

|                                                                                   |                                                                                                                                                                                                                               |                                                                                                                                                                                                                                              |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <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/4222/2014/4303V/1</b><br/> <b>PACKAGE: Condenser Air Evacuation Package</b><br/> <b>PROJECT: 2X660 MW Ennore PROJECT</b><br/> <b>DATE OF ISSUE OF ENQUIRY: 01/06/2017</b><br/> <b>ENQUIRY DUE DATE: 29/06/2017</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.

| Pre-Qualification Requirements |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Vendors Confirmation<br>Indicating page no.<br>where documents<br>are placed |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| 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 at least two (2) nos of "Condenser Air Evacuation package", for two different Thermal Power Plants with units rating of 500 MW or above and having Free dry Air Capacity 30 SCFM or higher at 1" Hg (abs) and ITD not more than 13.3 deg C.<br>"Condenser Air Evacuation package" should be in successful operation for a period not less than one (1) years, 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, with 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                            | 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 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 and supply 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                            | 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  
(Shirakant)  
By Mr. NXE

*[Signature]*

**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 P.O No. / Serial no of Package. This Test certificate should be issued by third party inspection agency or acceptance by Customer/end user.
- Copies of end user certificate issued on letter head as per Annexure-2. Bidder, who have already supplied the Condenser Air Evacuation package to BHEL Haridwar, need not to furnish end user certificate.
- 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).

*29/05/17*  
*Shiva Kant*  
*By nps/nxe*

*Robert L*

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**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. xxxxxx 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.**

(22)

**ANNEXURE-3: DETAILS OF EQUIPMENT**

Bidder's Name and Address :  
XXXXXXX

To  
BHEL, HEER, RANIPUR,  
Haridwar-249403

---

| 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/ 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. |
| 12.0 | Date of Commencement of Successful Operation                                                                                                       |

Yes/No

Signature of authorized signatory.....

| S. No. | Item Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13.0   | Brief Scope of Work                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 14.0   | Brief Technical Particulars of the System/Package/Equipments : <ul style="list-style-type: none"><li>(i) Designed by</li><li>(ii) Manufactured by</li><li>(iii) Type (Liquid Ring Type or any other type)</li><li>(iv) Make / Model No.</li><li>(v) Number per T.G. Unit</li><li>(vi) Rated free Dry Air Capacity in SCFM [at 25.4 mm Hg (abs) Suction Pressure at 21.1°C] of each Pump</li><li>(vii) Hogging Capacity of each Pump (at 254mm Hg (abs) Suction Pressure in SCFM</li><li>(viii) I.T.D. (deg.C)</li><li>(ix) Temp. of Cooling Water to Vacuum Pump Heat Exchanger (deg.C)</li><li>(x) Type of Heat Exchanger (Shell &amp; Tube Type/Plate Type)</li><li>(xi) No. of Stages</li><li>(xii) Whether Air Ejector is provided or not</li><li>(xiii) Impeller Material</li></ul> |

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<br>Status                | Graduate      |                   | Diploma | Skilled | Un-Skilled | Remarks |
|-----------------------------------|---------------|-------------------|---------|---------|------------|---------|
|                                   | Technica<br>l | Non-<br>Technical |         |         |            |         |
| Design                            |               |                   |         |         |            |         |
| Production                        |               |                   |         |         |            |         |
| Quality<br>Control/<br>Inspection |               |                   |         |         |            |         |
| After Sales<br>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. No. | Product | Name & Address of<br>Collaborator | Collaboration |      |            |
|---------|---------|-----------------------------------|---------------|------|------------|
|         |         |                                   | Scope         | Year | Valid 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                                                      |                                                  |        |

|    |               |  |  |
|----|---------------|--|--|
| l) | Packing       |  |  |
| m) | Other, if any |  |  |

20.

**a. Inspection & Testing Facilities available in-house:**

| Sl. No. | Description | Capacity & Nos. | Make & year of Mfg. | Calibration Status | Validity period |
|---------|-------------|-----------------|---------------------|--------------------|-----------------|
|         |             |                 |                     |                    |                 |

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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

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**ANNEXURE-5**

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

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**Details of Subsidiary/JV Company  
proposed for manufacturing of  
Vacuum pump package**

- |     |                                                                                                                                                                                                                                                                                                                  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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 promoter) 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).....

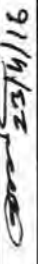
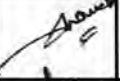
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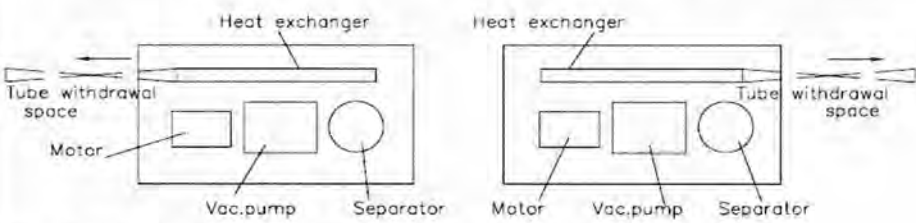
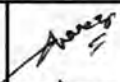
(Common Seal).....

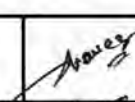
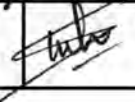
Signature of authorized signatory.....

|                                                                                                                                                                                                                     |  |                                                                                                                                                    |  |                               |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------|--|
| 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 प्रलेख में दी गई सूचना भारत हेवी एलेक्ट्रिकल्स लिमिटेड की संपत्ति है इसका उपयोग एवं प्रकाशन केवल के बिना की जा सकती है अन्यथा इसके दुरुपयोग के लिए कानूनी कार्यवाही की जायेगी         |  |                                                                                                                                                    |  |                               |  |
| 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 SHARMA                                                                                                                                      |  | जांचकर्ता CHECKED BY          |  |
| SUPERSEDES                                                                                                                                                                                                          |  | DATE & SIGNATURE                                                                                                                                   |  | पर्यवेक्षणकर्ता SUPERVISED BY |  |
| REV.NO. 03                                                                                                                                                                                                          |  | स्वीकृति<br>APPROVED : S.K.BAVEJA, AGM (HXE&PED);                                                                                                  |  | GR NO. 8.30                   |  |
| Dt. 18/04/2016                                                                                                                                                                                                      |  | निर्माण<br>PREPARED : HXE                                                                                                                          |  | जारी<br>ISSUED : TSX          |  |
| CHANGE ADVICE 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   |

