHECKED BY<br><b>SHIVA KANT</b>           |

17002L1191C

ON SHAWMUT/महा प्रक्षेपण

प्रथम कोण प्रक्षेपण/FIRST ANGLE PROJECTION

सभी विमाएं मिलीमीटर में हैं/ALL DIMENSIONS ARE IN mm.

प्रकार की आ (चौ)/FROM 38 (3)

## CONDENSER AIR EVACUATION PACKAGE UNIT (VACUUM PUMP PACKAGE)

## I. DESIGN DATA :

(No. of Condensers per TG set: Two)

## Note:

- a. Vacuum Pump to be selected (for supply) as per the followings design criteria.
- b. All Vacuum pump packages to be supplied shall be interchangeable with each other.

## A. Design criteria:

- 1) No. of Units required per Condenser : Two (2)
- 2) No. of Units normally working (Holding) : One (1)
- 3) No. of Units working during Start-up (Hogging) : Two (2)
- 4) Design ITD : 7.03 Deg C
- 5) Condenser back pressure : 0.07336 ATA (53.96 mmHg-a)
- 6) Condenser cooling water temp : 32.5 Deg C
- 7) Cooling water Quality : Sea Water

B. All flanges to be as per ANSI, B16.5

Note: C.W. for Vac.pump Heat Exchanger is same as that of Condenser.

## II. CAPACITY OF PUMP (as per HEI) :

- 1) Design capacity (Holding) : 20 SCFM at 1" Hg abs at design ITD (7.03 deg C)
- 2) Air+Steam mixture temperature: Sub-cooled by 4.17 °C
- 3) Volume to be evacuated (approx.) : 2000 m3 (Per condenser)
- 4) Time for initial evacuation : As per HEI (condenser)
- 5) Hogging capacity, each pump : 800SCFM (minimum)  
— At 10inch Hg(a)

## III. MATERIAL OF CONSTRUCTION : (FOR SEA WATER APPLICATION)

Clause No 4.0 B-2, "Water box and affected piping inside surfaces should be suitably coated against sea water application" should be read as :

- a. Water box shall be SS 316L against sea water application.
  - b. All counter flanges(along with bolts and nuts) , piping and instruments coming in contact with sea water shall be SS316L."
- IV. A conductivity Transmitter should be installed on Separator Tank for continuous monitoring of seal water conductivity.

V. All piping should be connected without strain. If required, proper support to be provided to avoid any strain on piping.

उत्पाद का प्रकार या ग्राहक/परियोजना का नाम  
TYPE OF PRODUCT OR NAME OF

VACUUM PUMP PACKAGE

CUSTOMER/PROJECT

(CODE NO. W90716150280)



भारत हेवी इलेक्ट्रिकल्स लिमिटेड, रानीपुर, हरियाणा  
BHARAT HEAVY ELECTRICALS LIMITED,  
RANIPUR, HARYANWAR

| डिजाइन/DESIGN | ड्राफ्ट/DRG | ड्राफ्ट/DRG | ड्राफ्ट/DRG | ड्राफ्ट/DRG |
|---------------|-------------|-------------|-------------|-------------|
| SHIVA         | Sd          | 28/01/17    | 28/01/17    | 28/01/17    |
| SHIVA         | Sd          | 28/01/17    | 28/01/17    | 28/01/17    |
| R.BANSAL      | Sd          | 02/02/17    | 02/02/17    | 02/02/17    |

| डिजाइन/DESIGN | ड्राफ्ट/DRG | ड्राफ्ट/DRG | ड्राफ्ट/DRG | ड्राफ्ट/DRG |
|---------------|-------------|-------------|-------------|-------------|
| HKE           | 28/01/17    | 28/01/17    | 28/01/17    | 28/01/17    |
| CODE          | 28/01/17    | 28/01/17    | 28/01/17    | 28/01/17    |

