



PRE - QUALIFYING REQUIREMENTS

DOCUMENT NO: PE-TS-390-614-C002

REVISION NO: 0 DATE: 07-07-2025

SHEET: 1 of 1

Dated:

ENQUIRY NO:

PROJECT: RAGHUNATHPUR THERMAL POWER PROJECT PHASE-II (2X660MW)

PACKAGE: VIBRATION ISOLATION SYSTEM (VIS) FOR MDBFP FOUNDATION & TDBFP

FOUNDATION

PRE-QUALIFYING REQUIREMENT CRITERIA FOR EVALUATION (TECHNICAL / FINANCIAL):

Bidder should have successfully executed the following in last ten (10) years as on the due date of bid submission: -

 Bidder should have supplied and commissioned/supervised during commissioning, Steel Helical Spring and Viscous damper based Vibration Isolation System (VIS) for foundation of rotary type machine viz fan/blower/pump/turbine having minimum machine weight of 200 kN and operating frequency of at least 8 Hz in a power plant or in any other industry including civil design engineering of RCC deck supported on the VIS for at least two (2) projects and the VIS should be in successful operation for at least one year since commissioning of the machine.

The documentary proof in support of the above requirements shall be submitted by the bidder along with the bid.

Note: -

In case supplier is not original equipment manufacturer (OEM), offer shall be evaluated as per point 1. of "General PQR" available at https://pem.bhel.com/PMD/PQR%20Document/C%20and%20IT/GENERAL%20PQR.pdf

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RAGHUNATHPUR THERMAL POWER PROJECT PHASE-II (2X660 MW) STEAM TURBINE & GENERATOR PACKAGE

TECHNICAL SPECIFICATION
FOR
VIBRATION ISOLATION SYSTEM
FOR
MDBFP FOUNDATION (4 NOS)
TDBFP FOUNDATION (4 NOS)

SPECIFICATION NO.: PE-TS-390-614-C001 (Rev 0)



BHARAT HEAVY ELECTRICALS LIMITED POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA-201301



SPECIFICATION NO. PE-TS-390-614-C001

REV. NO. 0 **DATE 08.07.2025**

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CORPORATE STANDARD PACKAGING SPEC

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SECTION-I	
SPECIFIC TECHNICAL REQUIREMENTS	



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1.0 GENERAL

1.01 This specification consists of Section-I and Section-II.

In the event of Contradictions between Section-I and Section-II, the requirements mentioned in the Section-I shall prevail.

1.02 Applicable input drawings of the equipment to be supported on the foundation are as listed in Table-1.

Table-1

<u>Sl.</u> <u>No.</u>	TITLE	DRAWING NO.
1	GENERAL ARRANGEMENT OF TDBFP SET (SHEET 10F2)	HY-DG-1-180-00-57592 (R0)
2	GENERAL ARRANGEMENT OF TDBFP SET (SHEET 20F2)	HY-DG-1-180-00-57592 (R0)
3	FOUNDATION ARRANGEMENT FOR BFP & DRIVE TURBINE (SHEET 10F3)	HY-DG-1-31301-06335 (R1)
4	FOUNDATION ARRANGEMENT FOR BFP & DRIVE TURBINE (SHEET 20F3)	HY-DG-1-31301-06335 (R1)
5	FOUNDATION ARRANGEMENT FOR BFP & DRIVE TURBINE (SHEET 30F3)	HY-DG-1-31301-06335 (R1)
6	GENERAL ARRANGEMENT OF MDBFP SET (SHEET 10F1)	HY-DG-1-180-00-57591 (R0)
7	FOUNDATION ARRANGEMENT OF MDBFP SET (SHEET 10F2)	HY-DG-1-180-00-57593 (R0)
8	FOUNDATION ARRANGEMENT OF MDBFP SET (SHEET 20F2)	HY-DG-1-180-00-57593 (R0)

- 1.03 Bidder shall furnish the information about the entire range of spring units, damper units and spring-cum-damper units, manufactured/supplied by the bidder along with the offer. The information to be furnished should include the load carrying capacity, stiffness (vertical & horizontal), damping resistance, dimension of spring and damper units as well as the quality plan.
- 1.04 Customer shall select springs and dampers (nos. and type) based on the information furnished by bidder in Cl. no. 1.03 of this specification during detailed engineering and the bidder shall be required to supply the springs finally selected by customer.



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1.05 General Project Information is furnished in the Table-2 below: -

Table-2

1.	Owner	DAMODAR VALLEY CORPORATION (DVC)
2.	Project	2X660 MW RAGHUNATHPUR TPP PHASE -II (STG PKG)
3.	No. of Units	2 (Two)
4.	Consultant	NTPC Ltd.
5.	Location	Raghunath Sub-division of Purulia District, West Bengal
6.	District	Purulia- 38 KM
7.	Nearest Major Town	Raghunathpur- 7 KM
8.	Nearest Railway Station	Sanka R.S. on Adra-Bhajudih Broad Gauge line of S.E. Railway – 11KM
9.	Approach Road	Neamatpur- Purulia State Highway – 7 KM

2.0 SCOPE

2.01 SUPPLY OF VIBRATION ISOLATION SYSTEM (VIS):

Supply of Vibration Isolation System shall consist of steel helical spring units and viscous dampers with required load carrying capacities for at least 90% isolation of dynamic loads including providing templates and adhesive pads for the following: -

- 4 Nos. of MDBFP foundation
- 4 Nos. of TDBFP foundation

Bidder shall provide the manuals for installation strategy of the VIS and maintenance indicating equipment, procedures etc. required for installation and replacement of vibration isolation system mentioning the required downtime involved.

2.02 SUPPLY OF ASSOCIATED AUXILIARIES FOR INSTALLATION AND COMMISSIONING OF VIBRATION ISOLATION SYSTEM: -

Associated auxiliaries for installation and commissioning of vibration isolation system shall include the following:

· Frames for pre-stressing of spring elements.



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- Suitable hydraulic jack system including electric pumps, high pressure tubes, manifold, lifting hook, packing plates, supporting stool, steel shims or any other minor tools as required for the pre-stressing, erection, release of pre-stress, alignment, commissioning and any other misc. works etc.
- One additional set of hydraulic jack and hand operated pump.

Supply shall include painting, packing and transportation as well.

2.03 SUPERVISION OF INSTALLATION AND COMMISSIONING OF THE VIBRATION ISOLATION SYSTEM

Bidder shall deploy experienced manpower for supervision during installation and commissioning of the vibration isolation system including pre-stressing of elements, placing of elements in position, checking clearances on the shuttering of the RCC top deck, releasing of pre-stress in spring elements, making final adjustments and alignments etc.

Bidder shall provide the details of readiness to be ensured by BHEL at site prior to deploying the bidder's manpower to site for supervision. Bidder shall deploy the manpower to site for supervision after receiving invitation from BHEL.

2.04 CIVIL DESIGN ENGINEERING OF RCC DECK SUPPORTED ON VIBRATION ISOLATION SYSTEM (Excluded from Bidder's scope)

The design of supporting arrangement for the equipment supported on steel helical springs and viscous dampers shall be done by the Employer/Customer. The supporting arrangement shall consist of an RCC deck supported on steel helical springs units and viscous dampers which in turn shall be supported on Steel structure. The RCC deck and substructure shall be provided by the Employer/Customer.

-Civil Design engineering shall consist of the following:

i) Selection of Vibration Isolation System:

The selection of vibration isolation system shall be done by the bidder, such that the amplitude at bearing locations are within permissible limits, as per machine supplier recommendation or as per ISO 10816, whichever is stringent.

ii) Dynamic analysis as per codes, manufacturer guidelines and specification:

The dynamic analysis shall consist of free vibration analysis and forced vibration analysis. The fundamental natural frequency shall be sufficiently above or below the frequency corresponding to operating speed of the machine. Transient analysis shall be carried out for the short circuit / blade failure condition with an appropriate force function, if required by the machine supplier.

iii) Static analysis as per codes, manufacturer guidelines and specification:

The static analysis shall include the

Dead weights of machine stationary parts



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- Dead weights of machine rotary parts
- Loads due to machine power torque
- Loads due to maximum allowable unbalance
- Temperature loads
- Loads due to blade unbalance/short circuit
- Erection loads
- Seismic loads
- · Any other loads given by the machine supplier.

Various load combinations must be investigated to obtain the most severe loads for foundation design purpose as per relevant IS codes or as per machine supplier recommendation, whichever is more critical.

iv) Check for Shaft Misalignment

Foundation deck must be adequately stiff to withstand all operating load combinations without excessively upsetting the rotor shaft alignment. The structural design must carefully be analysed for relative deflection of the members supporting machine shaft to satisfy the limits as given by machine supplier, if any.

v) Design of RCC Deck supported on vibration isolation system

Bidder shall provide General arrangement drawing of deck showing location and supporting detail of vibration isolation system, all embedment and their details as per the machine supplier drawing.

RCC design shall be done by working stress method for all machine foundations. Minimum reinforcement shall be governed by IS: 2974 and IS:456.

All documentation shall be in English language and all RCC/structural design shall be conforming to the relevant Indian Standard Code of practice.

Following calculations and details shall also be furnished by bidder: -

 Calculation of loads on substructure (below vibration isolation system) along with their points of application and deflection limitations.

vi) Documentation

All documents shall be in English language and SI unit of measurement shall be followed.

Bidder shall furnish following documents for approval of BHEL/ BHEL's customer:

- Bill of materials of various elements included in the supply along with detailed specifications of system and various items including list of standards (local or international) to which they conform. In case bidder uses codes, which are not in English, English translated copy shall be furnished by the bidder.
- General Arrangement (GA) drawing showing location and supporting details of vibration isolation system. (Excluded from Bidder's scope)



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- GA and reinforced concrete details drawings for RCC deck (supported on vibration isolation system) including bar bending schedule. (Excluded from Bidder's scope)
- Embedment drawings showing location of all embedment and their details pertaining to RCC deck (supported on vibration isolation system). (Excluded from Bidder's scope)
- Analysis and Design document. (Excluded from Bidder's scope)
- Methodology of providing the shuttering and its removal as well as concreting of RCC deck (supported on vibration isolation system), installation of vibration isolation system and sequence of above operation.
- Painting scheme for VIS to be submitted for approval including item codification / description of all coats of paints for manufacturer's, from whom the paint is intended to be procured.

3.0 DOCUMENTS TO BE SUBMITTED BY BIDDER

Document submission schedule after the award of contract shall be as below:

BHEL DRG NO	DRG TITLE	Drg Submission schedule	
Primary Documents - at	fecting Manufacturing/ Delivery Directly		
PE-V0-390-614-C201	Data sheet of VIS for MDBFP/TDBFP Foundation	First submission within two (02) weeks from LOI/PO or receipt	
PE-V0-390-614-C202	QAP of VIS for MDBFP/TDBFP Foundation	of inputs (whichever is later) & subsequent revisions within 10 days	
PE-V0-390-614-C203	Painting Scheme of VIS for MDBFP/TDBFP Foundation	of comments received from BHEL/ Customer.	
Secondary Documents - NOT affecting Manufacturing / Delivery Directly			
PE-V0-390-614-C204	Test certificate of VIS for MDBFP/TDBFP Foundation	After inspection	

The documents shall be submitted as mentioned below:

- i. Soft copy of all documents/drawings shall be furnished in soft (PDF) format.
- ii. Hard copies shall be submitted.
- iii. Submission of drawings/documents shall be as mentioned in the Table-3.



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Table-3

	Drawing	Document
For Approval	Soft copy + 02 nos. hard copies	Soft copy + 02 nos. hard copies
For RFC	Soft copy + 10 nos. hard copies	Soft copy + 04 nos. hard copies

4.0 SEISMIC LOADING:

Seismic loading shall be calculated adopting the site-specific seismic information as specified in **ANNEXURE-EQ.**

5.0 WIND LOADING:

Basic wind speed at project site is 44 m/sec. as per IS:875(Part-3, Latest revision) upto a height of 10 metres above mean ground level.

Terrain Category-2 shall be considered for all structures.

Risk coefficient (k1) shall be considered as 1.07.

Notwithstanding the design wind forces calculated based on above parameters, the structures shall not be designed with a wind pressure less than 1.5 KN/ sq. m.

6.0 RCC DECK (SUPPORTED ON VIBRATION ISOLATION SYSTEM) (Exclude from Bidder's scope)

Minimum grade of concrete: M30.

Reinforcing bars will be TMT bars of grade Fe500 conforming to IS-1786.

7.0 ADDITIONAL REQUIREMENTS

Natural frequencies of structures and components shall be away from the running speed of
equipment by at least 20% generally but for important ones it shall be away by at least 30%.
However, frequency separation criteria and amplitude criteria as laid down in IS:2974 and/or DIN
4024 and/or VDI 2056 and/or as required by the machine manufacturer, whichever is more
stringent shall also be satisfied. A fatigue factor of 2.0 shall be considered for dynamic forces/due



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to normal unbalance. For design of foundation of large fans etc. provision shall be kept in the foundation for addition of mass/area for retuning of the foundations, if required at a later date. (Excluded from Bidder's scope)

- In case of machines supported on VIS with springs and viscous dampers it shall be ensured that
 not more than 5% of the dynamic loads are transmitted to the substructure. Necessary provisions
 of DIN 4024 shall be adhered to while designing the substructure. Substructure shall be designed
 for static loads. (Excluded from Bidder's scope)
- The vibration isolation system shall consist of helical spring units and viscous dampers supporting the RCC inertia block which support the machine. The spring units shall conform to DIN 2089 and DIN2096.
- For all equipment foundations supported on VIS, the stiffness of the supporting substructure shall be at least ten (10) times that of spring elements as per DIN 4024. (Excluded from Bidder's scope)
- All steel surfaces shall be provided with self-curing Inorganic Zinc Silicate Primer Coat (Solid by volume minimum 60%) of minimum 75-micron DFT applied over blast cleaned surface to near white metal conforming to Sa2-1/2 finish of Swedish standard SIS-05-5900. The Primer Coat shall be applied in Shop immediately after blast cleaning by Airless Spray technique.
- Primer Coat shall be followed with the application of Intermediate Coat of Polyamide Cured pigmented Titanium Dioxide (TiO2) or Micaceous Iron Oxide (MIO) Epoxy based Paint (Solid by Volume Minimum 60%) of Minimum 75 Micron DFT. This Coat shall be applied in Shop after an interval of Minimum overnight (after the application of Primer Coat) by Airless spray technique.
- Intermediate Coat shall be followed with the application of Finish Coat of Polyamide Cured colour pigmented Epoxy based Paint (Solid by Volume Minimum 60%) of Minimum 75 Micron DFT. This Coat shall be applied after an interval of Minimum overnight and maximum indefinite (after the application of Intermediate Coat) either before Erection by Airless spray technique or after Erection by brush and / or spray. Colour and shade of the Coat shall be as approved by the Employer. The Finish Coat thickness of 75 Micron can be built up either in Single application at Shop or in two applications one at Shop and the other at Site.
- Finish Coat shall be followed with the application of Final Finish Coat of Polyurethane based colour pigmented Paint (Solid by Volume Minimum 40%) of Minimum 25 Micron DFT. This Coat shall be applied within Seven (7) days (after the completion of Finish Coat), after Erection by brush and/or spray. Colour and shade of the Coat shall be as approved by the Employer.

8.0 GENERAL REQUIREMENT

Steel helical springs and viscous dampers shall be provided for equipment requiring foundations with vibration isolation system by the supplier with requisite experience and proven track record.



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8.01 Material

- The objective of designing the supporting arrangement for any rotating equipment shall be so
 that the vibration level is maintained as minimum as possible under all operating conditions.
 Accordingly, respective rotating equipment shall be supported on RCC deck slab which in turn
 shall rest on vibration isolation unit consisting of steel helical springs and viscous dampers,
 which in turn shall be supported on RCC supporting structure
- The spring units shall have definite stiffness in both vertical and horizontal directions with the horizontal stiffness not less than 50% of vertical stiffness. The stiffness shall be such that the vertical natural frequency of any spring unit at its rated load carrying capacity is not more than 3 Hz.
- The damper units or spring-cum-damper units shall be of viscous type offering velocity proportional damping. The damper units shall be suitable for temperatures ranging from 0 to 50 deg. C. The damping resistance of individual damper units shall be such that the designed damping is provided using reasonable number of units. Damper shall have damping resistance ranging from 40 kN sec/m to 750 kN sec/m.
- The size of the spring units, damper units and spring-cum-damper units shall be such that groups of such units can be accommodated on column heads in case of elevated foundations and on pedestals/walls in case of foundations at ground level.
- The steel helical springs and viscous dampers shall be designed for minimum operating life of 30 years.