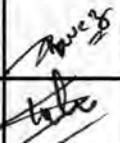
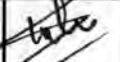
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| दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 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> |                                                                                                     |                                          |                                           |                                                                                                                                                                                                  |
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| स्वत्वाधिकार एवं गोपनीय<br>इस दस्तावेज में दी गई सूचना भारत हेवी एलेक्ट्रिकल लिमिटेड की संपत्ति है। इसका प्रयोग एवं प्रकाशक के बिना की जाने वाली प्रतिलिपि या अन्य किसी भी प्रकार से इस दस्तावेज के बिना 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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| सिग्नल एवं दिनांक<br>SIGN & DATE                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR) |             | HE 57016                                                                              |            |
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| सुपरसेड्स<br>INVENTORY                                                                                                                                                                                                                 | 3.21 Of the two vacuum pump packages, required per TG set(2x100% design),tube withdrawal space of heat exchanger in one shall be from inlet end and in the other, from outlet end (as indicated below):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                     |             |                                                                                       |            |
| सार्वजनिक माल को<br>अधिकारित करना है                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                     |             |                                                                                       |            |
| 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>4.0 MATERIAL OF CONSTRUCTION:</b><br><b>A. FOR NORMAL WATER APPLICATION:</b><br>1) Main Vacuum pump & Re-circulation Pump:<br>Casting : 2% Ni Cast Iron (GB 9439, HT 250)/ASTM A48,CLASS35<br>Shaft : Carbon Steel, En-8 or better<br>Impeller : Nodular Iron (ASTM A536,Gr.65-45-12) or better<br>Shaft Sleeve : (If applicable) Stainless Steel<br>2) Heat Exchanger (Shell & Tube Type):<br>Shell : Carbon Steel, SA285 Gr. C<br>Tubes : Welded SS, TP 316<br>Tube Plate : Carbon Steel, SA285 Gr. C<br>Water Box : (Channel) Carbon Steel, SA285 Gr. C/Cast Iron<br>Tube plate & Water box inside shall be epoxy coated.<br>Extra 20% Margin in area shall be provided<br>Cooling Water Pressure drop shall be limited to 3.5 MWC.<br>Vendor to furnish calculation to prove 20% margin in area and 3.5 MWC CW Pressure drop.  |                                                                                                     |             |                                                                                       |            |
| स्वामित्व अधिकार एवं गोपनीयता<br>इस दस्तावेज में की गई सूचना भारत भारती एलेक्ट्रिकल लिमिटेड की संपत्ति है। इसका प्रयोग एवं प्रसारण केवल उस व्यक्ति के द्वारा ही किया जा सकता है जिसने इसे प्राप्त किया है। अन्यथा इसका प्रयोग अवैध है। | <b>B. FOR SEA WATER APPLICATION:</b><br>1) Main Vacuum pump & Re-circulation Pump:<br>Casting : 2% Ni Cast Iron (GB 9439, HT 250)/ASTM A48,CLASS35<br>Shaft : Carbon Steel, En-8 or better<br>Impeller : Nodular Iron (ASTM A536,Gr.65-45-12) or better<br>Shaft Sleeve : (If applicable) Stainless Steel<br>2) Heat Exchanger (Shell & Tube Type):<br>Shell : Carbon Steel, SA285 Gr. C<br>Tubes : Welded Ti,SB 338,Gr-2<br>Tube Plate : Titanium/Ti-clad steel<br>Water Box : (Channel) Carbon Steel, SA285 Gr. C/Cast Iron<br>Water box & affected piping inside surface should be suitably coated against sea water application Extra 20% Margin in area shall be provided<br>Cooling Water Pressure drop shall be limited to 3.5 MWC.<br>Vendor to furnish calculation to prove 20% margin in area and 3.5 MWC CW Pressure drop. |                                                                                                     |             |                                                                                       |            |
| सिग्नल एवं दिनांक<br>SIGN & DATE                                                                                                                                                                                                       | <b>C. Duplex strainer with DPS &amp; DPI is to be provided at CW inlet of Heat Exchanger :</b><br>1) Material (for normal water application): SS 316, for filter body & element.<br>2) Material (for sea water application) : Gun metal- For filter body.<br>: Monel metal/SS 317 LN- For filter element.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                     |             |                                                                                       |            |
| सार्वजनिक माल को<br>INVENTORY NO.                                                                                                                                                                                                      | REV. NO.: 03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | निर्माणकर्ता<br>WORKED BY                                                                           | SHAVEZ KHAN |  | 18/04/2016 |
| सार्वजनिक माल को<br>INVENTORY NO.                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | जांचकर्ता<br>CHECKED BY                                                                             | SHIVA KANT  |  | 18/4/16    |

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| निम्न एवं प्रमाणित<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> |  |
| SUPERSEDES<br>INVENTORY                                                                                                                                                                                              |  | पृष्ठ 5 का 27<br>Page 5 of 27                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |                                                                                                                   |  |                 |  |
| मासिक सूची संख्या की<br>अधिकतम सीमा है                                                                                                                                                                               |  | <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.</p> <p>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 सूचना भारत की स्वतंत्रता एवं गोपनीयता के लिए है। इसका प्रयोग अन्य किसी भी उद्देश्य के लिए या किसी भी व्यक्ति के हित में प्रसारित नहीं किया जा सकता।                   |  | <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>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |                                                                                                                   |  |                 |  |
| निम्न एवं प्रमाणित<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>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |                                                                                                                   |  |                 |  |
| मासिक सूची संख्या<br>INVENTORY NO.                                                                                                                                                                                   |  | REV. NO.: .03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  | निर्माणकर्ता<br>WORKED BY                                                                                         |  | SHAVEZ KHAN     |  |
| P.5778                                                                                                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  | जांचकर्ता<br>CHECKED BY                                                                                           |  | SHIVA KANT      |  |
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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>               |           |
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| सामग्री सूची संख्या<br>INVENTORY NO. | सुपरसेडस<br>INVENTORY                                                                                                                                                                                                | <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> <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.<br/>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> |                           |                               |           |
| सामग्री सूची संख्या<br>INVENTORY NO. | स्वत्व अधिकार एवं गोपनीयता<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. | REV. NO: .03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | निर्माणकर्ता<br>WORKED BY | SHAVEZ KHAN                   | 18/4/2016 |
| दिनांक एवं हस्ताक्षर<br>SIGN & DATE  | सामग्री सूची संख्या<br>INVENTORY NO.                                                                                                                                                                                 | जांचकर्ता<br>CHECKED BY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | SHIVA KANT                | 18/4/16                       |           |

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| दिनांक एवं हस्ताक्षर<br>SIGN & DATE<br><br>सामग्री सूची संख्या<br>INVENTORY NO. | नवी एम डी एल<br>BHEL | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             | HE 57016<br>पृष्ठ 7 का 27<br>Page 7 of 27 |            |
|                                                                                 |                      | 10. <b>TYPE TEST :</b><br>a) <b>Type test-1 :</b> Supplier shall demonstrate by carrying out visual cavitation test that pump will be operating under all operating condition including black-off condition, without cavitation. In case this test has already been accepted by BHEL in earlier projects on the pump of same model, type, size, rating as proposed then records of same to be furnished for approval of BHEL.<br>b) <b>Type test-2 :</b> One complete unit shall also be subjected to demonstrate successful operation and performance testing with saturated air conditions at condenser design vacuum point as well as vacuum pump design point with total minimum three points. The test shall be conducted with respective motors to be supplied. The test shall also include check for vibration and noise level. If saturated air test is already accepted by BHEL in earlier projects on same model, type, size, rating, then test records along with drawing/data-sheet shall be submitted for approval of BHEL.<br><b>TYPE TEST REPORT:</b> Vendor shall furnish all type test report as mentioned above within 3-weeks of placement of order. These reports shall be for the test conducted within five years from date of bid opening on identical/similar components /equipments with those offered to be supplied. If the type test reports are not found satisfactory by BHEL/End user, the same shall be informed to vendor and all such tests shall be conducted again under this contract by the vendor free of cost and reports shall be submitted for approval.<br>11.0 The bidder shall be responsible for all necessary tests during fabrication/manufacture and before shipment to ensure that the equipment meets the specification and will operate satisfactorily, as an assembled unit. Approval or passing of tests/ inspection and thereby issue of test certificate or waiver of inspection by the inspection agency, shall not relieve the bidder of his responsibilities and obligations under the contract, as well as, shall not bind BHEL to accept the equipment, should it, on further tests after erection, be found not complying with the contract .<br>12.0 <b>PAINING REQUIREMENTS:</b><br>Condenser Air-evacuation Equipment shall be painted as per the following :<br>1. Priming coat : Epoxy base Zinc rich Primer Paint (2 coats): DFT=70 microns<br>2. Intermediate coat: Epoxy TiO2 pigmented Polyamide cured Paint(1 coat): DFT=70 microns<br>3. Finish coat: Aliphatic Acrylic 2 pack Polyurethane Finish Paint: DFT=60 microns<br>4. Finish paint shade : Blue (RAL 5012) or as per customer : Total DFT=180 microns(minimum)<br>Specific requirements.<br>13. <b>MARKING:</b> Following shall be marked on all the drawings and documents:<br>a. Customer : As in Purchase Order<br>b. Project : -----do-----<br>c. Revision No. and Date of the drawing /documents.<br>14.0 <b>SPARE :</b><br>14.1 <b>START-UP (Erection &amp; Commissioning ) SPARES:</b><br>Bidder shall give separate offer for start-up spares with item wise price break-up. Such spares shall be supplied along with the main pump order.<br>Gear box ( if applicable ): Necessary Gear oil required for commissioning to be supplied along with Vacuum pump package. |             |                                           |            |
| सामग्री सूची संख्या<br>INVENTORY NO.                                            | REV. NO.: 03         | निर्माणकर्ता<br>WORKED BY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | SHAVEZ KHAN | जांचकर्ता<br>CHECKED BY                   | SHIVA KANT |