शीर्षक/TITLE

ANNEX. TO HE57016

कार्ड कोड  
CARD CODE  
31611770041

ऑफिस संख्या/DRAWING NO.  
22 23 24

REV  
00

A3 माप/AS SIZE

14002/11915 ON DIMENSION/SCALE/PROJECTION

# CONDENSER AIR EVACUATION SYSTEM

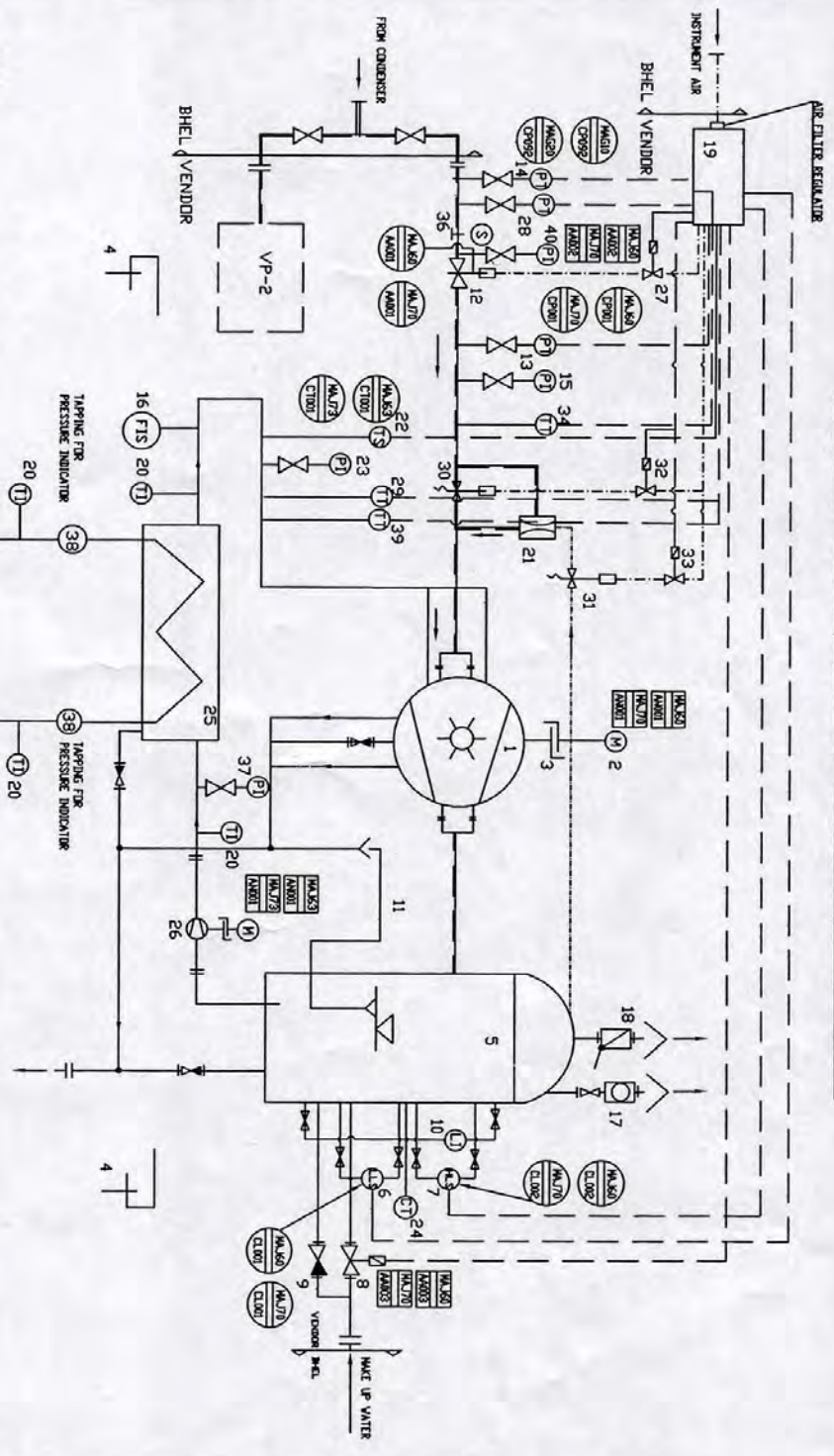
प्रथम कोण प्रक्षेप/ FIRST ANGLE PROJECTION

सभी विमाएँ मिलीमीटर में हैं / ALL DIMENSIONS ARE IN mm.

पत्र क्रमांक (शीट)/FROM 38 (B)

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INTEREST OF THE COMPANY.

संप्रदायिक एवं गोपनीय  
इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स लिमिटेड की  
संपत्ति है। इसका प्रयोग या अप्रत्यक्ष रूप से किसी भी तरह  
प्रयोग नहीं किया जाए जो कंपनी के हितों को नुकसान पहुंचावे।