8.02 Manufacturing & Testing

- Complete manufacturing and testing of the steel helical springs and viscous dampers shall be
 done at the manufacturing shop of the approved sub-vendor/supplier. For this purpose, the
 successful bidder/sub vendor shall submit the detail program for approval of engineer and take
 up the manufacturing/testing after approval of such program. The program shall include:
 - i Manufacturing schedule and quality check exercised during manufacturing
 - ii Detail of tests to be carried out at the manufacturing shop with their schedule.
 - iii Special requirements, if any, regarding concreting of top deck.
 - iv Complete step-by-step procedure covering the installation and commissioning of the spring system.
 - v Manuals for erection, commissioning, testing and maintenance of the steel helical springs and viscous dampers.
 - vi A checklist for confirming the readiness of the civil fronts for erection of steel helical springs and viscous dampers.
 - vii Checklist for equipment required at each stage of erection.
 - viii Bill of materials (data sheet) of various elements such as spring units, viscous dampers, with their rating, stiffness etc. included in the supply.
 - Bill of materials (data sheet) for frames for pre stressing, hydraulic jack including electric pump, high pressure tubes, hand operated pump etc. with their rating and numbers.
 - x Any other details which may be necessary to facilitate design and construction of the foundations/structures.



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 The springs shall conform to codes DIN 2089 and DIN 2096. The quality assurance and inspection procedures shall be finalized on the basis of the above codes and the quality plans be drawn accordingly.

8.03 Erection, Commissioning and Supervision

- Complete erection and commissioning of the steel helical springs and viscous dampers including pre-stressing of elements, placing of elements in position, checking clearances on the shuttering of the RCC top deck, releasing of pre-stress in spring elements, making final adjustments and alignments etc. all shall be done by a specialist supervisor of supplier/sub vendor trained for this purpose.
- The scope of work shall be deemed to include all activities, which may not have been explicitly
 mentioned but are reasonably implied for the successful commissioning of steel helical springs
 and viscous dampers.
- The successful bidder shall guarantee the performance of the steel helical springs and viscous dampers for 24 months from the date of commissioning of each machine which shall be termed as "Guarantee Period".
- If any realignment of the steel helical springs and viscous dampers is required to be done for aligning the shaft or for any other reasons during the first one year of operation from the date of commissioning of the machine, the same shall be done by the bidder.

8.04 Acceptance Criteria

Stiffness values shall be checked. The permissible deviations shall be as per DIN 2096. Following acceptance criteria shall be followed:

- General workmanship shall be good in line with the recommendation of the manufacturer and as approved by the Engineer.
- Tolerances are within the specified limit.
- Material test certificate (MTC) is in compliance with the applicable codes/standards.
- Bought out material is from the approved manufacturer/vendor.
- Bought out material is matching with the approved sample.

8.05 Codes and Standards

Latest revision of following codes shall be used for the design of the spring supported foundation:

IS: 456	Code of practice for plain and reinforced concrete.
IS: 2974	Code of practice for design and construction of machine foundations.
IS:1893	Criteria for earthquake resistant design of structures
DIN:4024	Machine foundation; Flexible supporting structures for machine with rotating masses
DIN: 2089	Helical compression springs out of round wire and rod: calculation & design
DIN: 2096	Helical compression springs out of round wire and rod: quality requirements for hot formed compression springs.
VDI: 2056	Criteria for assessing mechanical vibrations of machine.
VDI: 2060	Criteria for assessing the state of balance of rotating rigid bodies.



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SECTION-II	
STANDARD TECHNICAL SPECIFICATION	



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1. GENERAL REQUIREMENTS

- a. The total number of springs in a vibration isolation system module should be even.
- b. The ratio of actual spring supported weight to the nominal spring capacity shall not be more than 0.8.
- c. The vibration isolation system module should be structurally stable. Stability of the module in all direction needs to be ensured under maximum loads.
- d. The springs shall conform to latest version of codes DIN EN 13906-1 and DIN 2096 or equivalent.
- e. The damper units or spring cum damper units should be of viscous type offering velocity proportional damping.
- f. The damper units shall be suitable for temperatures ranging from 0 to 50° C.
- g. The damping resistance of the individual damper units shall be such that the designed damping can be provided using reasonable number of units.
- h. The size of the spring units, damper units, spring cum damper units should be such that groups of such units can be accommodated on column heads in case of elevated foundations and on pedestals/walls in case of foundations at ground level.
- i. The vibration isolation system module in the same foundation should have same deflection under its rated load carrying capacity. The height of all the modules to be used in a foundation must be same.
- j. Bidder shall furnish manufacturer's test certificate for the bought out items.
- k. The steel helical springs and viscous dampers shall be designed for a minimum operating life of 30 years.
- I. The material specification requirement has been mentioned in the reference Quality plan attached in this specification.
- m. The system shall be capable of withstanding seismic/ wind forces.

2. MANUFACTURING & TESTING

- 2.1 The bidder shall submit the detailed programme for approval of BHEL/BHEL's customer and take up the manufacturing / testing after approval of such programme. The programme / quality plan shall include:
 - i. Manufacturing schedule and quality check exercised during manufacturing.
 - ii. Detail of tests to be carried out at the manufacturing shop with its schedule.
 - iii. Special requirements, if any, regarding concreting of RCC deck (supported on vibration isolation system).



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- iv. Complete step- by- step procedure covering the installation and commissioning of the spring system.
- v. Manuals for installation, commissioning, testing and maintenance of the steel helical springs and viscous dampers.
- vi. A checklist for confirming the readiness of the civil fronts for erection of steel helical springs and viscous dampers.
- vii. Checklist for equipment/auxiliaries required at each stage of erection.
- viii. Bill of materials (data sheet) of various elements such as spring units, viscous dampers, with their rating, stiffness etc. included in the supply.
- ix. Bill of material (data sheet) for frames for pre-stressing, hydraulic jack including electric pump, high pressure tubes, hand operated pump etc. with their rating and numbers.
- x. Any other details which may be necessary to facilitate design and construction of the foundations / structures.
- 2.2 The springs shall conform to codes DIN EN 13906-1 and DIN 2096. The quality assurance and inspection procedure shall be finalised on the basis of the above codes and the quality plans be drawn accordingly.

3. QUALITY PLAN AND INSPECTION REQUIREMENTS

- 3.1 Bidder shall furnish the quality plan and Test certificate for the material in their scope of supply. The quality plan shall be reviewed by BHEL/BHEL's Customer wherein the inspection and hold points shall be indicated. Bidder shall submit test certificate based on approved quality plan.
- 3.2 Quality requirements shall be as per quality plan attached in the specification. Quality plan shall be subject to approval during detail engineering. No additional price implication shall be admissible for conducting any additional tests as per Quality plan approved by BHEL/BHEL's Customer.
- 3.3 Quality plan will be subject to BHEL/BHEL's Customer approval & customer hold points for inspection/ testing shall be marked in the Quality plan at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc.
- 3.4 Inspection for imported item shall be done by third party inspection agency (approved by BHEL) and certificate shall be submitted for review of BHEL. The charges for 3rd party inspection at foreign location for imported components shall be included by the bidder in the rate quoted for the VIS.



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4. PACKING AND TRANSPORTATION

- 4.1 All supply items shall be suitably protected, coated, covered, boxed and crated to prevent damage or deterioration during transit and handling.
- 4.2 The bidder shall be responsible for any loss or damage during transportation, handling at site.
- 4.3 The packing and transportation of supply items shall be done as per the BHEL Corporate standard no. AA0490010. Packing shall be of type "CQ" as per BHEL corporate standard or equivalent. In case transportation involves sea route, the BHEL standard no. AA0490004 shall be followed for sea worthy packing and transportation.

5. ENVIRONMENTAL PROTECTION

Vibration isolation system shall be suitably protected against environmental damages viz. abrasion, discolouration, corrosion, oily water etc. to give a prolonged service matching the plant life.

6. PERFORMANCE GUARANTEE

Bidder shall guarantee the performance of the vibration isolation system for 24 months from the date of commissioning of machine which shall be termed as "Guarantee Period".

7. CODES AND STANDARDS

Latest revision of following codes or equivalent international standard shall be used for the design of the spring-supported foundations:

1) IS: 456 Codes practice for plain and reinforced concrete.

2) IS: 2974 Code of practice for design and construction of machine

foundations.

3) IS: 1893 Criteria for earthquake resistant design of structures.

4) DIN: 4024 Machine foundations; Flexible supporting structures for machine

with rotating masses

5) DIN EN 13906-1: Helical compression springs out of round wire and rod: calculation

& design.

6) DIN: 2096 Helical compression springs out of round wire and rod: Quality

requirements for hot formed compression springs.

7) ISO 10816 (Part 1 to7) Mechanical vibration – Evaluation of machine vibration by

measurements on non-rotating parts.



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ANNEXURE – EQ	

CLAUSE NO.	
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SCOPE OF SUPPLY & SERVICES



ANNEXURE-EQ

CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT

All structures and equipment shall be designed for seismic forces adopting the site specific seismic information provided in this document and using the other provisions in accordance with IS:1893 (Part 1):2002 and IS:1893 (Part 4):2005. Pending finalisation of Parts 2, 3 and 5 of IS:1893, provisions of part 1 shall be read along with the relevant clauses of IS:1893:1984, for structures other than the buildings and industrial structures including stack-like structures.

A site specific seismic study has been conducted for the project site. The peak ground horizontal acceleration for the project site, the site specific acceleration spectral coefficients (in units of gravity acceleration 'g') in the horizontal direction for the various damping values and the multiplying factor (to be used over the spectral coefficients) for evaluating the design acceleration spectra are as given at **Annexure-I**.

Vertical acceleration spectral values shall be taken as 2/3rd of the corresponding horizontal values.

The site specific design acceleration spectra shall be used in place of the response acceleration spectra, given at figure-2 in IS:1893 (Part 1) and Annex B of IS:1893 (Part 4). The site specific acceleration spectra along with multiplying factors specified in **Appendix-I** includes the effect of the seismic environment of the site, the importance factor related to the structures and the response reduction factor. Hence, the design spectra do not require any further consideration of the zone factor (Z), the importance factor (I) and response reduction factor (R) as used in the IS:1893 (Part 1 and Part 4).

Damping in Structures

The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:

a)	Steel structures	:	2%
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b) Reinforced Concrete structures : 5%

c) Reinforced Concrete Stacks : 3%

d) Steel stacks : 2%

MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI PART-A	D-1 CIVIL	PAGE 7 OF 13
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SCOPE OF SUPPLY & SERVICES



Method of Analysis

Since most structures in a power plant are irregular in shape and have irregular distribution of mass and stiffness, dynamic analysis for obtaining the design seismic forces shall be carried out using the response spectrum method. The number of vibration modes used in the analysis should be such that the sum total of modal masses of all modes considered is at least 90 percent of the total seismic mass and shall also meet requirements of IS:1893 (Part 1). Modal combination of the peak response quantities shall be performed as per Complete Quadratic Combination (CQC) method or by an acceptable alternative as per IS:1893 (Part 1).

In general, seismic analysis shall be performed for the three orthogonal (two principal horizontal and one vertical) components of earthquake motion. The seismic response from the three components shall be combined as specified in IS:1893 (Part 1).

For buildings, if the design base shear (V_B) obtained from modal combination is less than the base shear (\bar{V}_B) computed using the approximate fundamental period (T_a) given in IS:1893:Part 1 and using site specific acceleration spectra with appropriate multiplying factor, the response quantities (e.g. member forces, displacements, storey forces, storey shears and base reactions) shall be enhanced in the ratio of \bar{V}_B/V_B . However, no reduction is permitted if \bar{V}_B is less than V_B .

For regular buildings less than 12m in height, design seismic base shear and its distribution to different floor levels along the height of the building may be carried out as specified under clause 7.5, 7.6 & 7.7 of IS:1893 (Part 1) and using site specific design acceleration spectra. The design horizontal acceleration spectrum value (Ah) shall be computed for the fundamental natural period as per clause 7.6 of IS:1893 (Part 1) using site specific spectral acceleration coefficients with appropriate multiplying factor given in **Annexure-I**. Further, the spectral acceleration coefficient shall get restricted to the peak spectral value if the fundamental natural period of the building falls to the left of the peak in the spectral acceleration curve.

Design/Detailing for Ductility for Structures

The site specific design acceleration spectra is a reduced spectra and has an in-built allowance for ductility. Structures shall be engineered and detailed in accordance with relevant Indian/International standards to achieve ductility.



ANNEXURE - I

: 0.057

SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT

The various site specific seismic parameters for the project site shall be as follows:

- 1) Peak ground horizontal acceleration (MCE) : 0.17g
- 2) Multiplying factor to be applied to the site specific horizontal acceleration spectral coefficients (in units of gravity acceleration 'g') to obtain the design acceleration spectra
 - a) for moment resisting steel frames designed and detailed as per IS:800 and moment resisting RC frames designed and detailed as per IS:456
 - b) for braced steel frames designed and detailed as per : 0.043 IS:800
 - c) for moment resisting RC frames designed and detailed as : 0.034 per IS:456 and IS:13920
 - d) for design of structures not covered under 2 (a) to 2 (c) : 0.057 above and under 3 below
- 3) Multiplying factor to be applied to the site specific : 0.113 horizontal acceleration spectral coefficients (in units of gravity acceleration 'g') for design of equipment and structures where inelastic action is not relevant or not permitted

Note: g = Acceleration due to gravity

The horizontal seismic acceleration spectral coefficients are furnished in subsequent pages.

MOUDA SUPER THERMAL POWER PROJECT
STAGE-II (2X660 MW)
STEAM TURBINE GENERATOR PACKAGE

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<u>APPENDIX – I</u>

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS (In units of 'g')

Time		Damping	Factor (A	As a perce	entage of	Critical D	amping)	
Period (Sec)	0.800	1.000	1.600	2.000	3.000	5.000	7.000	10.000
0.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
0.030	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
0.050	1.840	1.881	1.793	1.696	1.579	1.430	1.341	1.257
0.100	4.210	4.434	3.960	3.473	2.934	2.323	1.998	1.715
0.108	4.616	4.877	4.343	3.760	3.143	2.451	2.089	1.775
0.110	4.718	4.981	4.343	3.832	3.195	2.483	2.111	1.790
0.115	4.975	4.981	4.343	4.024	3.324	2.562	2.165	1.826
0.119	5.182	4.981	4.343	4.024	3.436	2.624	2.208	1.854
0.121	5.269	4.981	4.343	4.024	3.436	2.654	2.230	1.868
0.122	5.269	4.981	4.343	4.024	3.436	2.670	2.240	1.875
0.125	5.269	4.981	4.343	4.024	3.436	2.716	2.272	1.895
0.127	5.269	4.981	4.343	4.024	3.436	2.751	2.293	1.909
0.129	5.269	4.981	4.343	4.024	3.436	2.751	2.313	1.922
0.132	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.942
0.133	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.949
0.134	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.150	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.200	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.250	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.300	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.350	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.400	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.450	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.500	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.525	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.542	5.269	4.981	4.343	4.024	3.436	2.751	2.338	1.951
0.550	5.269	4.981	4.284	4.024	3.436	2.751	2.338	1.951
0.576	5.269	4.752	4.090	4.024	3.436	2.751	2.338	1.951
0.597	5.269	4.585	3.946	3.886	3.436	2.751	2.338	1.951
0.603	5.269	4.539	3.907	3.847	3.400	2.751	2.338	1.951
0.637	4.987	4.297	3.699	3.642	3.218	2.751	2.338	1.951

MOUDA SUPER THERMAL POWER PROJECT
STAGE-II (2X660 MW)
STEAM TURBINE GENERATOR PACKAGE

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APPENDIX - I

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS (In units of 'g')