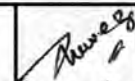
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| दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <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>अधिलेखन 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 एवं प्रसारण के बिना या इसकी ओर से बिना अनुमति के किसी भी प्रकार से किया जाना ग्राहक के हितों के विरुद्ध है।              | <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               |  | <b>उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)</b><br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                          | <b>HE 57016</b>                       |                      |
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| सापेक्ष सूची संख्या<br>INVENTORY NO.<br>P-5770 | SUPERSEDES INVENTORY                                                             | <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:</p> <ul style="list-style-type: none"> <li>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).</li> <li>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.</li> <li>c) Power consumption vs. suction pressure at rated ITD.</li> <li>d) Time vs Vacuum, while evacuating the volume specified in the Annexure.</li> <li>e) Dry air performance test curves and seal water temp. correction curves.</li> <li>f) Hogging performance curve.</li> <li>g) Holding performance curve.</li> </ul> <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:</p> <ul style="list-style-type: none"> <li>a) Performance characteristic curves as per clause 18.6 above.</li> <li>b) Motor characteristic curves as per clause V of Appendix-E.</li> </ul> <p>19.1.7 General arrangement drawing of the motor indicating overall dimensions, weights (rotor, total), fixing details, rotor removal space etc.</p> |                                          |                                       |                      |
| निमांक एवं दिनांक<br>SIGN & DATE<br>22/4/16    |                                                                                  | REV. NO.: 03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | निर्माणकर्ता<br>WORKED BY<br>SHAVEZ KHAN | जांचकर्ता<br>CHECKED BY<br>SHIVA KANT | 18/4/2016<br>18/4/16 |

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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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| SUPERSEDES<br>INVENTORY                                                                                                                                                                                               |                                                                                  | 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)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                       |           |         |
| कम्पली-पूरी नगर को<br>अधिनियम बना है                                                                                                                                                                                  |                                                                                  | <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.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                       |           |         |
| 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. |                                                                                  | 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.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                       |           |         |
| स्वतंत्राधिकार एवं गोपनीय<br>इस दस्तावेज में दी गई जानकारी भारत हीवी लिमिटेड का निजी संपत्ति है। इसका प्रसारण केवल भारत हीवी लिमिटेड के अधिकार के बिना ही नहीं किया जा सकता है।                                       |                                                                                  | <b>19.2.0 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: |                                       |           |         |
| दिनांक एवं हस्ताक्षर<br>SIGN & DATE<br>25/4/16                                                                                                                                                                        |                                                                                  | <b>19.3 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.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                       |           |         |
| सामग्री सूची संख्या<br>INVENTORY NO.<br>P-5778                                                                                                                                                                        | REV. NO: .03                                                                     | निर्माणकर्ता<br>WORKED BY<br>SHAVEZ KHAN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | जांचकर्ता<br>CHECKED BY<br>SHIVA KANT | 18/4/2016 | 18/4/16 |

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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    |         |
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| SUPERSEDES<br>INVENTORY                                                                                                                                                                                               | 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><br><br>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<br><br>20.2 <u>ANNEXURE:</u><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. |             |         |
| स्वतंत्रता दिवस<br>स्वतंत्रता दिवस                                                                                                                                                                                    | 23/4/16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |             |         |
| REV. NO: .03                                                                                                                                                                                                          | निर्माणकर्ता<br>WORKED BY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | SHAVEZ KHAN | 18/4/16 |
| जांचकर्ता<br>CHECKED BY                                                                                                                                                                                               | SHIVA KANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 18/4/16     | 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 data-bbox="701 338 1290 373" data-label="Section-Header"> <h2>CONDENSER AIR EVACUATION SYSTEM</h2> </div> <div data-bbox="362 385 1588 1421" data-label="Diagram"> </div> <div data-bbox="1701 460 1749 991" data-label="Section-Header"> <h3>SYSTEM FLOW DIAGRAM</h3> </div> <div data-bbox="1701 1184 1737 1362" data-label="Text">         APPENDIX-A       </div> |                                                                                                                                                                                                             |                                                                                                                                                                                                                      |                                                               |           |
| निर्माणकर्ता<br>WORKED BY<br>जांचकर्ता<br>CHECKED BY |                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                             |                                                                                                                                                                                                                      |                                                               | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br>PRODUCT PURCHASE SPECIFICATION<br>(HEEP: HARIDWAR) |
| SHAVEZ KHAN<br>SHIVA KANT                            |                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                             |                                                                                                                                                                                                                      |                                                               | पृष्ठ 12<br>Page 12 of 27                                                                    |
| 18/4/2016<br>18/4/16                                 |                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                             |                                                                                                                                                                                                                      |                                                               | HE 57016                                                                                     |

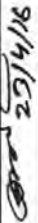
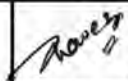
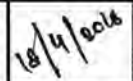
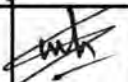
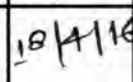
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| चिह्न एवं दिनांक<br>SIGN & DATE                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR) |                                          | HE 57016                                                                              |           |
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| 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> |                                                                                                     |                                          |                                                                                       |           |
| 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.                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                     |                                          |                                                                                       |           |
| स्वत्वाधिकार एवं गोपनीयता<br>इस दस्तावेज में दी गई प्रकृत प्रारण हेतु लैबोरेटरीय 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                     |                                          |                                                                                       |           |
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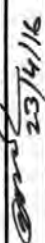
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APPENDIX-B