## ITEM DESCRIPTION

- VACUUM PUMP, 2-STAGE (OR 1-STAGE)
- MOTOR
- COUPLING
- FOUNDATION BOLT-NUT-WASHER
- SEPARATOR
- LOW LEVEL SWITCH WITH ISOLATION VALVE
- HIGH LEVEL SWITCH WITH ISOLATION VALVE
- MAKEUP WATER INLET VALVE
- MAKEUP WATER BYPASS VALVE
- LEVEL INDICATOR WITH ISOLATION VALVE
- OVERFLOW SIPHON LOOP
- SYSTEM INLET VALVE WITH OPEN/CLOSE LIMIT SWITCH
- PRESSURE TRANSMITTER FOR INLET VALVE OPEN.
- P.R. TRANSMITTER FOR STANDBY PUMP OPEN.
- PRESSURE INDICATOR WITH VALVE
- SEAL WATER FLOW SWITCH CUM INDICATOR
- AIR FLOW METER (ROTAMETER)
- AIR OUTLET CHECK VALVE WITH HANDLE
- JUNCTION BOX (REFER DRG. NO.)
- TEMPERATURE INDICATOR
- EJECTOR (IF APPLICABLE)
- TEMPERATURE SWITCH
- PRESSURE INDICATOR WITH VALVE
- CONDUCTIVITY TRANSMITTER
- HEAT EXCHANGER
- SEAL WATER PUMP WITH MOTOR
- SOLINOID VALVE (24 V DC)
- P.R. TRANSMITTER FOR SEAL WATER FOR EJECTOR (IF APPLICABLE)
- TEMP. TRANSMITTER FOR SEAL WATER FOR EJECTOR (IF APPLICABLE)
- BY-PASS VALVE FOR EJECTOR (IF APPLICABLE)
- MOTNE AIR VALVE FOR EJECTOR (IF APPLICABLE)
- SOLINOID VALVE (24V DC) FOR EJECTOR (IF APPLICABLE)
- SOLINOID VALVE (24V DC) FOR EJECTOR (IF APPLICABLE)
- TEMPERATURE TRANSMITTER IN SUCTION LINE
- DUPLEX FILTER WITH DPS & DFI
- TEMPORARY INLET SCREEN
- PRESSURE INDICATOR WITH VALVE
- TAPPING FOR PRESSURE INDICATOR
- TEMP. TRANSMITTER FOR SEAL WATER
- PRESSURE INDICATOR WITH VALVE
- ISOLATION VALVE

## VACUUM PUMP PACKAGE

उत्पाद का प्रकार या ग्राहक/परियोजना का नाम  
TYPE OF PRODUCT OR NAME OF  
CUSTOMER/PROJECT

भारत हेवी इलेक्ट्रिकल्स लिमिटेड, रांची, बिहार  
BHARAT HEAVY ELECTRICALS LIMITED,  
RANCHI, BIHAR

| क्र.सं./NO. | नाम/NAME | हस्ताक्षर/SIGN | दिनांक/DATE |
|-------------|----------|----------------|-------------|
| 1           | SHIVA    | Sd             | 28/01/17    |
| 2           | SHIVA    | Sd             | 28/01/17    |
| 3           | R.BANSAL | Sd             | 02/02/17    |

भारत हेवी इलेक्ट्रिकल्स लिमिटेड, रांची, बिहार  
BHARAT HEAVY ELECTRICALS LIMITED,  
RANCHI, BIHAR

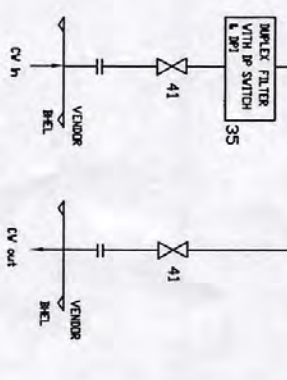
| क्र.सं./NO. | नाम/NAME | हस्ताक्षर/SIGN | दिनांक/DATE |
|-------------|----------|----------------|-------------|
| 1           | SHIVA    | Sd             | 28/01/17    |
| 2           | SHIVA    | Sd             | 28/01/17    |
| 3           | R.BANSAL | Sd             | 02/02/17    |

शीट/का.सं./TITLE  
P&ID - CONDENSER AIR  
EVACUATION SYSTEM

| क्र.सं./NO. | शीट/का.सं./TITLE     | शीट/का.सं./TITLE     |
|-------------|----------------------|----------------------|
| 1           | P&ID - CONDENSER AIR | P&ID - CONDENSER AIR |
| 2           | EVACUATION SYSTEM    | EVACUATION SYSTEM    |

| संख्या/संख्या<br>INVENTORY NO. | हस्ताक्षर और दिनांक/SIGN & DATE | संदर्भित अभिलेख संख्या<br>REFERENCE DRG. NO. |
|--------------------------------|---------------------------------|----------------------------------------------|
|                                |                                 |                                              |

LEGEND  
ELECTRICAL WIRING  
AIR PIPING  
AIR & STEAM MIXTURE PIPING  
WATER PIPING



A3 शीट/A3 SIZE