Period (Sec) 0.800 1.000 1.600 2.000 3.000 5.000 7.000 10.000 0.645 4.926 4.243 3.653 3.597 3.178 2.716 2.338 1.951 0.650 4.888 4.211 3.625 3.569 3.154 2.695 2.338 1.951 0.667 4.763 4.103 3.532 3.478 3.073 2.627 2.306 1.951 0.700 4.539 3.910 3.366 3.314 2.929 2.503 2.197 1.859 0.750 4.236 3.649 3.141 3.093 2.733 2.336 2.051 1.735 0.800 3.971 3.421 2.945 2.900 2.563 2.190 1.923 1.626 0.850 3.738 3.220 2.772 2.729 2.412 2.061 1.809 1.531 0.900 3.530 3.041 2.618 2.578 2.278 1.947 1.709 1.446	Time		Damping		As a perce		Critical D	amping)	
(Sec) 4.926 4.243 3.653 3.597 3.178 2.716 2.338 1.951 0.650 4.888 4.211 3.625 3.569 3.154 2.695 2.338 1.951 0.658 4.828 4.160 3.581 3.526 3.116 2.663 2.338 1.951 0.667 4.763 4.103 3.532 3.478 3.073 2.627 2.306 1.951 0.700 4.539 3.910 3.366 3.314 2.992 2.503 2.197 1.859 0.750 4.236 3.649 3.141 3.093 2.733 2.336 2.051 1.735 0.800 3.971 3.421 2.945 2.900 2.563 2.190 1.923 1.626 0.850 3.738 3.220 2.772 2.729 2.412 2.061 1.809 1.531 0.900 3.530 3.041 2.618 2.578 2.278 1.947 1.709 1.446									
0.650 4.888 4.211 3.625 3.569 3.154 2.695 2.338 1.951 0.658 4.828 4.160 3.581 3.526 3.116 2.663 2.338 1.951 0.667 4.763 4.103 3.532 3.478 3.073 2.627 2.306 1.951 0.700 4.539 3.910 3.366 3.314 2.929 2.503 2.197 1.859 0.750 4.236 3.649 3.141 3.093 2.733 2.336 2.051 1.735 0.800 3.971 3.421 2.945 2.900 2.563 2.190 1.923 1.626 0.850 3.738 3.220 2.772 2.729 2.412 2.061 1.809 1.531 0.900 3.530 3.041 2.618 2.578 2.278 1.947 1.709 1.446 0.950 3.344 2.881 2.480 2.442 2.158 1.844 1.619 1.369	(Sec)	0.800	1.000	1.600	2.000	3.000	5.000	7.000	10.000
0.658 4.828 4.160 3.581 3.526 3.116 2.663 2.338 1.951 0.667 4.763 4.103 3.532 3.478 3.073 2.627 2.306 1.951 0.700 4.539 3.910 3.366 3.314 2.929 2.503 2.197 1.859 0.750 4.236 3.649 3.141 3.093 2.733 2.336 2.051 1.735 0.800 3.971 3.421 2.945 2.900 2.563 2.190 1.923 1.626 0.850 3.738 3.220 2.772 2.729 2.412 2.061 1.809 1.531 0.900 3.530 3.041 2.618 2.578 2.278 1.947 1.709 1.446 0.950 3.344 2.881 2.480 2.442 2.158 1.844 1.619 1.369 1.000 3.177 2.737 2.356 2.320 2.050 1.752 1.538 1.301	0.645	4.926	4.243	3.653	3.597	3.178	2.716	2.338	1.951
0.667 4.763 4.103 3.532 3.478 3.073 2.627 2.306 1.951 0.700 4.539 3.910 3.366 3.314 2.929 2.503 2.197 1.859 0.750 4.236 3.649 3.141 3.093 2.733 2.336 2.051 1.735 0.800 3.971 3.421 2.945 2.900 2.563 2.190 1.923 1.626 0.850 3.738 3.220 2.772 2.729 2.412 2.061 1.809 1.531 0.900 3.530 3.041 2.618 2.578 2.278 1.947 1.709 1.446 0.950 3.344 2.881 2.480 2.442 2.158 1.844 1.619 1.369 1.000 3.177 2.737 2.356 2.320 2.050 1.752 1.538 1.301 1.050 3.026 2.607 2.244 2.210 1.952 1.669 1.465 1.239	0.650	4.888	4.211	3.625	3.569	3.154	2.695	2.338	1.951
0.700 4.539 3.910 3.366 3.314 2.929 2.503 2.197 1.859 0.750 4.236 3.649 3.141 3.093 2.733 2.336 2.051 1.735 0.800 3.971 3.421 2.945 2.900 2.563 2.190 1.923 1.626 0.850 3.738 3.220 2.772 2.729 2.412 2.061 1.809 1.531 0.900 3.530 3.041 2.618 2.578 2.278 1.947 1.709 1.446 0.950 3.344 2.881 2.480 2.442 2.158 1.844 1.619 1.369 1.000 3.177 2.737 2.356 2.320 2.050 1.752 1.538 1.301 1.050 3.026 2.607 2.244 2.210 1.952 1.669 1.465 1.239 1.100 2.888 2.488 2.142 2.109 1.864 1.593 1.337 1.131	0.658	4.828	4.160	3.581	3.526	3.116	2.663	2.338	1.951
0.750 4.236 3.649 3.141 3.093 2.733 2.336 2.051 1.735 0.800 3.971 3.421 2.945 2.900 2.563 2.190 1.923 1.626 0.850 3.738 3.220 2.772 2.729 2.412 2.061 1.809 1.531 0.900 3.530 3.041 2.618 2.578 2.278 1.947 1.709 1.446 0.950 3.344 2.881 2.480 2.442 2.158 1.844 1.619 1.369 1.000 3.177 2.737 2.356 2.320 2.050 1.752 1.538 1.301 1.050 3.026 2.607 2.244 2.210 1.952 1.669 1.465 1.239 1.100 2.888 2.488 2.142 2.109 1.864 1.593 1.398 1.183 1.200 2.648 2.281 1.963 1.933 1.708 1.460 1.282 1.084	0.667	4.763	4.103	3.532	3.478	3.073	2.627	2.306	1.951
0.800 3.971 3.421 2.945 2.900 2.563 2.190 1.923 1.626 0.850 3.738 3.220 2.772 2.729 2.412 2.061 1.809 1.531 0.900 3.530 3.041 2.618 2.578 2.278 1.947 1.709 1.446 0.950 3.344 2.881 2.480 2.442 2.158 1.844 1.619 1.369 1.000 3.177 2.737 2.356 2.320 2.050 1.752 1.538 1.301 1.050 3.026 2.607 2.244 2.210 1.952 1.669 1.465 1.239 1.100 2.888 2.488 2.142 2.109 1.864 1.593 1.398 1.183 1.150 2.763 2.380 2.049 2.017 1.783 1.523 1.337 1.131 1.200 2.648 2.281 1.963 1.933 1.708 1.460 1.282 1.084	0.700	4.539	3.910	3.366	3.314	2.929	2.503	2.197	1.859
0.850 3.738 3.220 2.772 2.729 2.412 2.061 1.809 1.531 0.900 3.530 3.041 2.618 2.578 2.278 1.947 1.709 1.446 0.950 3.344 2.881 2.480 2.442 2.158 1.844 1.619 1.369 1.000 3.177 2.737 2.356 2.320 2.050 1.752 1.538 1.301 1.050 3.026 2.607 2.244 2.210 1.952 1.669 1.465 1.239 1.100 2.888 2.488 2.142 2.109 1.864 1.593 1.398 1.183 1.150 2.763 2.380 2.049 2.017 1.783 1.523 1.337 1.131 1.200 2.648 2.281 1.963 1.933 1.708 1.460 1.282 1.084 1.250 2.542 2.190 1.885 1.856 1.640 1.402 1.230 1.041	0.750	4.236	3.649	3.141	3.093	2.733	2.336	2.051	1.735
0.900 3.530 3.041 2.618 2.578 2.278 1.947 1.709 1.446 0.950 3.344 2.881 2.480 2.442 2.158 1.844 1.619 1.369 1.000 3.177 2.737 2.356 2.320 2.050 1.752 1.538 1.301 1.050 3.026 2.607 2.244 2.210 1.952 1.669 1.465 1.239 1.100 2.888 2.488 2.142 2.109 1.864 1.593 1.398 1.183 1.150 2.763 2.380 2.049 2.017 1.783 1.523 1.337 1.131 1.200 2.648 2.281 1.963 1.933 1.708 1.460 1.282 1.084 1.250 2.542 2.190 1.885 1.856 1.640 1.402 1.230 1.041 1.300 2.444 2.105 1.812 1.785 1.577 1.348 1.183 1.001	0.800	3.971	3.421	2.945	2.900	2.563	2.190	1.923	1.626
0.950 3.344 2.881 2.480 2.442 2.158 1.844 1.619 1.369 1.000 3.177 2.737 2.356 2.320 2.050 1.752 1.538 1.301 1.050 3.026 2.607 2.244 2.210 1.952 1.669 1.465 1.239 1.100 2.888 2.488 2.142 2.109 1.864 1.593 1.398 1.183 1.150 2.763 2.380 2.049 2.017 1.783 1.523 1.337 1.131 1.200 2.648 2.281 1.963 1.933 1.708 1.460 1.282 1.084 1.250 2.542 2.190 1.885 1.856 1.640 1.402 1.230 1.041 1.300 2.444 2.105 1.812 1.785 1.577 1.348 1.183 1.001 1.350 2.353 2.027 1.745 1.719 1.519 1.298 1.139 0.964	0.850	3.738	3.220	2.772	2.729	2.412	2.061	1.809	1.531
1.000 3.177 2.737 2.356 2.320 2.050 1.752 1.538 1.301 1.050 3.026 2.607 2.244 2.210 1.952 1.669 1.465 1.239 1.100 2.888 2.488 2.142 2.109 1.864 1.593 1.398 1.183 1.150 2.763 2.380 2.049 2.017 1.783 1.523 1.337 1.131 1.200 2.648 2.281 1.963 1.933 1.708 1.460 1.282 1.084 1.250 2.542 2.190 1.885 1.856 1.640 1.402 1.230 1.041 1.300 2.444 2.105 1.812 1.785 1.577 1.348 1.183 1.001 1.350 2.353 2.027 1.745 1.719 1.519 1.298 1.139 0.964 1.400 2.269 1.955 1.683 1.657 1.464 1.251 1.099 0.929	0.900	3.530	3.041	2.618	2.578	2.278	1.947	1.709	1.446
1.050 3.026 2.607 2.244 2.210 1.952 1.669 1.465 1.239 1.100 2.888 2.488 2.142 2.109 1.864 1.593 1.398 1.183 1.150 2.763 2.380 2.049 2.017 1.783 1.523 1.337 1.131 1.200 2.648 2.281 1.963 1.933 1.708 1.460 1.282 1.084 1.250 2.542 2.190 1.885 1.856 1.640 1.402 1.230 1.041 1.300 2.444 2.105 1.812 1.785 1.577 1.348 1.183 1.001 1.350 2.353 2.027 1.745 1.719 1.519 1.298 1.139 0.964 1.400 2.269 1.955 1.683 1.657 1.464 1.251 1.099 0.929 1.450 2.118 1.885 1.571 1.547 1.367 1.168 1.025 0.867	0.950	3.344	2.881	2.480	2.442	2.158	1.844	1.619	1.369
1.100 2.888 2.488 2.142 2.109 1.864 1.593 1.398 1.183 1.150 2.763 2.380 2.049 2.017 1.783 1.523 1.337 1.131 1.200 2.648 2.281 1.963 1.933 1.708 1.460 1.282 1.084 1.250 2.542 2.190 1.885 1.856 1.640 1.402 1.230 1.041 1.300 2.444 2.105 1.812 1.785 1.577 1.348 1.183 1.001 1.350 2.353 2.027 1.745 1.719 1.519 1.298 1.139 0.964 1.400 2.269 1.955 1.683 1.657 1.464 1.251 1.099 0.929 1.450 2.191 1.888 1.625 1.600 1.414 1.208 1.061 0.897 1.500 2.118 1.825 1.571 1.547 1.367 1.168 1.025 0.867	1.000	3.177	2.737	2.356	2.320	2.050	1.752	1.538	1.301
1.150 2.763 2.380 2.049 2.017 1.783 1.523 1.337 1.131 1.200 2.648 2.281 1.963 1.933 1.708 1.460 1.282 1.084 1.250 2.542 2.190 1.885 1.856 1.640 1.402 1.230 1.041 1.300 2.444 2.105 1.812 1.785 1.577 1.348 1.183 1.001 1.350 2.353 2.027 1.745 1.719 1.519 1.298 1.139 0.964 1.400 2.269 1.955 1.683 1.657 1.464 1.251 1.099 0.929 1.450 2.191 1.888 1.625 1.600 1.414 1.208 1.061 0.897 1.500 2.118 1.825 1.571 1.547 1.367 1.168 1.025 0.867 1.550 2.050 1.766 1.520 1.497 1.323 1.130 0.992 0.839	1.050	3.026	2.607	2.244	2.210	1.952	1.669	1.465	1.239
1.200 2.648 2.281 1.963 1.933 1.708 1.460 1.282 1.084 1.250 2.542 2.190 1.885 1.856 1.640 1.402 1.230 1.041 1.300 2.444 2.105 1.812 1.785 1.577 1.348 1.183 1.001 1.350 2.353 2.027 1.745 1.719 1.519 1.298 1.139 0.964 1.400 2.269 1.955 1.683 1.657 1.464 1.251 1.099 0.929 1.450 2.191 1.888 1.625 1.600 1.414 1.208 1.061 0.897 1.500 2.118 1.825 1.571 1.547 1.367 1.168 1.025 0.867 1.550 2.050 1.766 1.520 1.497 1.323 1.130 0.992 0.839 1.650 1.986 1.711 1.473 1.450 1.281 1.095 0.961 0.813	1.100	2.888	2.488	2.142	2.109	1.864	1.593	1.398	1.183
1.250 2.542 2.190 1.885 1.856 1.640 1.402 1.230 1.041 1.300 2.444 2.105 1.812 1.785 1.577 1.348 1.183 1.001 1.350 2.353 2.027 1.745 1.719 1.519 1.298 1.139 0.964 1.400 2.269 1.955 1.683 1.657 1.464 1.251 1.099 0.929 1.450 2.191 1.888 1.625 1.600 1.414 1.208 1.061 0.897 1.500 2.118 1.825 1.571 1.547 1.367 1.168 1.025 0.867 1.550 2.050 1.766 1.520 1.497 1.323 1.130 0.992 0.839 1.600 1.986 1.711 1.473 1.450 1.281 1.095 0.961 0.813 1.650 1.925 1.659 1.428 1.406 1.242 1.062 0.932 0.788	1.150	2.763	2.380	2.049	2.017	1.783	1.523	1.337	1.131
1.300 2.444 2.105 1.812 1.785 1.577 1.348 1.183 1.001 1.350 2.353 2.027 1.745 1.719 1.519 1.298 1.139 0.964 1.400 2.269 1.955 1.683 1.657 1.464 1.251 1.099 0.929 1.450 2.191 1.888 1.625 1.600 1.414 1.208 1.061 0.897 1.500 2.118 1.825 1.571 1.547 1.367 1.168 1.025 0.867 1.550 2.050 1.766 1.520 1.497 1.323 1.130 0.992 0.839 1.600 1.986 1.711 1.473 1.450 1.281 1.095 0.961 0.813 1.650 1.925 1.659 1.428 1.406 1.242 1.062 0.932 0.788 1.700 1.869 1.610 1.386 1.365 1.206 1.031 0.905 0.765	1.200	2.648	2.281	1.963	1.933	1.708	1.460	1.282	1.084
1.350 2.353 2.027 1.745 1.719 1.519 1.298 1.139 0.964 1.400 2.269 1.955 1.683 1.657 1.464 1.251 1.099 0.929 1.450 2.191 1.888 1.625 1.600 1.414 1.208 1.061 0.897 1.500 2.118 1.825 1.571 1.547 1.367 1.168 1.025 0.867 1.550 2.050 1.766 1.520 1.497 1.323 1.130 0.992 0.839 1.600 1.986 1.711 1.473 1.450 1.281 1.095 0.961 0.813 1.650 1.925 1.659 1.428 1.406 1.242 1.062 0.932 0.788 1.700 1.869 1.610 1.386 1.365 1.206 1.031 0.905 0.765 1.750 1.815 1.564 1.346 1.326 1.171 1.001 0.879 0.743	1.250	2.542	2.190	1.885	1.856	1.640	1.402	1.230	1.041
1.400 2.269 1.955 1.683 1.657 1.464 1.251 1.099 0.929 1.450 2.191 1.888 1.625 1.600 1.414 1.208 1.061 0.897 1.500 2.118 1.825 1.571 1.547 1.367 1.168 1.025 0.867 1.550 2.050 1.766 1.520 1.497 1.323 1.130 0.992 0.839 1.600 1.986 1.711 1.473 1.450 1.281 1.095 0.961 0.813 1.650 1.925 1.659 1.428 1.406 1.242 1.062 0.932 0.788 1.700 1.869 1.610 1.386 1.365 1.206 1.031 0.905 0.765 1.750 1.815 1.564 1.346 1.326 1.171 1.001 0.879 0.743 1.850 1.717 1.479 1.274 1.254 1.108 0.947 0.831 0.703	1.300	2.444	2.105	1.812	1.785	1.577	1.348	1.183	1.001
1.450 2.191 1.888 1.625 1.600 1.414 1.208 1.061 0.897 1.500 2.118 1.825 1.571 1.547 1.367 1.168 1.025 0.867 1.550 2.050 1.766 1.520 1.497 1.323 1.130 0.992 0.839 1.600 1.986 1.711 1.473 1.450 1.281 1.095 0.961 0.813 1.650 1.925 1.659 1.428 1.406 1.242 1.062 0.932 0.788 1.700 1.869 1.610 1.386 1.365 1.206 1.031 0.905 0.765 1.750 1.815 1.564 1.346 1.326 1.171 1.001 0.879 0.743 1.800 1.765 1.521 1.309 1.289 1.139 0.973 0.854 0.723 1.850 1.717 1.479 1.274 1.254 1.108 0.947 0.831 0.703	1.350	2.353	2.027	1.745	1.719	1.519	1.298	1.139	0.964
1.500 2.118 1.825 1.571 1.547 1.367 1.168 1.025 0.867 1.550 2.050 1.766 1.520 1.497 1.323 1.130 0.992 0.839 1.600 1.986 1.711 1.473 1.450 1.281 1.095 0.961 0.813 1.650 1.925 1.659 1.428 1.406 1.242 1.062 0.932 0.788 1.700 1.869 1.610 1.386 1.365 1.206 1.031 0.905 0.765 1.750 1.815 1.564 1.346 1.326 1.171 1.001 0.879 0.743 1.800 1.765 1.521 1.309 1.289 1.139 0.973 0.854 0.723 1.850 1.717 1.479 1.274 1.254 1.108 0.947 0.831 0.703 1.900 1.672 1.441 1.240 1.221 1.079 0.922 0.809 0.685	1.400	2.269	1.955	1.683	1.657	1.464	1.251	1.099	0.929
1.550 2.050 1.766 1.520 1.497 1.323 1.130 0.992 0.839 1.600 1.986 1.711 1.473 1.450 1.281 1.095 0.961 0.813 1.650 1.925 1.659 1.428 1.406 1.242 1.062 0.932 0.788 1.700 1.869 1.610 1.386 1.365 1.206 1.031 0.905 0.765 1.750 1.815 1.564 1.346 1.326 1.171 1.001 0.879 0.743 1.800 1.765 1.521 1.309 1.289 1.139 0.973 0.854 0.723 1.850 1.717 1.479 1.274 1.254 1.108 0.947 0.831 0.703 1.900 1.672 1.441 1.240 1.221 1.079 0.922 0.809 0.685 1.950 1.629 1.404 1.208 1.190 1.051 0.898 0.789 0.667	1.450	2.191	1.888	1.625	1.600	1.414	1.208	1.061	0.897
1.600 1.986 1.711 1.473 1.450 1.281 1.095 0.961 0.813 1.650 1.925 1.659 1.428 1.406 1.242 1.062 0.932 0.788 1.700 1.869 1.610 1.386 1.365 1.206 1.031 0.905 0.765 1.750 1.815 1.564 1.346 1.326 1.171 1.001 0.879 0.743 1.800 1.765 1.521 1.309 1.289 1.139 0.973 0.854 0.723 1.850 1.717 1.479 1.274 1.254 1.108 0.947 0.831 0.703 1.900 1.672 1.441 1.240 1.221 1.079 0.922 0.809 0.685 1.950 1.629 1.404 1.208 1.190 1.051 0.898 0.789 0.667 2.000 1.589 1.369 1.178 1.160 1.025 0.876 0.769 0.651	1.500	2.118	1.825	1.571	1.547	1.367	1.168	1.025	0.867
1.650 1.925 1.659 1.428 1.406 1.242 1.062 0.932 0.788 1.700 1.869 1.610 1.386 1.365 1.206 1.031 0.905 0.765 1.750 1.815 1.564 1.346 1.326 1.171 1.001 0.879 0.743 1.800 1.765 1.521 1.309 1.289 1.139 0.973 0.854 0.723 1.850 1.717 1.479 1.274 1.254 1.108 0.947 0.831 0.703 1.900 1.672 1.441 1.240 1.221 1.079 0.922 0.809 0.685 1.950 1.629 1.404 1.208 1.190 1.051 0.898 0.789 0.667 2.000 1.589 1.369 1.178 1.160 1.025 0.876 0.769 0.651	1.550	2.050	1.766	1.520	1.497	1.323	1.130	0.992	0.839
1.700 1.869 1.610 1.386 1.365 1.206 1.031 0.905 0.765 1.750 1.815 1.564 1.346 1.326 1.171 1.001 0.879 0.743 1.800 1.765 1.521 1.309 1.289 1.139 0.973 0.854 0.723 1.850 1.717 1.479 1.274 1.254 1.108 0.947 0.831 0.703 1.900 1.672 1.441 1.240 1.221 1.079 0.922 0.809 0.685 1.950 1.629 1.404 1.208 1.190 1.051 0.898 0.789 0.667 2.000 1.589 1.369 1.178 1.160 1.025 0.876 0.769 0.651	1.600	1.986	1.711	1.473	1.450	1.281	1.095	0.961	0.813
1.750 1.815 1.564 1.346 1.326 1.171 1.001 0.879 0.743 1.800 1.765 1.521 1.309 1.289 1.139 0.973 0.854 0.723 1.850 1.717 1.479 1.274 1.254 1.108 0.947 0.831 0.703 1.900 1.672 1.441 1.240 1.221 1.079 0.922 0.809 0.685 1.950 1.629 1.404 1.208 1.190 1.051 0.898 0.789 0.667 2.000 1.589 1.369 1.178 1.160 1.025 0.876 0.769 0.651	1.650	1.925	1.659	1.428	1.406	1.242	1.062	0.932	0.788
1.800 1.765 1.521 1.309 1.289 1.139 0.973 0.854 0.723 1.850 1.717 1.479 1.274 1.254 1.108 0.947 0.831 0.703 1.900 1.672 1.441 1.240 1.221 1.079 0.922 0.809 0.685 1.950 1.629 1.404 1.208 1.190 1.051 0.898 0.789 0.667 2.000 1.589 1.369 1.178 1.160 1.025 0.876 0.769 0.651	1.700	1.869	1.610	1.386	1.365	1.206	1.031	0.905	0.765
1.850 1.717 1.479 1.274 1.254 1.108 0.947 0.831 0.703 1.900 1.672 1.441 1.240 1.221 1.079 0.922 0.809 0.685 1.950 1.629 1.404 1.208 1.190 1.051 0.898 0.789 0.667 2.000 1.589 1.369 1.178 1.160 1.025 0.876 0.769 0.651	1.750	1.815	1.564	1.346	1.326	1.171	1.001	0.879	0.743
1.900 1.672 1.441 1.240 1.221 1.079 0.922 0.809 0.685 1.950 1.629 1.404 1.208 1.190 1.051 0.898 0.789 0.667 2.000 1.589 1.369 1.178 1.160 1.025 0.876 0.769 0.651	1.800	1.765	1.521	1.309	1.289	1.139	0.973	0.854	0.723
1.950 1.629 1.404 1.208 1.190 1.051 0.898 0.789 0.667 2.000 1.589 1.369 1.178 1.160 1.025 0.876 0.769 0.651	1.850	1.717	1.479	1.274	1.254	1.108	0.947	0.831	0.703
2.000 1.589 1.369 1.178 1.160 1.025 0.876 0.769 0.651	1.900	1.672	1.441	1.240	1.221	1.079	0.922	0.809	0.685
	1.950	1.629	1.404	1.208	1.190	1.051	0.898	0.789	0.667
2.050 1.550 1.335 1.149 1.132 1.000 0.855 0.750 0.635	2.000	1.589	1.369	1.178	1.160	1.025	0.876	0.769	0.651
	2.050	1.550	1.335	1.149	1.132	1.000	0.855	0.750	0.635