ATRS/VACUUM PUMP INTERFACE

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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                              |  |
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| SUPERSEDES<br>INVENTORY<br><br>                                                                                                                                                                                      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  | <b>APPENDIX-C</b>                     |  |
| सामग्री सूची संख्या की<br>अधिकतम सीमा                                                                                                                                                                                |  | <b>INDUCTION MOTOR – SPECIFICATION</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>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 हेवी एलिक्ट्रिकल लिमिटेड की संपत्ति हैं प्रत्येक प्रतिय पर प्रतिलिपि 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 |  |
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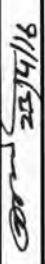
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| दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 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>अभिलेखित करें                                                                                                                                                           | <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. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                     |                                          |                                                                                       |                                                                                       |
| स्वामित्व अधिकार एवं गोपनीय<br>यह प्रतीक मे की गई सूचना भारत भारती एलेक्ट्रिकल लिमिटेड की संपत्ति है। इसका प्रयोग एवं प्रकाशन काय मे किसी भी तरह प्रयोग को बि बि कंपनी के हित मे हानिकारक हो न सिका 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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| निर्माणक<br>SIGN & DATE                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR) |                                          | HE 57016                                                                              |           |              |                                                                                             |                            |     |                             |     |
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| SUPERSEDES<br>INVENTORY<br><br>प्राचीन नमूने को<br>अतिरिक्त बना है                                                                                                                                                        | <p>5.0 <b>INSULATION AND WINDINGS:</b><br/>         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.</p> <p>6.0 <b>TEMPERATURE RISE:(For Air Cooled motors)</b><br/>         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.</p> <p>7.0 <b>CONSTRUCTIONAL FEATURES:</b></p> <p>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.</p> <p>7.2 Rotor shall be properly balanced so as to keep the vibration under running condition with in the limits specified in relevant standards.</p> <p>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%.</p> <p>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.</p> <p>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.</p> <p>7.6 Motors weighing more than 25Kg. shall be provided with eye bolt lugs or other suitable means to facilitate lifting.</p> <p>7.7 Motor shall be either TEFC (Totally enclosed fan cooled) or CACA (close Air circuit Air cooled) type.</p> <p>7.8 Noise Level &amp; Vibration Level shall be within limit as per IS: 12065 &amp; IS: 12075 respectively. Motors shall withstand vibrations produced by the driven equipment.</p> <p>7.9 System fault level may be considered as 50 KA RMS (max)for one second.</p> <p>7.10 The spacing between gland plate and centere of terminal stud shall be as follows:</p> <table border="1"> <thead> <tr> <th>Motor rating</th> <th>Dimension of terminal boxes<br/>( min distance between centre of stud and gland plate in mm)</th> </tr> </thead> <tbody> <tr> <td>a) Above 90 KW-upto 125 KW</td> <td>331</td> </tr> <tr> <td>b) Above 125 KW-upto 200 KW</td> <td>203</td> </tr> </tbody> </table> <p>8.0 <b>BEARINGS:</b></p> <p>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.</p> <p>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.</p> <p>9.0 <b>SPACE HEATERS:</b></p> <p>9.1 Space heaters shall be provided for all motor above 30 KW capacity suitable for 240 Volt single phase, 50Hz, supply.</p> <p>9.2 Terminals of the space heaters shall be brought out on a separate terminal box.</p> <p>10.0 <b>TERMINAL BOX AND LEADS:</b></p> <p>10.1 Separate terminal box should be provided for each of the following:</p> <p>a) Stator leads</p> <p>b) Space heaters</p> |                                                                                                     |                                          |                                                                                       |           | Motor rating | Dimension of terminal boxes<br>( 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 |
|                                                                                                                                                                                                                           | Motor rating                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Dimension of terminal boxes<br>( 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                     |                                          |                                                                                       |           |              |                                                                                             |                            |     |                             |     |
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| स्वत्वधिकार एवं गोपनीयता<br>इस दस्तावेज में दी गई जानकारी भारत भारती मोटोरिज लिमिटेड की संपत्ति है। इसका प्रयोग अन्य किसी व्यक्ति या संस्था के बिना भारत भारती मोटोरिज लिमिटेड की लिखित अनुमति के बिना नहीं किया जा सकता। |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                     |                                          |                                                                                       |           |              |                                                                                             |                            |     |                             |     |
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| सामग्री सूची संख्या<br>INVENTORY NO.<br>P-5778                                                                                                                                                                            | REV. NO.: 03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                     | निर्माणकर्ता<br>WORKED BY<br>SHAVEZ KHAN |  | 19/4/2016 |              |                                                                                             |                            |     |                             |     |
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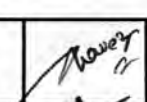
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| दिनांक एवं हस्ताक्षर<br>SIGN & DATE  |                                                                                | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR)                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | HE 57016                                                                                                                                                               |              |
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| सामग्री सूची संख्या<br>INVENTORY NO. | सामग्री सूची संख्या के अधिनीति द्वारा 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 भारती लिमिटेड की संपत्ति है तथा यह सूचना के अधिनियम के तहत गोपनीय है। इसकी कृपया सुरक्षा करें। | 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 | दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | दिनांक एवं हस्ताक्षर एवं गोपनीयता<br>इस दस्तावेज में दी गई जानकारी भारत भारती लिमिटेड की संपत्ति है तथा यह सूचना के अधिनियम के तहत गोपनीय है। इसकी कृपया सुरक्षा करें। | REV. NO: .03 |
| 5778                                 | 23/4/16                                                                                                                                                        |                                                                                                                                                                                                                     | निर्माणकर्ता<br>WORKED BY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | SHAVEZ KHAN                                                                                                                                                            | 18/4/2016    |
|                                      |                                                                                                                                                                |                                                                                                                                                                                                                     | जांचकर्ता<br>CHECKED BY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | SHIVA KANT                                                                                                                                                             | 18/4/16      |

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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 :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                           |                                 |           |
| मालिकारहित एवं गोपनीय<br>इस प्रतिलिपि में दी गई सूचना भारत भारती एल्यूमीनियम लिमिटेड की संपत्ति है। इसका उपयोग एवं प्रसारण के बिना या बिना की कदमी के बिना से हानिकारक हो न किता जाय।                                | <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 |                           |                                 |           |
| SIGN & DATE<br>INVENTORY NO.                                                                                                                                                                                         | REV. NO: .03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | निर्माणकर्ता<br>WORKED BY | SHAVEZ KHAN                     | 18/4/2016 |
| 15778                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 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                        |           |
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| सामग्री सूची संख्या<br>INVENTORY NO.                                                                                                                                                                                 | सामग्री सूची संख्या को<br>अधिकृत 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><br>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<br>7. Blank-off suction pressure : mbar<br>(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: mwc<br>(across heat exchanger terminals)<br>11. Sealing water flow: cu.m/ hr<br>12. Sealing water pressure drop: mwc<br>(across heat exchanger terminals)<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. |                                 |           |
| सामग्री सूची संख्या<br>INVENTORY NO.                                                                                                                                                                                 | दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                              | 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   |

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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 जाना नहीं 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                                                                                                                                                                                  |  | मासुकी सूची संख्या<br>INVENTORY NO.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  | REV. NO: .03                                                                                                      |  | निर्माणकर्ता<br>WORKED BY                                                             |  |
|                                                                                                                                    |  | 25/4/16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                                                                                                                   |  | SHAVEZ KHAN                                                                           |  |
| मासुकी सूची संख्या<br>INVENTORY NO.                                                                                                                                                                                   |  | 25778                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                                                                                                   |  | जांचकर्ता<br>CHECKED BY                                                               |  |
| 25778                                                                                                                                                                                                                 |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |                                                                                                                   |  | 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. | 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)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             | HE 57016                                                                              |           |
|                                                                                                                                                                                                                       |                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             | पृष्ठ 23 का 27<br>Page 23 of 27                                                       |           |
| 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> <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> <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> <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> <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> <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> <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> |             |                                                                                       |           |
| 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. |                                                                                  | स्वत्वाधिकार एवं गोपनीयता<br>इस दस्तावेज में दी गई सूचना भारत भारी विद्युत निगम की संपत्ति है। इसका प्रयोग एवं प्रसारण केवल उसी उद्देश्य के लिए ही किया जा सकता है जो कि दस्तावेज में निर्दिष्ट है। अन्यथा इसका उपयोग कानून के विरुद्ध होगा।                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |             |                                                                                       |           |
| दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                   | दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                              | 23/4/16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |             |                                                                                       |           |
| सामग्री सूची संख्या<br>INVENTORY NO.                                                                                                                                                                                  | REV. NO.: 03                                                                     | निर्माणकर्ता<br>WORKED BY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | SHAVEZ KHAN |  | 18/4/2016 |
| 25778                                                                                                                                                                                                                 |                                                                                  | जांचकर्ता<br>CHECKED BY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | SHIVA KANT  |  | 18/4/16   |



|                                                                                                                                                                                                                      |                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                       |                                             |         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------------|---------|
| निष्पन्न एवं हस्ताक्षर<br>SIGN & DATE<br><br>सामग्री सूची संख्या को<br>अधिकारित करना है<br><br>SUPERSEDES<br>INVENTORY<br><br>सामग्री सूची संख्या को<br>अधिकारित करना है                                             |  | उत्पाद क्रय विनिर्देश (हीप : हरिद्वार)<br><b>PRODUCT PURCHASE SPECIFICATION</b><br>(HEEP: HARIDWAR)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                       | HE 57016<br>पृष्ठ 25 का 27<br>Page 25 of 27 |         |
|                                                                                                                                                                                                                      |                                                                                  | <b>MOTOR DATA SHEET &amp; GA dwg</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. 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. _____ |                                       |                                             |         |
| स्वत्वाधिकार एवं गोपनीय<br>इस दस्तावेज में दी गई प्रतिलिपि भारत भारती लिमिटेड की संपत्ति है। इसका प्रयोग एवं प्रसारण केवल केवल के निर्देशों के बिना ही नहीं किया जा सकता।                                            |                                                                                  | निष्पन्न एवं हस्ताक्षर<br>SIGN & DATE<br>23/4/16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                       |                                             |         |
| सामग्री सूची संख्या<br>INVENTORY NO.<br>P-57798                                                                                                                                                                      | REV. NO.: 03                                                                     | निर्माणकर्ता<br>WORKED BY<br>SHAVEZ KHAN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | जांचकर्ता<br>CHECKED BY<br>SHIVA KANT | 23/4/2016                                   | 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>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
| 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |

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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>                       |
| सामग्री सूची संख्या को<br>अधिष्ठापित करना है                                                                                                                                                                         | SUPERSEDES<br>INVENTORY                                                          | 41. Motor paint shade.<br>42. Motor earthing point.<br>43. a) Heating time constant.<br>b) Cooling time constant.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | पृष्ठ 27 का 27<br>Page 27 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 |                                                                                  | <b>III.CONSTRUCTIONAL FEATURESS</b><br>1. Stator winding insulation<br>a. Tropicalised insulation<br>b. Class & Type<br>c. Temperature rise over 50.0 deg.C ambient temp. (deg.C)<br>d. Stator winding connections<br>e. Number of terminals brought out<br>2. Type of terminal box for<br>a. Stator leads<br>b. Space heater<br>3. For main terminal box (suggestive)<br>a. Location<br>b. Entry of cables<br>c. Recommended cable size<br>d. Fault level KA /sec.<br>e. Lug for terminal inside terminal box<br>f. Cable glands<br>4. For Bearings (Drive end/Non-Drive end )<br>a. Type<br>b. Manufacturer<br>c. Size<br>d. Recommended lubricant<br>e. Guaranteed Life<br>5. Space heaters<br>a. Numbers<br>b. Location<br>c. Power requirement (KW)<br>6. Weight (Kg.) of<br>a. Motor stator<br>b. Motor rotor<br>c. Total motor<br>d. Overall dimension of motor |                                       |
| स्वत्वाधिकार एवं गोपनीय<br>इस दस्तावेज में दी गई सूचना भारत हेवी एलेक्ट्रिकल लिमिटेड की संपत्ति है. इसका प्रयोग एवं अवलोकन केवल उस व्यक्ति के द्वारा ही किया जा सकता है जो कि इसकी स्वीकृति प्राप्त करेगा.           |                                                                                  | 41-----<br>42-----<br>43-----<br>1-----<br>a.-----<br>b.-----<br>c.-----<br>d.-----<br>e.-----<br>2-----<br>a.-----<br>b.-----<br>3-----<br>a.-----<br>b.-----<br>c.-----<br>d.-----<br>4,-----<br>a.-----<br>b.-----<br>c.-----<br>d.-----<br>5-----<br>a.-----<br>b.-----<br>c.-----<br>6-----<br>a.-----<br>b.-----<br>c.-----<br>d.-----                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                       |
| दिनांक एवं हस्ताक्षर<br>SIGN & DATE<br>25/11/16                                                                                                                                                                      |                                                                                  | <b>IV. GA DRAWINGS OF MOTOR &amp; TERMINAL BOX :</b><br><br><b>V. CHARACTERISTIC CURVES (AT 80 %, 100% &amp; 110 % OF RATED VOLTAGE)</b><br><div style="display: flex; justify-content: space-between;"> <div>           1. Current v/s speed<br/>           2. Torque v/s speed<br/>           3. Thermal with stand curve<br/>           4. Current v/s time         </div> <div>           Curve No.<br/>           1.-----<br/>           2.-----<br/>           3.-----<br/>           4.-----         </div> </div>                                                                                                                                                                                                                                                                                                                                              |                                       |
| सामग्री सूची संख्या<br>INVENTORY NO.<br>P5778                                                                                                                                                                        | REV. NO: 03                                                                      | निर्माणकर्ता<br>WORKED BY<br>SHAVEZ KHAN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | जांचकर्ता<br>CHECKED BY<br>SHIVA KANT |
|                                                                                                                                                                                                                      |                                                                                  | 18/11/16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 18/11/16                              |

31611770021

DRAWING NO.

## CONDENSER AIR EVACUATION PACKAGE UNIT

## A. DESIGN DATA :

- 1) No. of Units required per TG set : 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 : 13.3 Deg C
- 5) Condenser back pressure : 0.1047 ATA (77 mmHg-a)
- 6) Condenser cooling water temp : 33.0 Deg C
- 7) Cooling water Quality : Sea Water
- 8) All flanges should be to ANSI, B16.5

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

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

- 1) Design capacity (Holding) : 30 SCFM at 1" Hg abs at condenser design ITD
- 2) Dry Air Quantity: 135 lbs/hr
- 3) Water vapour to saturate : 297 lbs/hr
- 4) Total mixture Quantity: 432 lbs/hr
- 5) Air+Steam mixture temperature: Sub-cooled by 4.17 °C
- 6) Volume to be evacuated (approx.) : 2200 m3
- 7) Time for initial evacuation : As per HEI (condenser)  
(with two pumps in operation)
- 8) Hogging capacity, each pump : 800SCFM (minimum)  
-At 10inch Hg(a)

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

- 1) In Clause No 4.0 B-2 , add "All pipings, valves & Instruments coming in contact with sea water shall be SS 316L".

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INTEREST OF THE COMPANY.

सब अधिकार एवं गोपनीयता  
इस दस्तावेज़ में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स लिमिटेड की  
सम्पत्ति है। इसका प्रयोग या अनुवाद अन्य किसी भी तरह  
प्रयोग नहीं किया जाए या कम्पनी के हित में हानिकारक हो।

संदर्भ नमूना संख्या  
INVENTORY NO.

हस्ताक्षर और दिनांक/SIGN & DATE  
REFERENCE DRG. NO.

(CODE NO. W90716150204)

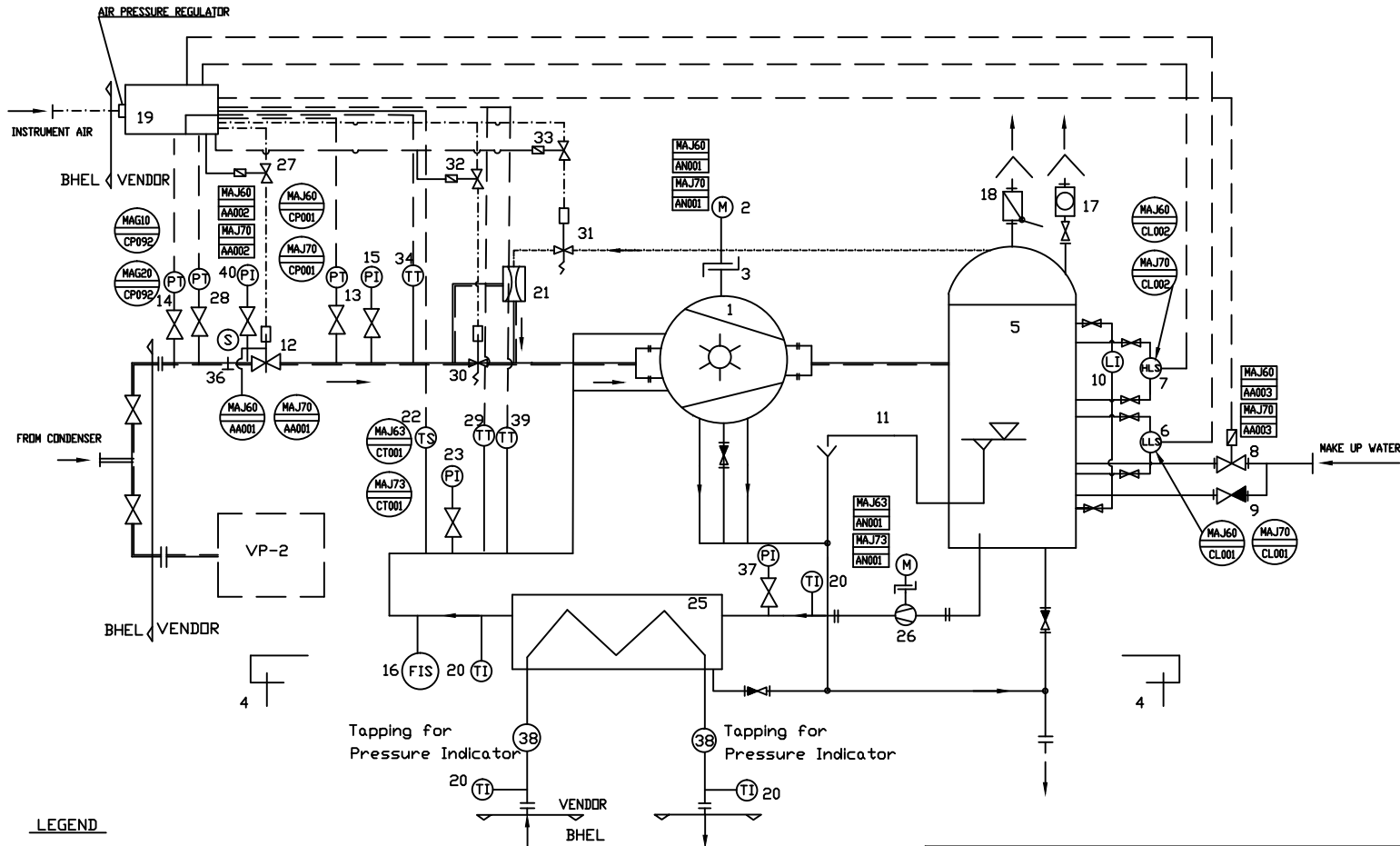
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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----------------------------------|-----------------------------|-----------------------------------------------------|
| उत्पाद का प्रकार या ग्राहक/परियोजना का नाम<br>TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT                                                                                                         |     |                                   |                             |                                                     |
| 30 SCFM VACUUM PUMP PACKAGE                                                                                                                                                                       |     |                                   |                             |                                                     |
|  भारत हेवी इलेक्ट्रिकल्स लिमिटेड, रानीपुर, हरिद्वार<br>BHARAT HEAVY ELECTRICALS LIMITED,<br>RANIPUR, HARDWAR |     |                                   |                             |                                                     |
| विकास<br>DEPIT.                                                                                                                                                                                   | HXE | अनुपात/SCALE                      | भार कि.ग्रा.<br>WEIGHT (KG) | असम्बन्धी अभिकल्प का संदर्भ<br>REFER TO ASSLY. DRG. |
| कोड/CODE                                                                                                                                                                                          |     | -                                 | -                           | संग क्रमांक<br>ITEM NO.                             |
| शीर्षक/TITLE                                                                                                                                                                                      |     | कार्ड कोड<br>CARD CODE            |                             | संगों की संख्या<br>NO. OF ITEMS                     |
| ANNEX. TO HE57016                                                                                                                                                                                 |     | 7 31611770021                     |                             | REV<br>05                                           |
| पृष्ठ संख्या/Sheets No. 1                                                                                                                                                                         |     | पृष्ठों की संख्या/No. of Sheets 2 |                             | 22 23 24                                            |