MOUDA SUPER THERMAL POWER PROJECT
STAGE-II (2X660 MW)
STEAM TURBINE GENERATOR PACKAGE

CLAUSE NO.

SCOPE OF SUPPLY & SERVICES



APPENDIX - I

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS (In units of 'g')

Time		Damping	Factor (A	As a perce		Critical D	amping)	
Period		Damping	, . actor (/		inage of	STRIOGI D	amping)	
(Sec)	0.800	1.000	1.600	2.000	3.000	5.000	7.000	10.000
2.100	1.513	1.303	1.122	1.105	0.976	0.834	0.732	0.620
2.150	1.478	1.273	1.096	1.079	0.953	0.815	0.715	0.605
2.200	1.444	1.244	1.071	1.055	0.932	0.796	0.699	0.591
2.250	1.412	1.216	1.047	1.031	0.911	0.779	0.684	0.578
2.300	1.381	1.190	1.024	1.009	0.891	0.762	0.669	0.566
2.350	1.352	1.165	1.003	0.987	0.872	0.746	0.654	0.554
2.400	1.324	1.140	0.982	0.967	0.854	0.730	0.641	0.542
2.450	1.297	1.117	0.962	0.947	0.837	0.715	0.628	0.531
2.500	1.271	1.095	0.942	0.928	0.820	0.701	0.615	0.520
2.550	1.246	1.073	0.924	0.910	0.804	0.687	0.603	0.510
2.600	1.222	1.053	0.906	0.892	0.788	0.674	0.592	0.500
2.650	1.199	1.033	0.889	0.875	0.774	0.661	0.580	0.491
2.700	1.177	1.014	0.873	0.859	0.759	0.649	0.570	0.482
2.750	1.155	0.995	0.857	0.844	0.745	0.637	0.559	0.473
2.800	1.135	0.978	0.841	0.829	0.732	0.626	0.549	0.465
2.850	1.115	0.960	0.827	0.814	0.719	0.615	0.540	0.456
2.900	1.096	0.944	0.812	0.800	0.707	0.604	0.530	0.449
2.950	1.077	0.928	0.799	0.786	0.695	0.594	0.521	0.441
3.000	1.059	0.912	0.785	0.773	0.683	0.584	0.513	0.434
3.050	1.042	0.897	0.772	0.761	0.672	0.574	0.504	0.427
3.100	1.025	0.883	0.760	0.748	0.661	0.565	0.496	0.420
3.150	1.009	0.869	0.748	0.737	0.651	0.556	0.488	0.413
3.200	0.993	0.855	0.736	0.725	0.641	0.548	0.481	0.407
3.250	0.978	0.842	0.725	0.714	0.631	0.539	0.473	0.400
3.300	0.963	0.829	0.714	0.703	0.621	0.531	0.466	0.394
3.350	0.948	0.817	0.703	0.693	0.612	0.523	0.459	0.388
3.400	0.934	0.805	0.693	0.682	0.603	0.515	0.452	0.383
3.450	0.921	0.793	0.683	0.672	0.594	0.508	0.446	0.377
3.500	0.908	0.782	0.673	0.663	0.586	0.501	0.439	0.372
3.550	0.895	0.771	0.664	0.654	0.577	0.494	0.433	0.366
3.600	0.883	0.760	0.654	0.644	0.569	0.487	0.427	0.361
3.650	0.870	0.750	0.645	0.636	0.562	0.480	0.421	0.356
·								

MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM TURBINE GENERATOR PACKAGE TECHNICAL SPECIFICATION
SECTION-VI
PART-A

D-1 CIVIL

PAGE 12 OF 13 CLAUSE NO.

SCOPE OF SUPPLY & SERVICES



APPENDIX - I

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS (In units of 'g')

Time		Damping	Factor (A	As a perce	entage of	Critical D	amping)	
Period (Sec)	0.800	1.000	1.600	2.000	3.000	5.000	7.000	10.000
3.700	0.859	0.740	0.637	0.627	0.554	0.474	0.416	0.352
3.750	0.847	0.730	0.628	0.619	0.547	0.467	0.410	0.347
3.800	0.836	0.720	0.620	0.611	0.539	0.461	0.405	0.342
3.850	0.825	0.711	0.612	0.603	0.532	0.455	0.399	0.338
3.900	0.815	0.702	0.604	0.595	0.526	0.449	0.394	0.334
3.950	0.804	0.693	0.596	0.587	0.519	0.444	0.389	0.329
4.000	0.794	0.684	0.589	0.580	0.513	0.438	0.385	0.325

MOUDA SUPER THERMAL POWER PROJECT STAGE-II (2X660 MW) STEAM TURBINE GENERATOR PACKAGE TECHNICAL SPECIFICATION
SECTION-VI
PART-A

D-1 CIVIL

PAGE 13 OF 13



SPECIFICATION NO. PE-TS-390-614-C001				
REFERENCE QUALITY PLAN				
REV. NO . 0	DATE 08.07.2025			

REFERENCE QUALITY PLAN	



MANUFACTURER / SUPPLIER NAME & ADDRESS

STANDARD QUALITY PLAN SPEC. NO: PE-TS-999-600-C026 DATE: 18-05-2023 CUSTOMER: -NA-QP NO.: PE-QP-999-618-C202 (Rev-) DATE: 26-02-2024 PROJECT: -NA-PO NO.: -NA-DATE: -NA-ITEM: VIBRATION ISOLATION SYSTEM: VIS for BFP, FAN & SYSTEM INSPECTION CATEGORY:- -NA-MILL Foundation SHEET 1 of 4

NO	& OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	REFERENCE ACCEP		ACCEPTANCE NORMS	FORMAT RECOR		A	GENO	CY	REMARKS					
1	2	3	3	3	3	3	3	3	3 4 5 6		7 8	8	9		+	10**		11
					M	C/N	· · · · · · · · · · · · · · · · · · ·	-	,	40	-			11				
1.0	Materials				171	C/IV				*D		M						
1.1	For boxes of VIS module	Chemical/Mechanical	MA	Verify	One / Heat	-	IS 2062 / DIN EN 10025 or Equivalent	Same as column "7"	Certificate	V	Р	V	-					
1.2		a) Chemical	MA	Verify	One / Heat	-	51CrV4 as per EN10089 or equivalent	Same as column "7"	Certificate	1	Р	V	-					
	For Springs	b) Grain Size	MA	Verify	One / Heat	-	IS 4748 / ASTM E 112	Grain size ASTM 6 or finer	Certificate	1	P	٧	-					
2.0		c) NMI (Non- metallic inclusions)	MA	Verify	One / Heat	-	IS 4163/ DIN EN 10247 or Equivalent	As per IS 4163 / EN 10089 or equivalent	Certificate	1	Р	V	-					
	Component Springs (at	a) Hardness	MA	Test	One/Lot	-	IS 1500	ASTM A125 /	Certificate	V	P	V	-	Refer Note-				
	Manufacturers end)	b) Decarburization	MA	Test	One/Lot	-	IS6396	EN10089 Max. depth 0.5% bar dia-partial	Certificate	1	P	V	-					
2.1		c) NDE (Non- destructive examination) after compression (MPI i.e. Magnetic particle inspection)	MA	Test	100%	-	IS3703	No cracks	Certificate	V	P	V	-					
		d) Micro structure	MA	Verificati on	One/Lot	-	-	Tempered Martensite (Predominant)	Certificate	V	P	V	-					

		ВН	EL					
	ENGINE	ERING	QUALITY					
	Sign & Date	Name		Sign & Date	Name			
Prepared by:	Our	Anil Khandelwal	Checked by:	_	Suman Nakwal			
Reviewed by:	Athay 2.20	Abhay Kumar	Reviewe d by:	Atin 2.21	Harish Kumar			
				27				

BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL							
Sign & Date	Doc No:								
Seal		Sign & Date	Name	Seal					
	Reviewed								
	by:								
	Approved								
	by:								



MANUFACTURER / SUPPLIER NAME & ADDRESS

STANDARD QUALITY PLAN SPEC. NO: PE-TS-999-600-C026 DATE: 18-05-2023 CUSTOMER: -NA-QP NO.: PE-QP-999-618-C202 (Rev-) DATE: 26-02-2024 PROJECT: -NA-PO NO.: -NA-DATE: -NA-ITEM: VIBRATION ISOLATION SYSTEM: VIS for BFP, FAN & INSPECTION CATEGORY:- -NA-SHEET 2 of 4 SYSTEM MILL Foundation

.1.1	Springs (at Supplier end)	Spring Rate	MA	Test	AQL 4.0 of Table 7.1	-	DIN 2096	Same as column	Certificate	1	P	V	-	
2.2	Viscoliquid (For visco damper)	Viscosity/Penetration Speed	MA	Test	One/ Lot	-	DIN 53019 or equivalent	Same as column	Certificate	V	Р	V	~	
2.2	Studs & Nuts	Chemical/Mechanical	MI	Verify	One/Lot	-	IS1367	As per Data sheet	Certificate	V	P	V	-	
		Dimensions(mm)	MI	Measure	10%	-	IS 4218 (Tolerance Class 6G & 6H)	Same as column	Internal Record	V	Р	V	-	
3	In Process Ins	pection									1	1		1
3.1	Welding	Visual/Surface exam	MA	Visual/	10% on	_	DIN EN 25817/D or							
				Measure	welds	-	BS EN ISO 5817 or Equivalent	Same as column *7	Certificate	V	P	V		
		NDE (Non-destructive examination)	MA	DPT	10% Random	-	ASTM E 165	Same as column	Certificate	V	Р	V	-	
3.2	Boxes	Dimensions	MA	Measure	10%	-	Datasheet (data & dimensions)	EN ISO 13920 C	Internal Record	V	P	V	-	
3.3	Adhesive pads, Steel shims	Dimensions	MI	Measure/ Visual	10%	-	Datasheet (data & dimensions)	DIN 7168 Sg/ ISO 2768-1 v	Internal Record	V	Р	V	-	
4	Final Inspectio	n						1002/00//	record					
4.1	Shot Blasting	Surface preparation	MA	Compare	10%	-	EN ISO 12944-4	As per Datasheet	Certificate	V	P	V		
4.2	Painting	Thickness	MA	Measure	10%	-	EN ISO 12944-5	As per Datasheet	Certificate	V	P	V	-	
4.3	Spring Unit	Dimensions (Except Height at nominal load & max pre- stressed	MI	Measure	10%	10%	Data Sheet	EN ISO 13920 C	Internal Record	V	P	W	W	

		ВН	EL						
	ENGINE	ERING	QUALITY						
	Sign & Date	Name		Sign & Date	Name				
Prepared by:	Con The sales	Anil Khandelwal	Checked by:	27.02.24	Suman Nakwal				
Reviewed by:	27.2.2	Abhay Kumar	Reviewe d by:	at any	Harish Kumar				
				2702					

BIDDER/ SUPPLIER					

	FOR CU	STOMER REVIE	EW & APPROVAL
Doc No			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			



MANUFACTURER / SUPPLIER NAME & ADDRESS

STANDARD Q	UALITY PLAN	SPEC. NO : PE-TS-999-600-C026	DATE: 18-05-2023
CUSTOMER: -NA-		QP NO.: PE-QP-999-618-C202 (Rev-)	DATE: 26-02-2024
PROJECT: -NA-		PO NO.: -NA-	DATE: -NA-
ITEM: VIBRATION ISOLATION SYSTEM	SYSTEM: VIS for BFP, FAN & MILL Foundation	INSPECTION CATEGORY:NA-	SHEET 3 of 4

4.4	Constant of Spring Units (Vertical)	Load Vs Displacement (kN/mm)	CR	Test	10%	10%	DIN 2096	Datasheet (data & dimensions)	Certificate	V	P	W	W	
4.5	Document Control	Verification of above documents (TC/IR)	MA	Compare	All	-	This MQP	Application rows tick marked under col. 'D'	Certificate	V	Р	V	-	
4.6	Packing / Marking	Visual	MA	Visual/ Compare	100%	-	As per supplier's standard or BHEL Corporate standard	Same as column *7	Certificate	V	Р	V	-	

LEGENDS:

*RECORDS, INDENTIFIED WITH "TICK"(v) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, C: BHEL/ THIRD PARTY INSPECTION AGENCY, N: BHEL'S CUSTOMER

P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE

MA: MAJOR, MI: MINOR, CR: CRITICAL

Notes:

- 1. Material shall be packed suitably in order to avoid damage during transit and also during storage at site in tropical climate condition.
- 2. Latest revision/ year of issue of all the standards (IS/ ASME/ IEC/EN etc.) Indicated in QP shall be referred.
- 3. Hardness value shall be 399-476 BHN.

		ВН	EL					
	ENGINEER	RING	QUALITY					
	Sign & Date	Name		Sign & Date	Name			
Prepared by:	Out or 24	nil Khandelwal	Checked by:	27.02.21	Suman Nakwa			
Reviewed by:	Altay A	bhay Kumar	Reviewe d by:	A 24	Harish Kumar			

BIDDER/ SUPPLIER				
Sign & Date				
Seal				

FOR CUSTOMER REVIEW & APPROVAL									
Doc No									
	Sign & Date	Name	Seal						
Reviewed by:									
Approved by:									





CORPORATE STANDARD

AA0490004 Rev. No. 02

PAGE 1 of 11

SEAWORTHY PACKING (PACKING INSTRUCTIONS FOR GENERAL COMPONENTS / ASSEMBLIES / EQUIPMENT)

1 GENERAL

This standard lays down packing instructions for seaworthy packing of Components /Assemblies/ Equipment to be dispatched against Customer's contracts, for which there are no special instructions issued by the Engineering Departments.

The Components/Assemblies need to be packed suitably to avoid physical damage & corrosion during transit for storage. For specific applications the concerned engineering department shall issue a product standard. Reference of this standard, must appear in the Shipping list/Packing List.

2 SCOPE

This procedure gives minimum guidelines for seaworthy packing to be complied with for packing of Components /Assemblies / Equipment. This packing shall be suitable for different handling operations and for the adverse conditions during transportation and during indoor / outdoor storage for periods more than one year.

3 CROSS REFERRED SPECIFICATION

Multi-layered cross laminated plastic film : AA51420 Packing Wood : AA51401 Silica gel : AA55619 Thermocole : AA51416 Packing slip holders : AA7240901 Corrugated Fibre Board : AA51414 Rubber sheet : AA59001 VCI paper : AA51406 High quality full glossy out door finishing paint : AA56126 Polyethylene air bubble film : IS 12787

Structural steel - standard quality (plates, sections, strips flats & bars) : AA10108

International Standards For Phytosanitary Measures No. 15 : ISPM-15:2009

4 WOOD SPECIFICATION FOR PACKING

The wood shall conform to specification AA51401.

For export packing wood in addition to the above the following has to be met:

The standard requires the use of debarked wood in the construction of compliant wood packaging material. Debarked wood is defined in the ISPM 5.

5 TYPE OF PACKING

The following 5 types of packings have been standardized for packing of General Components /Assemblies.

	Revisions:			APPROVED:									
				PROCEDURAL GU PG(OMMITTEE –								
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5	Dt: 27-07-2018	Dt:	Year:	HPEP, Hyderabad	Corp. R&D	17-08-2013							

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- 'OP' Open Type
- 'PP' Partially Packed
- 'CP' Crate Packing Components/Equipment requiring physical protection
- 'CQ' Case Packing Small medium Components/ Assemblies/ Equipment which require corrosion & physical protection
- 'CR' Case Packing Electrical Components/Assemblies which require special packing viz. Water Proof, Shock Proof, etc.

6 DESCRIPTION OF TYPES OF PACKING

The various types of packing, as standardized above, are described below.

6.1 'OP' - Open Type

In case, of components which are not affected by water & dust & do not require special protection &, are generally not machined, shall be sent as open packages. However these components may be sent in crates, wherever necessary.

6.2 'PP' - Partially Packed

Components which need special protection, at selected portions only, shall be dispatched partially packed. Machined surfaces should not be allowed to come directly in contact with the wood. Such surfaces after application of TRP should be protected with Multi-layered cross laminated plastic film to AA51420.

6.3 'CP' - Crate Packing - General

Assemblies/Components which need only physical protection from the point of view of handling shall be dispatched duly packed in crates.

6.4 'CQ' - Case Packing - Machined Components/Assemblies/Equipment

- a) Small & Medium sized components/assemblies/equipment due to size/weight & to avoid handling, and pilferage, problems shall be packed in Case/Containers.
- b) Wherever required adequate quantity of silica gel to AA55619 or VCI Powder/ Tablets, packed in thin muslin cloth cotton bags shall be suitably placed.
- c) Small machines/components of less weight shall be provided with suitable cushioning. Wood Wool/Expanded Polyethylene Foam Sheet, if used, shall be sandwiched between polyethylene sheets and sealed.
- d) The components inside the case shall be entirely covered with Multi-layered cross laminated plastic film to AA51420, where-ever required.

6.5 'CR' - Case Packing - Electrical & Electronic Components/Assemblies

Delicate components likely to be damaged e.g. Gauges, Instruments etc. are to be wrapped in waxed paper or polyethylene air bubble film and packed in cartons.

- a) Adequate quantity of Silica gel to AA55619 packed in cotton bags, of 100 grams each are to be suitably placed in the cartons. The cartons shall be entirely covered with Multi-layered cross laminated plastic film to AA51420, before being packed in the cases.
- b) VCI Powder/Tablets can be used as an alternative to Silica Gel to AA55619.
- c) Empty space in the cartons shall be filled with small chips of Expanded Polystyrene (Thermocole), Wood Wool etc. Polyethylene air bubble film shall conform to IS 12787/AA51420 Expanded polystyrene (Thermocole) shall conform to AA51416.
- d) The cartons shall be manufactured from corrugated Fibre Board, meeting requirements of AA51414.

6.6 Special Packing

Components requiring special packing (as per customer/contractual/ engineering requirements) not included in this specification shall be covered by product standards.



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7 PREPARATION OF PACKING CASE

- Cases and crates with gross weight up to 1,000 kgs. shall be provided with bottom cleats of min. 40 mm thicknesses to ensure clearance for handling by forklift. Cases and crates exceeding gross weight of 1,000 kgs. shall be provided with skid runners, number and size according to weight of package.
- 2) The base of the case shall be made of wooden batons for planks giving necessary reinforcement, such that the bottom of the equipment is at a height of 100 to 200 mm from the ground level depending upon size & weight of equipment. However for packing cases of smaller size equipment can be at a height of 40 mm from the ground level.
- 3) In case of 'CR1 Packing Viz. Electrical & Electronic components for instruments/assemblies, a rubber sheet, Self-expanded polyethene foam sheet, preferably 10 mm thick, shall be fixed on to the base to act as cushioning to the equipment.
- 4) The four sides, shall be lined, from inside with multi-layered cross-laminated polyethylene sheet of 90GSM as per AA51420 and tacked at suitable places.
 - Whenever specified the top cover will have a layer of multi-layered cross laminated polyethylene sheet of 90 GSM over the cover. This should project about 100 250mm on all sides.
 - It is preferable to have a single piece of the above Multi-layered cross laminated polyethylene sheet fixed on the four sides. In case jointing is unavoidable, it should be done by overlapping of approximately 100mm.
- 5) Place the Components/cartons with corrosion inhibitors duly applied wherever necessary for place suitably, thin muslin cloths bags containing 100 grams (approx.) of activated Blue Silica Gel to AA55619, wherever necessary. Alternatively VCI Powder or Tablet may be used.
- 6) In case, depression is formed, at the top, after the equipment is lowered, provide ply board/wooden batons.
- 7) Cover the whole equipment with polyethylene sheet of at least 100 micron thickness, on all sides preferably by a single piece.
- 8) For indoor panels/equipment, provide suitable packing batons with covering of Thermocole/expanded soft polyethylene foam/polyethylene air bubble film wrapped with suitable cords, to avoid cutting of the polyethylene sheet so that finished surface is not damaged.
- 9) Empty space in the box shall be filled with adequate cushioning material e.g. Thermocole Chips, Wood Wool etc. to avoid movement for shocks. Alternatively put wooden blocks/batons wherever necessary.
- 10) The inner side of the top cover shall be lined with polyethylene sheet, of at least
- 11) 100 micron thickness, which shall project approximately 25 to 150 mm depending upon the size of the case on all sides of the top cover shall be provided below the top cover. This projection, after nailing the top cover, shall be folded over, on the sides of the crates & tacked, to, prevent ingress of water from the top.
- 12) For specific requirement of packing the cases are to be provided with Tongue and Groove joints.

8 STEEL CONTAINERS

Steel containers for packing can be used in case of repeated supplies of the same equipment. Empty steel containers are to be returned back from customer's end and to be reused for the next supplies.

The containers are to be made of structural steel as per AA10108 with proper reinforcement with I, C and T Sections.

Following precautions are to be taken during packing:

- Put the Components/Assemblies/Equipment in the steel container properly. Cover the Components/Assemblies/Equipment with polythene.
- To arrest the movement in the steel container necessary wooden Blocks/Batons may be put.
- Put cover on steel, container and Bolt Properly.

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9 SEALED PACKING

Components sub-assemblies and assemblies sensitive to climatic conditions shall be packed seal tight. All the openings of the sensitive components, sub-assemblies and assemblies shall be blanketed to prevent the ingress of dust and moisture.

The components sub-assemblies and assemblies are completely covered with 2 layers of polyethylene sheet. All sharp corners and edges are to be protected by rubber mats to prevent the polyethylene sheet from damage. Top surface of the case shall be free from dents to prevent rain water pockets.

10 SLING PLATE

Sling plate shall be provided to prevent damage to the packing box during lifting. Size of the sling plate shall be selected depending upon the net weight of the consignment.

11 PACKING SLIP HOLDERS

Two nos. steel packing slip holders, specification no. AA7240901 containing the packing list, sealed in thick polyethylene film, shall be fixed one inside and the other outside the packing box.

12 Volatile Corrosion Inhibitor (VCI) Paper

- a) Un-protected surfaces of steel and cast iron components, tools bearing, shaft seals etc. are covered with VCI paper. VCI paper has been impregnated with corrosion inhibitors which by evaporation and chemical conversion protect metals in an enclosed area against corrosion.
- b) 7 m³ VCI paper is necessary for 1 m³ of packed item approximately as per AA51406.

Application Limitation:

VCI paper shall not be used for components made of aluminium, aluminium alloys as well as Zinc, copper, brass, cadmium and silver.

VCI powder is sprinkled inside the piping components ends shall be protected with end cover as specified in plant standards, drawings.

13 Moisture Absorber

Silica gel is used for this purpose to protect the contents over sufficiently long time from corrosion. At the time of use, silica gel should be so dried that its colour becomes dark blue. These shall be filled in small cotton bags. Before sealing the equipment, the silica gel bags should be kept inside the polyethylene film cover at different locations. The quantity of silica gel should not be less than 1.0 kg per cubic metre volume of the packing box



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14 GENERAL PRECAUTIONS

- a) While fixing nails during packing, necessary care shall be taken to ensure that materials used for protection inside the case e.g. paper, polyethylene sheet, coir etc. do not get damaged.
- b) Sling protection brackets to be provided on cases wherever required.
- c) It shall be ensured that all stencil marks external, front & rear sides of the casing shall be of water proof Material to prevent obliteration in transit.
- d) The various caution signs shall be marked with stencil on both sides of the packing box.
- e) Do not pack any other Mechanical items with this case (do not use any other non-permitted packing materials).

THE FOLLOWING DETAILS ARE TO BE MARKED ON THE PACKING CASES.

- a) Address of consignee.
- b) Purchase Order No./ SO No/WO No.
- c) Description of item or title of packing list.
- d) Case identification Number/ Packing List No.
- e) Net Weight.
- f) Gross Weight.
- g) Dimensions of box
- h) Marking showing upright position.
- i) Marking showing sling position.
- j) Marking showing umbrella (i.e. for machines/components to be stored under covered storage.
- k) Loading and unloading precautions

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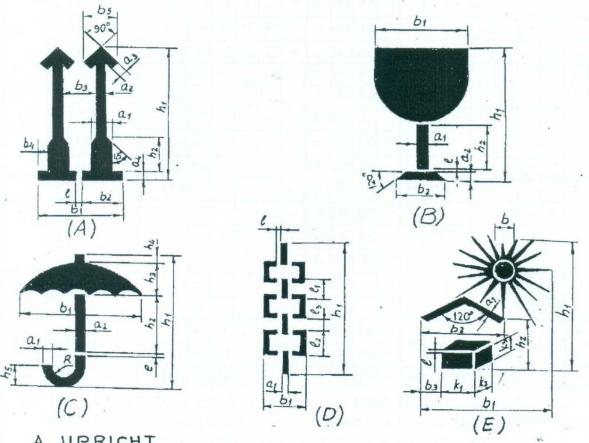
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MARKINGS ON PACKING CASES

- 1. THIS PLANT STANDARD PRESCRIBES THE VARIOUS CAUTION SIGNS
- AND OTHER MARKINGS ON PACKING CASES.

 2. DIMENSIONS IN THE TABLE 1 SHALL BE USED FOR MAKING STENCILS ONLY.



- A. UPRIGHT
- B. FRAGILE
- C. PROTECTION FROM FALLING OR CONDENSING MOISTURE.
- D. SLINGING POSITION
- E. PROTECTION FROM DIRECT RADIATIONS.

Figure 1

CENTER OF GRAVITY

Figure 2



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Table 1

DESIGN-								I	NIC	1EI	VS	10	NS	5 11	NT	nn	٦.			-70	*	acome		
ATIO	MOITA		a_2	α_3	ац	ы	bz	b3	64	65	Ь	L	hi	hz	h3	h4	h5	K ₁	K ₂	Кз	21	12	13	R
A -	1	12	5	5	4	52	25	19	8	21	-	2.	84	23	-	-	-		-	-	-	-	-	-
	2	17	7	7	6	75,	36	29	11	30		3	119	33	-	-	-	-	-	-	-	-	-	-
	3	24	10	10	8	104	50	38	16	42		4	168	46	-	-	-	-	-	-	-	-	-	-
	4	34	14	14	11	147	71	59	23	60	-	5	239	65	-	-	-	-	-	-	-	-	-	- - - - - -
	9	5	5	-	-	50	33	-	-	-	-	2	84	25	-	Street		-	-	-	1	-	-	_
D	2	7	7	-	-	71	47	-		-	-	3	119	36	-	-	-		-	-	-	-	I	-
В	3	10	10	-	-	100	66	-	-		-	4	168	50	-	-	-	-	-	-	-	-	~~	1
	4	14	14		-	142	94	-	_	-	-	5	239	71		-	-	-	-	-	-	-	-	-
c	1	4	3	-	-	66	-	-	-	-	-	2	80	39	19	5	11	-	-	-	-	-	-	6
	2	6	4	-	_	85	-	-	-	-	-	3	114	55	27	7	16	-	-	-		-	-	9
	3	8	6	-	-	120	-	_	_	-	_	4	160	78	38	10	22	-	-	-	-	-	-	12
	4	11	9		-	170	-	-	-		-	5	227	110	54	14	31	_	-	-	-	-	-	17
$D = \frac{1}{2}$	1	6	-	-	_	30	-	-		-	-	4	148	-	_	-	-	-	_	-	30	30	10	-
	2	9	-	-	_	42	-	-	-	-	-	5	209	-	-	-	-	-	-	-	42	42	14	-
	1	3		-	-	69	47	10	-	-	16	2	91	26	-	-	-	17	8	11		-	-	-
E	2	4	_	-	_	98	67	15	=	-	23	3	128	33	-	-	-	24	11	16	-	-	-	-
3	3	6	-	-	-	138	94	20	-	-	32	4	182	62	-	-	-	34	16	22	-	-	-	-

Black and Red Marking Ink to IS: 1234 "Ink, Stencil, Oil Base, For Marking Porous Surfaces" or duplicating ink stencilling, oil base for marking porous surfaces.