A3 साइज़/A3 SIZE

17007711915

ON DRAWING/हस्ताक्षर

## CONDENSER AIR EVACUATION SYSTEM



## 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 SYPHON LOOP
- SYSTEM INLET VALVE WITH OPEN/CLOSE LIMIT SWITCH
- PRESSURE TRANSMITTER FOR INLET VALVE OPRN.
- PR. TRANSMITTER FOR STANDBY PUMP OPRN.
- 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
- 
- HEAT EXCHANGER (SHELL & TUBE)
- SEAL WATER PUMP WITH MOTOR
- SOLENOID VALVE (24 V DC)
- PR. TRANSMITTER FOR EJECTOR (IF APPLICABLE)
- TEMP. TRANSMITTER FOR SEAL WATER FOR EJECTOR (IF APPLICABLE)
- BY-PASS VALVE FOR EJECTOR (IF APPLICABLE)
- MOTIVE AIR VALVE FOR EJECTOR (IF APPLICABLE)
- SOLENOID VALVE (24V DC) FOR EJECTOR (IF APPLICABLE)
- SOLENOID VALVE (24V DC) FOR EJECTOR (IF APPLICABLE)
- TEMPERATURE TRANSMITTER IN SUCTION LINE
- 
- TEMPORARY INLET SCREEN
- PRESSURE INDICATOR WITH VALVE
- TAPPING FOR PRESSURE INDICATOR
- TEMP. TRANSMITTER FOR SEAL WATER
- PRESSURE INDICATOR WITH VALVE

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

VACUUM PUMP PACKAGE



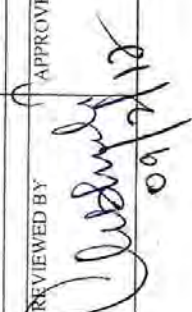
भारत हेवी इलेक्ट्रिकल्स लिमिटेड, रानीपुर, हरिद्वार  
BHARAT HEAVY ELECTRICALS LIMITED,  
RANIPUR, HARDWAR

| नाम/NAME  | हस्ताक्षर/SIGN | दिनांक/DATE | वैकल्पिक संख्या<br>No. of Var. |
|-----------|----------------|-------------|--------------------------------|
| DR. SHIVA | Sd             | 23/01/17    |                                |
| SHIVA     | Sd             | 23/01/17    |                                |
| R. BANSAL | Sd             | 23/01/17    |                                |

|                |                                        |  |              |                             |                                                    |                                             |                               |
|----------------|----------------------------------------|--|--------------|-----------------------------|----------------------------------------------------|---------------------------------------------|-------------------------------|
| विभाग<br>DEPT. | HXE                                    |  | अनुपात/SCALE | भार कि.ग्रा.<br>WEIGHT (KG) | असेम्बली अभिकल्प का संदर्भ<br>REFER TO ASSLY. DRG. | नाम क्रमांक<br>ITEM NO.                     | सभी की संख्या<br>NO. OF ITEMS |
| कोड/           | CODE                                   |  | -            | -                           |                                                    |                                             |                               |
| शीर्षक/TITLE   | P&ID – CONDENSER AIR EVACUATION SYSTEM |  |              |                             | कार्ड कोड<br>CARD CODE                             | अभिकल्प संख्या/DRAWING NO.<br>7 31611770021 |                               |
|                |                                        |  |              |                             | पृष्ठ संख्या/Sheets No. 2                          | पृष्ठों की संख्या/No. of Sheets 2           |                               |
|                |                                        |  |              |                             | REV<br>05<br>22 23 24                              |                                             |                               |

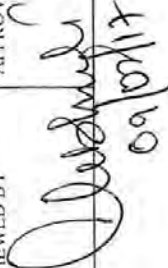
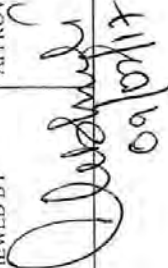
| BHEL   |                       | MANUFACTURERS NAME & ADDRESS |       |               | INSPECTION AND TEST PLAN                                                |                             |                  |        | PACKAGE: TG                       |         |     |
|--------|-----------------------|------------------------------|-------|---------------|-------------------------------------------------------------------------|-----------------------------|------------------|--------|-----------------------------------|---------|-----|
|        |                       |                              |       |               | QP NO:QA/BI/QP/006<br>REV.: 05<br>DATE: 17.10.2015<br>PAGE: Page 1 of 4 |                             |                  |        | CONTRACT NO.:<br>CONTRACTOR: BHEL |         |     |
| Sr. No | COMPONENT / OPERATION | CHARACTERISTICS              | CLASS | TYPE OF CHECK | QUANTUM OF CHECK                                                        | REFERENCE /ACCEPTANCE NORMS | FORMAT OF RECORD | AGENCY |                                   | REMARKS |     |
| 1.     | 2.                    | 3.                           | 4.    | 5.            | 6.                                                                      | 7.                          | 8.               | D      | M                                 | C       | N   |
|        |                       |                              |       |               |                                                                         |                             |                  |        |                                   |         | 10. |