All cases containing fragile items are to be stencilled with red marking and stencilling paint/ink.

"HANDLE WITH CARE", "FRAGILE DO NOT TURN OVER".

Besides the caution signs the product information shall be stencilled of letters with 13mm to 50mm height.

In case of consignment consists of more than one package, each package shall carry its Package No. as given in shipping list. All caution signs shall be stencilled in higher quality full glossy out door finishing paint red in colour (AA56126). All other markings shall be carried out in black enamel (AA56126).

Caution signs & other markings shall be stencilled on both the end shooks & the side shooks. Caution sign (for slinging) shall be stencilled only on side shooks at the appropriate place.

Note: In case the size of package is small for using the stencils, then hand written letters/figures shall be allowed.

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15 PROCEDURE FOR HANDLING OF COMPONENTS

The purpose of this procedure is to protect the quality of the components/equipment while handling in various stages of manufacturing packing & despatching.

- **15.1** Adequate care shall be taken in handling the material, and components to avoid damage during receipts, storage issue manufacture & despatch operations.
- **15.2** Appropriate material handling equipment like fork lifters, cranes etc. Shall be used where needed.
- **15.3** Lifting by crane and transportation by trolley of critical items and large components like rotors castings etc. Shall be done carefully.
- 15.4 For critical items, where specified, special handling fixtures shall be used for lifting.
- **15.5** Slings and shackles used for lifting the components/equipment shall be checked for fitness and suitability before use.
- **15.6** Slings used on machined surfaces shall be suitably padded. No slings shall be used on journal surfaces.
- **15.7** Precision machined components like blades, catches, rollers etc. Shall be lifted using suitable wooden pallets.

15.8 HANDLING OF COMPONENTS ON RECEIPT/DESPATCH:

Before loading/unloading a packing case from the carrier look for the following shipping instructions painted on the packing case.

- The markings showing the upright position.
- The markings showing the sling position
- Markings showing the fragile contents.
- Other required markings as per Clause No. 12
- **15.8.1** Appropriate cranes and slings should be used for different components/ cases. Slings should normally make an angle as minimum as possible (width wise) but in no case more than 15°.
- **15.8.2** Handling and lifting should be done without jerks or impacts.
- 15.8.3 Immediately after receipt of the goods, the packing should be examined all-round for any sign of damage. If necessary, lift the cover or a number of boards of the case so as to make the contents visible. In the event of sealed packing being used the plastic sheeting should not be damaged. It is imperative that the packing material is restored in original condition after the inspection.
- 15.8.4 On receipt of the equipment it should be checked with the shipping list and missing or damage if any should be reported immediately. It is important to arrange for immediate examination to determine the extent of the damage, the cause of the damage and where applicable the person or persons responsible for the damage. According to general practice when transporting by railway or by road vehicle the carrier concerned should be immediately called upon (within specified periods) for jointly establishing a statement of the damage. This is essential as a basis for a subsequent claim and possible damage report to the insurance company.
- 15.8.5 Protective coating applied on machined surfaces should not be disturbed. The plastic covering should be put back carefully so that it prevents ingress of dust and moisture. Some packing may have vapour phase inhibitor (VPI) paper enclosed inside the packing cases. This should be restored to its original place as far as possible.
- **15.8.6** Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

16 GI SHEET

The packing cases are covered with GI sheet on outside for sides and top; inside for bottom as per the Figure-3 (GI sheet covering is applicable for all closed type of wooden packing).



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17 Treatment of Wood & Application and use of the mark

For seaworthy export packing, treatment of wood has to be carried out as below subject to BHEL Engg & QC approval.

As per customer requirement for export packing, wood to be treated as applicable should be done as per International Standards for Phytosanitary Measures ISPM: 15 to control the growth stages viz. egg to adult of structural insects (beetles, borers, bugs, fleas, flies, lice, moths, roaches, termites) and other pests (mice, rats, spiders) etc. in stored products.

The specified marks applied to wood packaging material treated in accordance with ISPM 15 must conform to the requirements described in Annex 2 of ISPM 15.

17.1 Heat treatment using a conventional steam or dry kiln heat chamber (treatment code for the mark: HT)

When using conventional heat chamber technology, the fundamental requirement is to achieve a minimum temperature of 56 °C for a minimum duration of 30 continuous minutes throughout the entire profile of the wood (including its core).

This temperature can be measured by inserting temperature sensors in the core of the wood. Alternatively, when using kiln-drying heat chambers or other heat treatment chambers, treatment schedules may be developed based on a series of test treatments during which the core temperature of the wood at various locations inside the heat chamber has been measured and correlated with chamber air temperature, taking into account the moisture content of the wood and other substantial parameters (such as species and thickness of the wood, air flow rate and humidity). The test series must demonstrate that a minimum temperature of 56 °C is maintained for a minimum duration of 30 continuous minutes throughout the entire profile of the wood.

Treatment schedules should be specified or approved by the National Plant Protection Organisation (NPPO). Treatment providers should be approved by the NPPO.

17.2 Heat treatment using dielectric heating (treatment code for the mark: DH)

Where dielectric heating is used (e.g. microwave), wood packaging material composed of wood not exceeding 20 cm when measured across the smallest dimension of the piece or the stack must be heated to achieve a minimum temperature of 60 °C for 1 continuous minute throughout the entire profile of the wood (including its surface). The prescribed temperature must be reached within 30 minutes from the start of the treatment.

Treatment schedules should be specified or approved by the NPPO.

17.3 Methyl bromide treatment (treatment code for the mark: MB)

Wood packaging material containing a piece of wood exceeding 20 cm in cross-section at its smallest dimension must not be treated with methyl bromide.

The fumigation of wood packaging material with methyl bromide must be in accordance with a schedule specified or approved by the NPPO (National Plant Protection Organisation) that achieves the minimum concentration-time product (CT) over 24 hours at the temperature and final residual concentration specified in Table 1. This CT must be achieved throughout the profile of the wood, including its core, although the concentrations would be measured in the ambient atmosphere. The minimum temperature of the wood and its surrounding atmosphere must not be less than 10 °C and the minimum exposure time must not be less than 24 hours. Monitoring of gas concentrations must be carried out at a minimum at 2, 4 and 24 hours from the beginning of the treatment. In the case of longer exposure times and weaker concentrations, additional measurement of the gas concentrations should be recorded at the end of fumigation.

If the CT is not achieved over 24 hours, corrective action needs to be taken to ensure the CT is reached; for example, the treatment is restarted or the treatment time extended for a maximum of 2 hours without adding more methyl bromide to achieve the required CT (see the footnote to Table 2).

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Table 2 - Minimum CT over 24 hours for wood packaging material fumigated with methyl bromide

Temperature (°C)	CT (g·h/m³) over 24 h	Minimum final concentration (g/m³) after 24 h#					
21.0 or above	650	24					
16.0 – 20.9	800	28					
10.0 – 15.9	900	32					

In circumstances when the minimum final concentration is not achieved after 24 hours, a deviation in the concentration of \sim 5% is permitted provided additional treatment time is added to the end of the treatment to achieve the prescribed CT.

One example of a schedule that may be used for achieving the specified requirements is shown in Table 3.

Table 3 – Example of a treatment schedule that achieves the minimum required CT for wood packaging material treated with methyl bromide (initial doses may need to be higher in conditions of high sorption or leakage)

Temperature (°C)	Dosage (g/m³)	Minimum concentration (g/m³) at:							
	(g/iii*)			24 h					
21.0 or above	48	36	31	24					
16.0 – 20.9	56	42	36	28					
10.0 – 15.9	64	48	42	32					

Treatment providers should be approved by the NPPO.

17.4 Marking

The specified marks applied to wood packaging material treated in accordance with ISPM 15 must conform to the requirements described in ISPM 15.

18 PROVISION FOR INSPECTION

This clause is applicable only where contractual requirement of customer is there. For other packings this is not applicable.

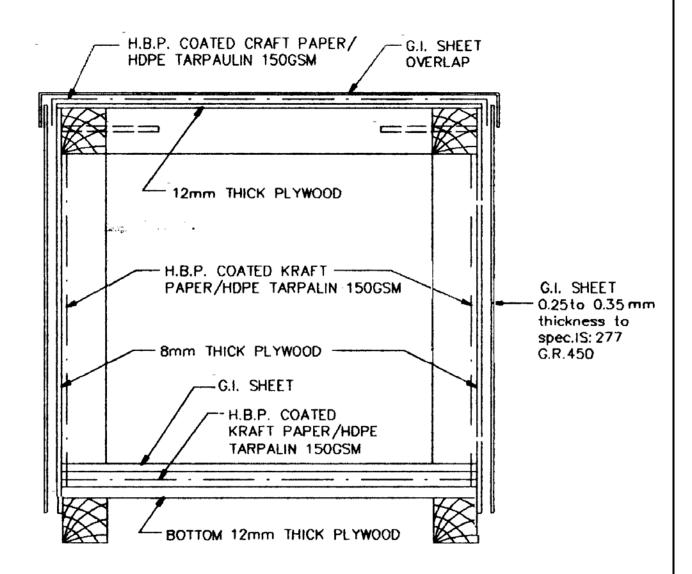
Each transportable packing's shall have provision for inspection by customer authority etc. during transport from origin of dispatched till destination. This inspection may require opening of the package and subsequently closing it again. For this purpose suitable designed opening with bolted cover shall be provided. Such an opening shall be clearly marked as "OPENING" with clear instruction for opening & closing written on this cover. For large consignment the size of the opening shall be suitable to facilitate entry of personnel.



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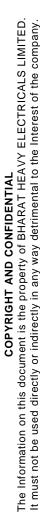
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CLOSED PACKING CASE WITH G.I.SHEET SHOWING LAYERS OF PACKING MATERIALS

Figure 3





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DOMESTIC PACKING

COMMON GUIDELINES

1 GENERAL:

This standard lays down packing instructions for domestic packing of Components/ Assemblies/ Equipment to be despatched against Customer's contracts, for which there are no special instructions issued by the Engineering Departments. For Seaworthy Packing refer standard AA0490004 wherever applicable.

The Components/Assemblies need to be packed suitably to avoid physical damage & corrosion during transit & storage. For specific applications the concerned engineering department shall issue a product standard. Reference of this product standard, must appear in the Shipping list/Packing List.

2 SCOPE:

This procedure gives minimum guidelines to be complied with for domestic packing of Components /Assemblies/ Equipment. This domestic packing shall be suitable for different handling operations and for the adverse conditions during transportation and during indoor / outdoor storage of materials.

3 WOOD SPECIFICATION

Based on availability, the wood shall conform to specification AA51401 or AA51402.

4 TYPES OF PACKING:

The following 5 types of packing have been standardized for packing of General Components/Assemblies.

- 1) 'OP' Open Type.
- 2) 'PP' Partially Packed.
- 3) 'CP' Crate/Box Packing Components/Equipment requiring physical protection.
- 4) 'CQ' Case Packing Machined components-Small & Medium Components/ Assemblies/ Equipment which require corrosion & physical protection.
- 5) 'CR' Case Packing Electrical/Electronic Components/ Assemblies, which require special packing viz. Water Proof, Shock Proof etc...

5 DESCRIPTION OF TYPES OF PACKING:

The various types of packing, as standardized above, are described below.

5.1 'OP' - Open Type

In case, of components which are not affected by water & dust and do not require special protection, are generally not machined, shall be sent as open packages. However, these components may be sent in crates, wherever necessary.

5.2 'PP' - Partially Packed

Components which need special protection at selected portions only shall be despatched partially packed. Machined surfaces should not be allowed to come directly in contact with the wood. Such surfaces should be protected with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene

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	Dt: 28-08-2018	Dt:	Year:	HPBP, Trichy	Corp. R&D	31-05-2018				

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Film to Specification No. AA51420. All sharp corners and edges shall be protected by rubber mats to prevent damage to the polyethylene film

5.3 'CP' - Crate Packing

Assemblies/Components which need only physical protection from the point of view of handling shall be despatched duly packed in crates.

5.4 'CQ' - Case Packing - Machined Components/Assemblies/Equipment

Small and medium sized components/assemblies/equipment due to size/weight and to avoid handling and pilferage problems shall be packed in Case/Containers. Wherever required adequate quantity of silica gel to AA55619 or VCI Powder/Tablets, packed in thin muslin cloth cotton bags shall be suitably placed. Small machines/components of less weight shall be provided with suitable cushioning by Rubberised coir. The components inside the case shall be entirely covered with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420, wherever required. This may be prescribed for electronic parts/critical machined components/surfaces.

For mechanical product like valves where motors are separately securely wrapped in polyethylene, the requirement of individual component wrapping shall be exempted.

5.5 'CR' - Case Packing - Electrical & Electronic Components/Assemblies

Delicate components likely to be damaged e.g. Gauges, Instruments etc. are to be wrapped in waxed paper or polyethylene air bubble film and packed in cartons. Adequate quantity of Silica gel to AA55619 packed in cotton bags of 100grams each are to be suitably placed in the cartons. The cartons shall be entirely covered with 100GSM(Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No. AA51420 before being packed in the cases. VCI Powder/Tablets can be used as an alternative to Silica Gel to AA55619.

Empty space in the cartons shall be filled with rubberized coir to get proper cushioning effect. The cartons shall be manufactured from corrugated Fiber Board, meeting requirements of AA51414.

6 PREPARATION OF PACKING CASES

6.1 DIMENSIONS:

- a) Thickness of planks for Front, rear, top and bottom sides and binding, jointing battens shall be 25/20mm +2/-3 mm as per applicable drawings of the respective units.
- b) Width of all planks including the tongue shall be more than 125mm and after plaining it shall be minimum 100mm.
- c) Minimum number of planks shall be used for a shook.
- d) Horizontal, vertical, diagonal planks shall be given for binding (number of such planks depend on the dimension of panel.
- e) Width of binding planks shall be minimum 100mm.
- f) Distance between any 2 binding planks shall be less than 750mm.
- g) diagonal planks shall be used in between vertical binding planks when distance between inner to inner of vertical planks is more than 750mm
- h) Distance of the outer edges of these planks from the edge of case shall be less than 250mm.
- i) Diagonal planks are not required for top planks and width side, if the width of pallet is less than 750mm.

6.2 JOINTING OF PLANKS

Single length planks shall be used for cubicles whose overall length is less than 2400mm. For cubicles of length more than 2400mm, jointing is permitted. The jointing shall be done with one single or maximum of 2 planks of wood same as other planks of width 250 mm (minimum) with two rows of nails on either side of the joint in zigzag manner. From the joint along height side, it shall be of lap joint with overlap of at least the width of plank.



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6.3 TONGUE AND GROOVE JOINTS

Two consecutive planks shall be joined by tongue and groove joint. Depth of tongue shall be 12+1 mm, thickness of tongue shall be 8 +1 mm. The groove dimensions shall be such that the tongue fits tightly into the groove to make a good joint. This type of joint can be done based on the product requirement wherever required.

6.4 PERMISSIBLE DEFECTS

Wood shall be free from knots, bows, visible sign of infection and any kind of decay caused by insects, fungus, etc.

End splits: Longest end splits at each end shall be measured and lengths added together. The added length shall not exceed 60mm per meter run of shook's. Wood pins shall be used to prevent further development of split.

Surface cracks: Surface cracks with a maximum depth of 3mm are permissible. A continuous crack of any depth all along the length is not allowed.

6.5 OTHER MATERIALS

6.5.1 NAILS

The dia. of the nails shall be 3.15mm. The length of the nails shall be 65mm wherever two planks of 25mm thickness are joined and 75mm wherever a 25mm planks is joined to a 50mm plank.

6.5.2 BLUE NAILS

These are used for nailing bituminized Kraft paper/hessian cloth to the planks. The length of the nails shall be 16mm.

6.5.3 HOOP IRON STRIPS

These are used for strapping the boxes. The width of the strips shall be 19+1mm and thickness 0.6+0.01mm. The material shall be free from rust. If sufficient nailing is done for bigger boxes, strapping need not be done.

6.5.4 CLIPS

These shall be used for strapping the hoop iron strips on the boxes.

6.5.5 BRACKETS

These brackets are used for nailing to the corners of cubicle boxes. The brackets shall be of mild steel of thickness min 2mm and width 25+1mm. The brackets shall be of "L" shape, the length of each side being 100+2mm. Two holes shall be provided towards the end of each side for screwing /nailing.

6.5.6 FASTENERS

Bolts, double nuts, spring washers will have to be used for packing of some special items like transformers, reactors, breakers, etc., to hold the job to the bottom plank of the box. The bolts, nuts, washers will be provided by the vendor. Drilling of holes will have to be done using contractor's tools.

6.5.7 MULTI LAYERED CROSS LAMINATED POLYTHELENE FILM

100GSM (Colourless) Multi Layered Cross Laminated Polythelene Film Specification No: AA51420 are used to make covers to the jobs individually. The cross lamination gives qualities of extra toughness, together with flexibility and lightness coupled with good weather resistance to ultra violet rays.

6.5.8 RUBBERISED COIR:

The rubberized coir is used as cushioning material. For the packing of loose items, items are to be arrested by using rubberized coir. For the packing of cubicles rubberized coir of thickness 25mm and width 75mm shall be used.