|     |                                                                 |                                                                      |       |                          |          |                                     |                                     |     |   |   |   |                          |
|-----|-----------------------------------------------------------------|----------------------------------------------------------------------|-------|--------------------------|----------|-------------------------------------|-------------------------------------|-----|---|---|---|--------------------------|
| 1.  | MAIN PARTS FOR VACUUM PUMP<br>• CASING<br>• IMPELLER<br>• SHAFT | CHEMICAL & MECHANICAL PROPERTIES<br>EXAMINATION OF MACHINED SURFACES | MAJOR | CHEMICAL & MECHANICAL    | PER HEAT | AS PER APPROVED DRAWING / DATASHEET | AS PER APPROVED DRAWING / DATASHEET | TC  | ✓ | P | V | NO WELD REPAIR PERMITTED |
| 2.  | PIPE / FITTINGS (For System Pipe Work)                          | CHEMICAL & MECHANICAL PROPERTIES                                     | MAJOR | CHEMICAL & MECHANICAL    | 100%     | ASME VIII DIV 1 APPENDIX 7          | DRAWING / VENDOR'S STD              | TC  | ✓ | P | V |                          |
| 3.  | PUMP BEARINGS                                                   | DIMENSIONS<br>MAKE/TYPE                                              | MAJOR | VISUAL                   | 100%     | AS PER APPROVED DRAWING / DATASHEET | AS PER APPROVED DRAWING / DATASHEET | COC | ✓ | P | V |                          |
| 4.  | IMPELLER                                                        | DYNAMIC BALANCING                                                    | MAJOR | BALANCING AT RATED SPEED | 100%     | AS PER APPROVED DRAWING / DATASHEET | AS PER APPROVED DRAWING / DATASHEET | TC  | ✓ | P | V |                          |
| 5.  | SHAFT                                                           | UT TEST                                                              | MAJOR | CHECK                    | 100%     | VENDOR'S STD                        | VENDOR'S STD                        | TC  | ✓ | P | V |                          |
| 4a. | HEAT EXCHANGER (SHELL                                           | VISUAL & DIMENSIONAL                                                 | MAJOR | MEASUREMENT / VISUAL     | 100%     | ASTM A 388                          | AA0850118 CAT II                    | TC  | ✓ | P | V |                          |
|     |                                                                 |                                                                      |       |                          |          | VENDOR'S DRAWING                    | VENDOR'S DRAWING                    | -   | - | P | - |                          |

|                                                                                                   |            |                                                                                                                |  |         |
|---------------------------------------------------------------------------------------------------|------------|----------------------------------------------------------------------------------------------------------------|--|---------|
| LEGEND:                                                                                           |            | FOR CUSTOMER                                                                                                   |  | DOC NO. |
| I RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. |            |                                                                                                                |  |         |
| II M: MANUFACTURER / SUBCONTRACTOR                                                                |            | C: CONTRACTOR / NOM                                                                                            |  |         |
| INSPECTION AGENCY                                                                                 |            | N: CUSTOMER                                                                                                    |  |         |
| INDICATE 'P' PERFORM 'W' WITNESS AND 'V' VERIFICATION                                             |            |                                                                                                                |  |         |
| ALL 'W' INDICATED IN COLUMN 'N' SHALL BE 'CHP' OF CUSTOMER                                        |            |                                                                                                                |  |         |
| MANUFACTURER/SUB CONTRACTOR                                                                       | CONTRACTOR | REVIEWED BY<br><br>09/12/12 |  |         |
|                                                                                                   |            | APPROVED BY                                                                                                    |  |         |

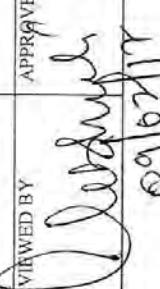
|               |                              |                                         |              |                                                                                                      |                         |                                    |                         |                                                 |                |   |     |
|---------------|------------------------------|-----------------------------------------|--------------|------------------------------------------------------------------------------------------------------|-------------------------|------------------------------------|-------------------------|-------------------------------------------------|----------------|---|-----|
| <b>BHEL</b>   |                              | <b>MANUFACTURERS NAME &amp; ADDRESS</b> |              | <b>INSPECTION AND TEST PLAN</b>                                                                      |                         |                                    |                         | <b>PACKAGE: TG</b>                              |                |   |     |
|               |                              |                                         |              | <b>ITEM:CONDENSOR AIR</b><br><b>EVACUATION PUMP PACKAGE</b><br><b>SUB-SYSTEM:</b>                    |                         |                                    |                         | <b>CONTRACT NO.:</b><br><b>CONTRACTOR: BHEL</b> |                |   |     |
|               |                              |                                         |              | <b>Q.P NO.QA/BI/QP/006</b><br><b>REV.: 05</b><br><b>DATE: 17.10.2015</b><br><b>PAGE: Page 2 of 4</b> |                         |                                    |                         |                                                 |                |   |     |
| <b>Sr. No</b> | <b>COMPONENT / OPERATION</b> | <b>CHARACTERISTICS</b>                  | <b>CLASS</b> | <b>TYPE OF CHECK</b>                                                                                 | <b>QUANTUM OF CHECK</b> | <b>REFERENCE /ACCEPTANCE NORMS</b> | <b>FORMAT OF RECORD</b> | <b>AGENCY</b>                                   | <b>REMARKS</b> |   |     |
| 1.            | 2.                           | 3.                                      | 4.           | 5.                                                                                                   | 6.                      | 7.                                 | 8.                      | M                                               | C              | N | 10. |

|    | &TUBE/PLATE) | CHEMICAL & MECHANICAL PROPERTIES OF TUBES /TUBE SHEET / SHELL    | MAJOR | CHEMICAL & MECHANICAL                                                       | PER HEAT                                 | APPROVED DRAWING / DATASHEET        | APPROVED DRAWING / DATASHEET                 | TC | ✓                            | P                            | V                            |                                                                                                                |
|----|--------------|------------------------------------------------------------------|-------|-----------------------------------------------------------------------------|------------------------------------------|-------------------------------------|----------------------------------------------|----|------------------------------|------------------------------|------------------------------|----------------------------------------------------------------------------------------------------------------|
|    |              | EDDY CURRENT TEST ON TUBES                                       | MAJOR | ECT                                                                         | 100%                                     | APPROVED DRAWING / DATASHEET        | APPROVED DRAWING / DATASHEET                 | TC | ✓                            | P                            | V                            | As applicable                                                                                                  |
|    |              | SOUNDNESS OF WELD                                                | MAJOR | X RAY OF BUTT WELDS                                                         | 10%                                      | APPROVED DRAWING / DATASHEET ASME V | APPROVED DRAWING / DATASHEET ASME VIII DIV 1 | TC | ✓                            | P                            | V                            | As applicable                                                                                                  |
|    |              | HYDRAUSTATIC TEST                                                | MAJOR | PRESSURE TEST SHELL & TUBE SIDES                                            | 100%                                     | APPROVED DRAWING / DATASHEET        | APPROVED DRAWING / DATASHEET                 | TC | ✓                            | P                            | V                            |                                                                                                                |
| 5. | MOTOR        | IDENTITY<br>ROUTINE TEST<br>TYPE REPORT<br><br>Energy Efficiency | MAJOR | VISUAL & MEASUREMENT TEST<br><br>TEST<br><br>Energy efficiency class –eff 1 | 100%<br><br>100%<br><br>100%<br><br>100% | IEC 60034 / IEC 34.1 / BES 4999     | IEC 60034 / IEC 34.1 / BES 4999              | TC | -<br><br>✓<br><br>✓<br><br>✓ | P<br><br>P<br><br>P<br><br>P | -<br><br>V<br><br>V<br><br>W | Type Test Of Same Vendor, Model, Rating Shall be Reviewed<br><br>W- along with routine test HE57016 Appendix C |

|                                    |  |                   |  |                                                                                                                                                                                                                                                                                    |  |                                                                                                                |  |                                                                                                                |  |
|------------------------------------|--|-------------------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------|--|
| <b>MANUFACTURER/SUB CONTRACTOR</b> |  | <b>CONTRACTOR</b> |  | <b>LEGEND:</b>                                                                                                                                                                                                                                                                     |  | <b>FOR CUSTOMER</b>                                                                                            |  | <b>DOC NO.</b>                                                                                                 |  |
|                                    |  |                   |  | 1 RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION<br>11 M: MANUFACTURER / SUBCONTRACTOR<br>INSPECTION AGENCY<br>INDICATE 'P' PERFORM 'W' WITNESS AND 'V' VERIFICATION<br>ALL 'W' INDICATED IN COLUMN 'N' SHALL BE 'CHP' OF CUSTOMER |  | REVIEWED BY<br><br>09/10/17 |  | APPROVED BY<br><br>09/10/17 |  |

|               |                              |                                         |              |                                                                                                                                                              |                         |                                     |                         |                                                 |   |                |     |
|---------------|------------------------------|-----------------------------------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-------------------------------------|-------------------------|-------------------------------------------------|---|----------------|-----|
| <b>BHEL</b>   |                              | <b>MANUFACTURERS NAME &amp; ADDRESS</b> |              | <b>INSPECTION AND TEST PLAN</b>                                                                                                                              |                         |                                     |                         | <b>PACKAGE: TG</b>                              |   |                |     |
|               |                              |                                         |              | <b>ITEM: CONDENSOR AIR EVACUATION PUMP PACKAGE</b><br><b>QIP NO. QA/BI/QIP/006</b><br><b>REV.: 05</b><br><b>DATE: 17.10.2015</b><br><b>PAGE: Page 3 of 4</b> |                         |                                     |                         | <b>CONTRACT NO.:</b><br><b>CONTRACTOR: BHEL</b> |   |                |     |
| <b>Sr. No</b> | <b>COMPONENT / OPERATION</b> | <b>CHARACTERISTICS</b>                  | <b>CLASS</b> | <b>TYPE OF CHECK</b>                                                                                                                                         | <b>QUANTUM OF CHECK</b> | <b>REFERENCE / ACCEPTANCE NORMS</b> | <b>FORMAT OF RECORD</b> | <b>AGENCY</b>                                   |   | <b>REMARKS</b> |     |
| 1.            | 2.                           | 3.                                      | 4.           | 5.                                                                                                                                                           | 6.                      | 7.                                  | 8.                      | M                                               | C | N              | 10. |

|    |                                             |                                            |       |                                                                            |      |                                                        |     |   |   |   |                                                      |
|----|---------------------------------------------|--------------------------------------------|-------|----------------------------------------------------------------------------|------|--------------------------------------------------------|-----|---|---|---|------------------------------------------------------|
| 6. | INSTRUMENTS<br>TEMP /<br>PRESSURE<br>GAUGES | CALIBRATION AND<br>ACCURACY                | MAJOR | CALIBRATION                                                                | 100% | AS PER VENDOR STD /<br>APPROVED DRAWING /<br>DATASHEET | COC | ✓ | P | V | clause no<br>4.1 (a) & (b)<br>are to be<br>witnessed |
| 7. |                                             |                                            |       |                                                                            |      |                                                        |     |   |   |   |                                                      |
| 7. | PACKAGE<br>ASSEMBLY                         | HYDROSTATIC<br>TEST<br>PERFORMANCE<br>TEST | MAJOR | PRESSURE TEST                                                              | 100% | VENDOR'S<br>STD<br>VENDOR'S<br>STD                     | TC  | ✓ | P | W |                                                      |
|    |                                             |                                            |       | CAPACITY &<br>POWER VS<br>SUCTION<br>PRESSURE<br>PROGRAMME<br>DEMOSTRATION | 100% | AS PER<br>APPD<br>WRITE UP<br>VENDOR'S                 | TC  | ✓ | P | W |                                                      |
|    | PLC                                         |                                            |       |                                                                            | 100% | AS PER<br>APPD<br>WRITE UP<br>VENDOR'S                 | TC  | ✓ | P | W | IF<br>APPLICABLE                                     |
|    | NOISE                                       |                                            |       | NOISE LEVEL                                                                | 100% | AS PER<br>APPD<br>WRITE UP<br>VENDOR'S                 | TC  | ✓ | P | W |                                                      |

|                                                                                                                                                                                                                                                                                          |                   |                                                                                                                       |  |                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|--|----------------------------|
| <b>LEGEND:</b>                                                                                                                                                                                                                                                                           |                   | <b>FOR CUSTOMER</b>                                                                                                   |  | <b>DOC NO.</b>             |
| 1. RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY<br>CONTRACTOR IN QA DOCUMENTATION<br>(M) MANUFACTURER / SUBCONTRACTOR<br>(I) INSPECTION AGENCY<br>INDICATE 'P' PERFORM 'W' WITNESS AND 'V' VERIFICATION<br>ALL 'W' INDICATED IN COLUMN 'N' SHALL BE 'CHP' OF CUSTOMER |                   | <b>REVIEWED BY</b><br><br>09/10/15 |  | <b>APPROVED BY</b><br><br> |
| <b>MANUFACTURER/SUB<br/>CONTRACTOR</b>                                                                                                                                                                                                                                                   | <b>CONTRACTOR</b> |                                                                                                                       |  |                            |

2

|                       |    |                                         |    |                                                               |               |                  |                              |                                                                          |    |        |         |
|-----------------------|----|-----------------------------------------|----|---------------------------------------------------------------|---------------|------------------|------------------------------|--------------------------------------------------------------------------|----|--------|---------|
| <b>BHEL</b>           |    | <b>MANUFACTURERS NAME &amp; ADDRESS</b> |    | <b>INSPECTION AND TEST PLAN</b>                               |               |                  |                              | <b>PACKAGE: TG</b>                                                       |    |        |         |
|                       |    |                                         |    | ITEM: CONDENSOR AIR<br>EVACUATION PUMP PACKAGE<br>SUB-SYSTEM: |               |                  |                              | QP NO. QA/BI/QP/006<br>REV.: 05<br>DATE: 17.10.2015<br>PAGE: Page 4 of 4 |    |        |         |
| COMPONENT / OPERATION |    | CHARACTERISTICS                         |    | CLASS                                                         | TYPE OF CHECK | QUANTUM OF CHECK | REFERENCE / ACCEPTANCE NORMS | FORMAT OF RECORD                                                         |    | AGENCY |         |
| 1.                    | 2. | 3.                                      | 4. | 5.                                                            | 6.            | 7.               | 8.                           | D                                                                        | 9. | 10.    | REMARKS |

|    |                      |                                                 |      |                       |       |  |  |   |   |   |  |
|----|----------------------|-------------------------------------------------|------|-----------------------|-------|--|--|---|---|---|--|
|    | MEASUREMENT          | CHECK                                           | STD  | APPROVED DATASHEET    | TC    |  |  |   |   |   |  |
|    | VIBRATION            | -VIBRATION CHECK                                | 100% | VENDOR'S STD          | TC    |  |  | ✓ | P | W |  |
|    | VISUAL / DIMENSIONAL | VISUAL / MEASUREMENT                            | 100% | VENDOR'S STD          | TC    |  |  | ✓ | P | W |  |
| 8. | COMPLETE PACKAGE     | CONFIRMATION FOR COMPLETENESS OF BHEL APPD. PID | 100% | AS PER BHEL APPD. PID | TC    |  |  | ✓ | P | W |  |
| 9. | PAINTING & PACKING   | MAJOR CHECK                                     | 100% | VENDOR'S STD          | CHECK |  |  | - | P | - |  |

NOTE: - TYPE TESTS - HUMID AIR TEST AND CAVITATION TO BE DONE ONLY ONCE PER PUMP TYPE

*Handwritten signature*  
09/07/17

|                             |            |                                                                                                                                                                                                                                                                                                   |  |              |             |
|-----------------------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------|-------------|
| MANUFACTURER/SUB CONTRACTOR | CONTRACTOR | LEGEND:<br>I RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION<br>M: MANUFACTURER / SUBCONTRACTOR<br>N: INSPECTION AGENCY<br>W: INDICATE 'P' PERFORM 'W' WITNESS AND 'V' VERIFICATION<br>ALL 'W' INDICATED IN COLUMN 'N' SHALL BE 'CHIP' OF CUSTOMER |  | FOR CUSTOMER | DOC NO.     |
|                             |            |                                                                                                                                                                                                                                                                                                   |  | REVIEWED BY  | APPROVED BY |

*Handwritten signature*  
Vibhuti Shah  
09/07/17