6.5.9 FOAM RUBBER / 'U' FOAM:

This is used for covering the delicate items. This material is provided by the vendor.

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6.5.10 MARKING PLATE:

This shall be of anodized aluminium sheet. Size of the marking plate shall be maintained minimum of size as per the details specified in the Figure 4.

6.5.11 PACKING SLIP HOLDER:

This shall be of galvanized iron tinned sheet /Aluminium sheet

6.5.12 SILICA GEL:

This shall be of indicating type to conform to IS: 3401/AA55619. Silical gel shall be used for such products only where moisture needs to be avoided.

6.5.13 COTTON BAGS:

These are used for holding silica gel. The bags shall have the following matter indicated on them:

BHEL-UNIT NAME PLACE-PINCODE

SILICA GEL INDICATING TYPE

BLUE: ACTIVE

ROSE: REDUCED ACTIVITY

WHITE: NO ACTIVITY. TO BE REPLACED WITH FRESH SILICA GEL

6.5.14 COTTON/ PLASTIC TAPE:

This is used for tying small items. And also to prevent vibrations of moving parts within the cubicles.

6.5.15 MARKING INK:

The ink used normally is black in color. In some special cases other color also will have to be used. The ink shall be non-fading/indelible and non-washable by water.

6.5.16 POLYETHYLENE BAGS:

These are to be used for keeping the Packing slips. The bag shall be of size 70mm X 100mm (minimum).

6.5.17 Hessian cloth, twine thread, paint will have to be used in packing certain items.

6.5.18 Mechanical Latching clamps:

For CLW Railway panels and similar Panels self-locking clamps can also be used on need basis in conjunction with or apart from regular bolt and nut fixing arrangement. For reusable boxes, these clamps provide easy locking and unlocking arrangement. These clamps will be made available from BHEL in some cases.

6.5.19 STICKERS

The following stickers to be put by the vendor on cubicles/Boxes after packing.

- 1) Case No sticker: 2 nos. Size 25.Cm x 0.45Cm
- 2) BHEL Monogram sticker: 1 no. Size 1.75Cm x 2.3Cm
- 3) Address sticker: 2 nos. Size 3.8Cm x 3.0Cm
- 4) Direction sticker "Front" & "Back" 4 nos. Size 2.0Cm x 0.75Cm
- 5) Chain Mark Sticker: 4 Nos. Size 3.0Cm x 0.75Cm
- 6) "Fragile" sticker: 2 Nos. Size. 2.1Cm x 1.5Cm
- 7) "DO NOT STACK" sticker 2 Nos. Size 3.0Cm x 2.2Cm



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In place of stickers, writing all the details legibly with paint shall be allowed & respective units may take decision accordingly.

7 PACKING OF CUBICLES:

- **7.1** The packing is to be done as per clause 5 in all respects.
- **7.2** The cubicles are already fixed on wooden pallets. Hence the contractor need not arrange the bottom pallets normally.
- 7.3 The cubicles will be of different sizes both width wise and lengthwise. The cubicles may be made up of single suite, 2 Suite, 3 Suite, 4 Suite, etc., The width of the cubicles generally varies from 400 mm to 1650mm. The length of the cubicle, generally varies from 1500 mm to 4800 mm. The height is normally 2430 mm. In some cases, the height may be less/more.

7.4 MULTI LAYER CROSS LAMINATED POLY FILM

The inner surface of 4 sides of shook's shall be nailed with Multi-layer cross laminated poly film (as per 6.5.7) using blue nails (as per 6.5.2) wherever 2 pieces of Cross laminated poly film are used, the joint shall have an overlap of minimum 20mm.

The inner surface of top cover shall be nailed with Multi-layer cross laminated poly film (as per 6.5.7). This sheet shall project outside on 4 sides by at least 100mm and shall be nailed properly on sides. Joining of sheets should have overlap of minimum 20mm.

The cubicles shall be covered with Multi-layer cross laminated poly film (as per 6.5.7).

7.5 SILICA GEL:

Silica gel (as per 6.5.12) packed in cotton bags shall be kept at different places inside the cubicle as per BHEL-Unit directions. Each suit of cubicle shall be provided with 1 kg of Silica gel (for a 4 suit cubicle 4 kgs of Silica Gel to be used. The bag containing silica gel to be as per 6.5.13).

7.6 LOOSE PARTS:

Any loose parts in the cubicles shall be tied using cotton/ plastic tape. Wooden battens shall be provided wherever necessary.

7.7 WOODEN BATTENS:

In case of cubicle which are not rectangular in shape like control desks, sufficient number of wooden rafters/battens of proper size shall be provided to give strength to the package.

7.8 RUBBERISED COIR:

Gap between the cubicle and the case shall be filled with rubberized coir (as per 6.5.8) with distance between consecutive layers less than 500mm.

7.9 CLAMPING:

Packing shall be bound at edges by nailing M.S. Clamps / Brackets (as per 6.5.5). Each vertical edge shall have minimum 3 clamps. Top horizontal edges will have one clamp for every meter length of package. However, minimum 4 clamps shall be nailed at the top for any cubicle.

7.10 PACKING SLIP:

Packing slip kept in the polyethylene bag (As per 6.5.16) shall be placed in the box at appropriate place. In addition, one more packing slip covered in polyethylene cover and packing slip holder (as per 6.5.11) shall be nailed to front / rear of case.

7.11 MARKING PLATE:

One no. (As per 6.5.10) shall be nailed to the front side of the case.

7.12 CASE MOUNTING:

After complete packing, stencil marking of various details and marking of symbols shall be done as per BHEL instructions using indelible / non washable marking ink.

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7.13 Different types (Typical) of Cubicles with sizes for Packing

- 1. Single suite cubicle 900 x 950 x2500
- 2. Two suite cubicle 1650 x 950 x 2500
- 3. Three suite cubicle 2400 x 950 x2500
- 4. Four suite cubicle 3150 x 950 x 2500
- 5. Regulation cub 1300 x 1350 x 2500
- 6. Thy cub 2870 x 1350 x 2500
- 7. VFD Cub 3800 x 1550 x 2500

7.14 PACKING OF CUBICLES FOR EXPORT

Refer Corporate Standard AA0490009.

8 PACKING OF LOOSE ITEMS/SPARES

- 1) Shape of cases shall be square, rectangular with single gabled roof or with double gabled roof depending on the nature of the job to be packed. Construction shall be as per drawings enclosed. Only gable will be additional as required.
- 2) Wood shall conform to specification AA51401 or AA51402 with Tongue and Groove joint as per clause 6.3.
- 3) Width of planks shall be at least 100 mm. Width of binding planks (battens) shall be at least 75mm.
- 4) External surface of planks on front and rear shall be plane 100% (except bottom plank).
- 5) Inner surfaces of all 6 sides shall be lined with Multi Layered Cross Laminated Polythelene Film (as per clause 6.5.7) using blue nails.
- 6) Rubberized coir of minimum 25mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of box.
- 7) Internal packing: Items that go into the box shall be packed using 100GSM, (Colourless) Multi Layered Cross Laminated Polyethylene Film Specification No: AA51420. Any space left between the job and the sides and the top of the box shall be filled with rubberized coir to get proper cushioning effect.
- 8) Certain items like transformers, reactors, breakers, etc., shall be bolted to the bottom of the box using bolts, nuts and washers.
- 9) Silica gel as per clause 6.5.12 held in cotton bags as per clause 6.5.13 shall be kept at proper places in the box.
- 10) Packing slip kept in polyethylene bag (clause 6.5.16) shall be placed in the box.
- 11) Marking plate as per clause 6.5.10 shall be nailed to side of the box.
- 12) Two numbers of hoop iron strips as per clause 6.5.3 shall be strapped tightly on the case using clips.
- 13) Stencil marking of various details and marking of various symbols shall be done as per BHEL instructions using indelible/non-washable marking ink.
- 14) Loose items to be kept inside the cubicle
- The components which are removed from cubicle for shipping purpose only, such as meters shall be kept inside the cubicle individually, kept in wooden box and tied firmly in bottom of Cubicle.
- Other items which are given loose in addition to cubicle shall be packed in separate boxes.

9 BOX SIZES

9.1 BOX SIZES



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Table 1 - SPARES WOODEN BOX DETAILS

SNO	BOX TYPE	BOX SIZE (in mm)	BOX Wt (in KG)	Carrying Capacity
1	Α	800 X 200 X 200	15	
2	В	1500 X 200 X 200	22	
3	С	2000 X 200 X 200	27	
4	D	1100 X 200 X 200	15	
5	Е	200 X 200 X 200	5	
6	F	320 X 250 X 260	13	
7	G	320 X 250 X 430	16	
8	Н	430 X 370 X 430	23	
9	1	1100 X 400 X 400	45	
10	J	1500 X 500 X 400	65	
11	K	2000 X 500 X 400	93	
12	L	2500 X 500 X 400	88	
13	М	900 X 600 X 600	100	
14	N	3000 X 400 X 400	60	
15	Р	600 X 500 X 400	35	
16	Q	710 X 630 X 600	90	
17	R	850 X 630 X 670	102	
18	S	1000 X 770 X 670	140	
19	Т	2500 X 850 X 800	180	
20	U	1500 X 700 X 700	120	
21	W	1200X900X600	120	
22	Υ	450 X 200 X 200	10	

Table 2 - WOODEN BOX DETAILS

BOX TYPE	BOX SIZE (in MM)	BOX Wt (in KG)	Carrying Capacity
1	320X250X260	10	
2	320X250X430	15	
3	430X370X430	25	
4	670X670X470	65	
5	720X630X600	75	
6	1000X770X660	100	
7	1100X430X670	80	
8	1200X1200X900	80	
9	1300X770X1050	155	
10	2500X850X800	225	
11	2000X1500X1200	305	
12	1850X1050X1250	260	
13	2000X800X800	180	
14	2600X1500X1600	470	
15	250X250X600	20	
16	250X250X880	30	
17	300X300X700	25	
18	380X380X880	45	
19	510X510X1400	60	
20	570X570X1400	80	
21	575X575X1875	105	
22	3600X1100X1100	390	
23	900X500X800	110	
24	2000X950X740	225	
25	1600X1120X700	220	
26	2500X2000X1200	490	
27	2900X1900X1400	525	
28	3000X1000X900	370	
29	3200X2200X950	450	
30	2150X1100X750	325	
31	2000X2000X700	130	
32	700X1200X1325	130	

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Table 3 - STEEL BOXES

SL NO	TYPE	DIM	TENSION IN I	им	WEIGHT	CARRYING CAPACITY				
		LENGTH	BREADTH	HEIGHT		(KGS)				
1	1	2480	1680	1500	339	4500				
2	П	1200	900	600	061	2000				
3	IIB	1800	850	950	115	2500				
4	Ш	900	600	600	029	1000				
5	IV	600	450	500	019	750				
6	V	400	350	300	011	500				

TYPICAL PATTERN OF WOODEN BOX

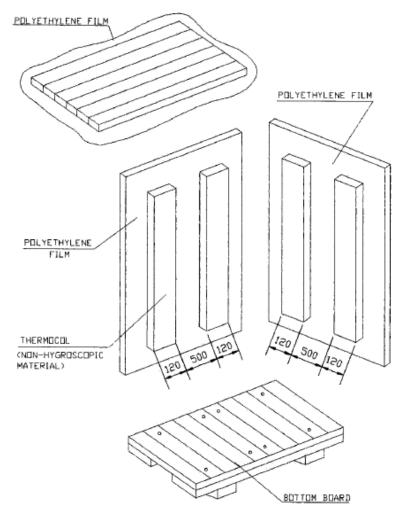


Figure 1



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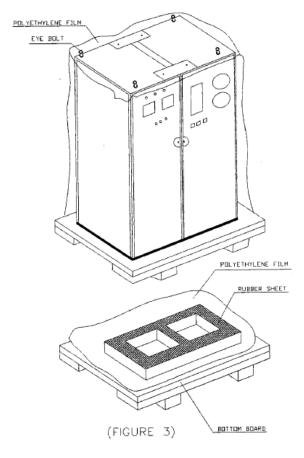


Figure 2

9.2 STEEL CONTAINERS:

Steel containers for packing can be used in case of repeated supplies of the same equipment. Empty steel containers are to be returned back from customer's end and to be reused for the next supplies. The containers are to be made of structural steel as per AA10108 with proper reinforcement with I, C and T Sections. Depends on the availability of resources & requirements units may be allowed to use standard cargo containers also instead of fabricated steel boxes.

- a) Following precautions are to be taken during packing: -
- b) Put the machine in the steel container properly,
- c) Cover the machine with polythene.
- d) To arrest the movement in the steel container necessary wooden Blocks/Battons may be put.
- e) Put cover on steel, container and Bolt Properly

9.3 SEALED PACKING:

Components sub-assemblies and assemblies sensitive to climatic conditions shall be packed seal tight. All the openings of the sensitive components, sub-assemblies and assemblies shall be blanketed to prevent the ingress of dust and moisture. The components sub-assemblies and assemblies are completely covered with 2 layers of polyethylene sheet. All sharp corners and edges are to be protected by rubber mats to prevent the polyethylene sheet from damage. Top surface of the case shall be free from dents to prevent rain water pockets.

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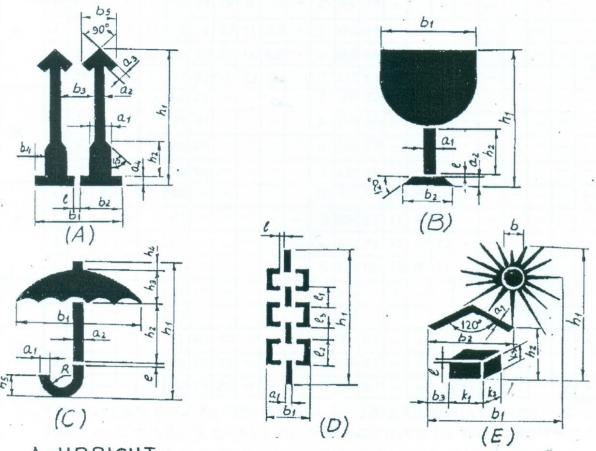
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10 MARKINGS/STENCILINGS

MARKINGS ON PACKING CASES

- 1. THIS PLANT STANDARD PRESCRIBES THE VARIOUS CAUTION SIGNS AND OTHER MARKINGS ON PACKING CASES.
- 2. DIMENSIONS IN THE TABLE 1 SHALL BE USED FOR MAKING STENCILS ONLY.



- A. UPRIGHT
- B. FRAGILE
- C. PROTECTION FROM FALLING OR CONDENSING MOISTURE.
- D. SLINGING POSITION
- E. PROTECTION FROM DIRECT RADIATIONS.



Figure 3



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DES											DI	MEI	NSION	IN MI	M									
ATION		a1	a2	а3	a4	b1	b2	b3	b4	b5	b	I	h1	h2	h3	h4	h5	k1	k2	k3	11	12	13	R
Α	1	12	5	5	4	52	25	19	8	21		2	84	23										
	2	17	7	7	6	75	36	29	11	30		3	119	33										
	3	24	10	10	8	104	50	38	16	42		4	168	46										
	4	34	14	14	11	147	71	59	23	60		5	239	65										
В	1	5	5			50	33					2	84	25										
	2	7	7			71	47					3	119	36										
	3	10	10			100	66					4	168	50										
	4	14	14			142	94					5	239	71										
С	1	4	3			66						2	80	39	19	5	11							6
	2	6	4			85						3	114	55	27	7	16							9
	3	8	6			120						4	160	78	38	10	22							12
	4	11	9			170						5	227	110	54	14	31							17
D	1	6				30						4	148								30	30	10	
	2	9				42						5	209								42	42	14	
Е	1	3				69	47	10			16	2	91	26				17	8	11				
	2	4				98	67	15			23	3	128	33				24	11	16				
	3	6				138	94	20			32	4	182	62				34	16	22				

Table 4

Black and Red Marking Ink to IS:1234 "Ink, Stencil, Oil Base, For Marking Porous Surfaces" or duplicating ink stencilling, oil base for marking porous surfaces.

All cases containing fragile items are to be stencilled with red marking and stencilling paint/ink

"HANDLE WITH CARE", "FRAGILE DO NOT TURN OVER".

Besides the caution signs the product information's shall be stencilled of letters with 13mm to 50mm height.

In case of consignment consists of more than one package, each package shall carry its package no as given in shipping list. All caution signs shall be stencilled in high quality full glossy out door finishing paint red in colour (AA56126). All other markings shall be carried out in black enamel(AA56126).

Caution signs & other markings shall be stencilled on both the end shooks & the side shooks.

Caution sign (for slinging) shall be stencilled only on side shooks at the appropriate place.

Note: Incase the size of package is small for using the stencils, then hand written letters/figures shall be allowed.

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BHFI	BHEL - <unit> - <location> - <pin></pin></location></unit>					
CONSIGNEE						
MATERIAL						
CUSTOMER REF.				MO. NO.		
DESPATCH ADVICE NOTE NO				CASE NO		
DIMENSIONS(MM) L x B x H				NET WT –KGS	GROSS WT –KGS	
SPECIAL	HANDLE WITH CARE - KEEP DRY					
INSTRUCTIONS	DO NOT	DROP -	DO NOT	TILT		

Figure 4 – TYPICAL MARKING PLATE (225 X 170)

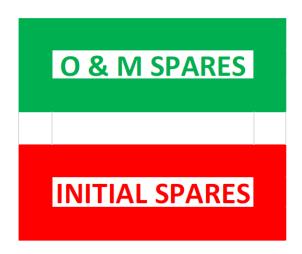


Figure 5

Easy spares [Initial and O&M] Traceability and Identification at units and as well as at sites:

11 RECYCLING OF INCOMING WOODEN PACKING CASES

OBJECTIVES

- To utilize useable wood of incoming packing cases, for manufacturing of new packing boxes.
- To recycle incoming wooden packing cases, as such, wherever possible.



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- 1) All incoming wooden packing cases received from suppliers /customers will be opened carefully, with the intention of reusing them, by Shop.
- 2) After carefully taking out the contents, the empty wooden packing cases will be shifted by Shop to the specified locations i.e. bin / nearly spaces, already earmarked in stores.
- 3) Material shifting contractor engaged by store, will collect all such wooden packing cases and scrap wood from specified points, on a regular basis.
- 4) After collecting / loading the empty packing cases/ scrap wood, contractor will take the carrier first to Weighment Bridge for weighment, thereafter; he will go to Carpentry, where Carpentry representative will identify the packing cases which can be used by Carpentry for manufacturing of New Packing Boxes. All such identified packing boxes will be unloaded and handed over to Carpentry by contractor.
- 5) These packing boxes will be made re-useable after necessary rectification and additional work.
- 6) Contractor will again take the carrier for weighment and this second reading will also be recorded on the same "Weighment Slip".
- 7) Weight of empty packing cases / scrap wood taken will be calculated on the basis of 1st and 2nd weighment readings recorded on the "Weighment Slip". A copy of "Weighment Slip" (where both the weighment readings are recorded) will be given by the contractor to the carpentry representative. Based on this "Weighment Slip", carpentry will maintain a register in which details of quantity received will be recorded.
- 8) All "Weighment Slips" will invariably be signed by carpentry representative (even when no boxes have been unloaded by carpentry). Store will accept the scrap wood only if "Weighment Slips" are signed by carpentry representative.
- 9) Balance empty packing cases / scrap wood will be handed over by contractor to Store, for storing in scrap yard.
- 10) A separate area in Scrap yard will be provided, for executing the work of denailing of wooden packing cases, under supervision of carpentry.
- 11) Carpentry contractor will identify packing cases / scrap wood for denailing, which will behanded over to him by Store, at Scrap yard, for denailing and further operation.
- 12) Quality and Carpentry will jointly inspect the wood generated by de-nailing process and will prepare "INSPECTION CUM RECEIPT REPORT OF USEABLE WOOD RECEIVED FROM TPS STORE BY CARPENTRY".
- 13) After acceptance of the wood by Quality and Carpentry, the same will be shifted to carpentry for receipt and its record will be maintained by carpentry.
- 14) This will be a Permanent Productivity Project executed by carpentry. "Productivity Savings "duly verified at the current Purchase Order rate of wood, will be sent every month to Resource Management Department, for highlighting it in their monthly progress report.

12 STANDARD METHOD OF PACKING

Table 5 - Standard Method of Packing

DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
DESCRIPTION	CASE	CRAIL	SKID	BUNDLE	DAKE	DKOW	WIETAL DROW	FIBRE DRUM
PRESSUE VESSELS								
TOWERS					0			
TANKS					0			
VESSELS					0			
GASKETS	0							
FASTENERS	0							
COVERS		0						
EXCHANGERS								
			†		†			

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DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
HEAT EXCHANGERS					0			
TUBE BUNDLE	0							
SHELL					0			
AIR FIN COOLERS					0			
COLOUMNS, MOTOR SUSPENSIONS, PLENUM CHAMBERS, SCREEN GUARDS, ETC					0			
BEARING BLOCKS	0							
FANS	0	0						
MOTORS	0							
GASKETS	0							
FASTENERS	0							
TEST FLANGES			0					
TEST RINGS			0					
COVERS			0					
CRYOGENIC VESSELS								
COLD CONVERTERS					0			
HORIZONTAL STORAGE TANKS					0			
TRANSPORTATION TANK					0			
COLD BOX					0			
DRYING UNIT					0			
DRYING BOTTLES					0			
MOISTURE SEPARATORS					0			
SILENCERS					0			
ONGC SKIDS					0			
VAPORISER		0						
SPECIAL PRODUCTS								
SI/VI PIPING		0						
CRO BIO CONTAINERS	0							
AIR BOTTLES	0							
TITANIUM BOTTLE	0							
WAR HEAD CONTAINER	0							
MISSILE CONTAINER	0							
FUEL CONTAINER	0							
AIR LOCK ASSEMBLY	0							
BOILER DRUMS					0			
BOILER ITEMS								
COILS			0					
PANELS					0			
HEADERS			0		0			
FEEDERS								
MACHINED ITEMS								
SHELL SEGMENTS					0			



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DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
SHELL SEGMENTS IN STACKS					0			
SPHERE PETALS								
COLOUMNS, BASE PLATES, TIERCOS, PIPES, NOZZLE E1, F1, INTERNAL PIPES, PADS ETC.					0			
ROLLERS	0							
VALVE TRAYS								
VALVE TRAY COMPONENTS	0							
LATTICE GIRDERS		0						
FASTENERS	0							
GASKETS	0							
SUB CONTRACTS								
FAB STRUCTURALS					0			
SUPPORTING STRUCTURALS					0			
STRUCTURE SUB ASSEMBLY					0			
FAB PIPES					0			
GRATINGS					0			
STAIR CASES					0			
HANDRAILS/ PLATFORMS					0			
BOUGHT OUT COMPONENTS								
IRON & STEEL (LIKE PLATES, BEAMS, ANGLES, CHANNELS ETC.)					0			
PIPE FITTINGS								
CS PIPES, TUBES					0			
SS PIPES, TUBES					0			
FIN TUBES	0							
ELBOWS		0			0			
FLANGES	0	0						
VALVES	0							
GAUGES	0							
DEMISTERS		0						
ABSCRBANTS (LIKE MOLECULAR SIEVES, ACTIVATED ALUMINA, MOBILE SORBID)						0		
PAINT TINS		0						
PAINT DRUMS						0		
IGNITORS	0							
SPRAY NOZZLES	0							
ELECTRICAL INSTRUMENTATION								
MOTORS, PUMPS, COMPRESSORS, TURBINES	0							
SWITCH BOARDS, DISTRIBUTION BOARDS, STARTERS, JUNCTION BOXES		0						
INDICATORS, VIBRATOR SWITCHES	0							

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CORPORATE STANDARD



DESCRIPTION	CASE	CRATE	SKID	BUNDLE	BARE	DRUM	METAL DRUM	FIBRE DRUM
CABLE BUNDLES, CABLE DRUMS					0			
CABLE TRAYS, CABLE RACKS, EARTHING MATERIAL		0						
OPERATIONAL SPARES	0							

13 PROCEDURE FOR HANDLING OF COMPONENTS

The purpose of this procedure is to protect the quality of the components/equipment while handling in various stages of manufacturing packing & despatching.

- **13.1** Adequate care shall be taken in handling the material, and components to avoid damage during receipts, storage issue manufacture & despatch operations.
- 13.2 Appropriate material handling equipment like fork lifters, cranes etc. shall be used where needed.
- **13.3** Lifting by crane and transportation by trolley of critical items and large components like rotors castings etc. shall be done carefully.
- 13.4 For critical items, where specified, special handling fixtures shall be used for lifting.
- **13.5** Slings and shackles used for lifting the components/equipment shall be checked for fitness and suitability before use.
- **13.6** Slings used on machined surfaces shall be suitably padded. No slings shall be used on journal surfaces.
- **13.7** Precision machined components like blades, catches, rollers etc. shall be lifted using suitable wooden pallets.

13.8 HANDLING OF COMPONENTS ON RECEIPT/DESPATCH

Before loading/unloading a packing case from the carrier look for the following shipping instructions painted on the packing case.

- a) The markings showing the upright position.
- b) The markings showing the sling position
- c) Markings showing the fragile contents.
- d) Other required markings as per clause no.10
- **13.8.1** Appropriate cranes and slings should be used for different components/ cases. Slings should normally make an angle as minimum as possible (width wise) but in no case more than 15°.
- **13.8.2** Handling and lifting should be done without jerks or impacts.
- 13.8.3 Immediately after receipt of the goods, the packing should be examined all-round for any sign of damage. If necessary, lift the cover or a number of boards of the case so as to make the contents visible. In the event of sealed packing being used the plastic sheeting should not be damaged. It is imperative that the packing material is restored in original condition after the inspection.
- 13.8.4 On receipt of the equipment it should be checked with the shipping list and missing or damage if any should be reported immediately. It is important to arrange for immediate examination to determine the extent of the damage, the cause of the damage and where applicable the person or persons responsible for the damage. According to general practice when transporting by railway or by road vehicle the carrier concerned should be immediately called upon (within specified periods) for jointly establishing a statement of the damage. This is essential as a basis for a subsequent claim and possible damage report to the insurance company.
- 13.8.5 Protective coating applied on machined surfaces should not be disturbed. The plastic covering should be put back carefully so that it prevents ingress of dust and moisture. Some packing may have vapour phase inhibitor (VPI) paper enclosed inside the packing cases. This should be restored to its original place as far as possible.



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13.8.6 Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

14 GENERAL GUIDELINES FOR ODC TRANSPORTATION/DESPATCH

Based on the Dimensions/Weight indicated in the Transportation Sketch, the type of Trailer is decided and indicated in the Tender Enquiry.

14.1 TRANSPORTATION:

1. LOW BED TRAILERS (LB 8):

Well Bed Length : 10000mm
Over Gooseneck : 13000mm
Width : 3000mm
Carrying Capacity : 40MT

2. LOW BED TRAILERS (LB 16):

Well Bed Length : 12000mm
Over Gooseneck : 16000mm
Width : 3000mm
Carrying Capacity : 75MT

3. TOW TYPE TRAILERS (WITH FRONT DOLLEY 16 TYRES): 12000MM length

(for Exceptional equipment length: 30000mm and above)

Bigger Dia equipment are loaded in the Well with overhanging.

Smaller Dia equipment with excess length are loaded over Gooseneck with rear hanging. The Vehicle Dimensions are defined above are only guidelines for selection based on actual Dimensions/ Weight of the Consignment

14.2 PACKING:

For all ODCs, Wooden Saddles are cut to the diameter of equipment as per the Transportation Sketch.

Wooden Saddles For Diameter up to 4000mm		For Diameter above 4000mm
Length:	1836/2743mm (6'0"/9'0")	3353mm (11'0")
Width:	300mm (1'0")	300mm (1'0")
Height:	Saddle + one/two wedges a top	Saddle + three/four wedges a top

Number of Saddles:	
Minimum	3 in case of Loading inside Well +1 when loaded on Gooseneck
Maximum:	4 in case of Loading inside Well +2 when loaded on Gooseneck

For Securing the equipment firmly on the Trailer, 19mm (3/4"), wire rope with 25mm (1") Heavy Duty Turn Buckles / BD Clamps are used as Lashing for the equipment.

14.3 NUMBER OF LASHINGS:

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	CONSIGNMENT LOADED INSIDE WELL BED	CONSIGNMENT LOADED OVER GOOSENECK
a) up to 40MT	4 (2 Single Line lashing 2 Double Line Lashing)	5 (3 Single Line Lashing 2 Double Line Lashing)
b) 40MT to 60MT	5 (3 Single Line Lashing 2 Double Line Lashing)	5 (Single Line Lashing 3Double Line Lashing)
c) 60MT and above	5 (2 Single Line Lashing 3 Double Line Lashing)	6 (3 Single Line Lashing 3 Double Line Lashing)

15 GUIDELINES FOR HANDLING/LOADING/LASHING

15.1 HANDLING



Figure 6

Before unloading the jobs Completely painted and neatly stencilled will be checked.

Pipes with split type end cover will be checked



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Figure 7

All Coil Tubes to be provided with End Caps.



Figure 8

Neatly stacked Coil Assemblies.

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Figure 9

Columns to be lifted with Nylon belts. This protect painting, edges and attachments.



Figure 10

15.2 LOADING

All the components to be transported by putting inside the properly fabricated Crating



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Figure 11

Small components may fall down while transporting without closed crating and there are chances of missing of small parts. Hence, it is always better to transport small components in closed containers/crating. Loose to be being shipped in a closed crating.



Figure 12

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No component loaded over the crating.



Figure 13

Headers supported with wooden V blocks at 3 meters interval.



Figure 14

Spacers in between each coil assembly.



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Figure 15

Goose pipe to be provided with rubber pad protects removal of painting and damage to the job.



Figure 16

15.3 LASHING

Use Nylon belts only for lashing of all components. It prevents removal off painting and cut in the materials.

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Figure 17

Nylon Belts used for lashing the beams.



Figure 18

16 PRODUCT WISE SPECIAL INSTRUCTION

Additional instructions of packing not included in this standard shall be covered by individual product standard.

17 REFERRED STANDARDS (Latest publications including amendments):

1) AA51420

2) AA55619

3) AA51414

4) IS:3401

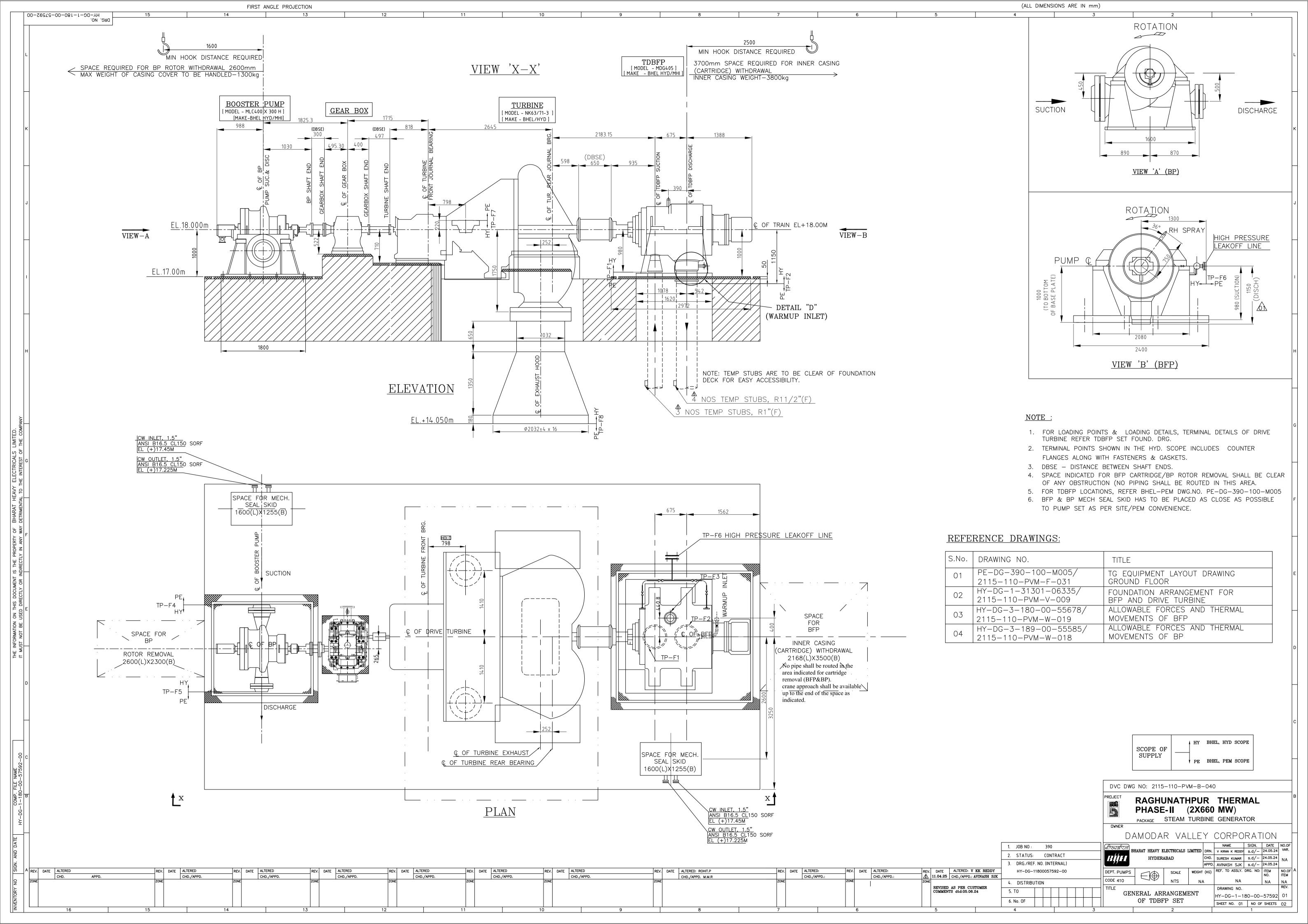
5) AA10108

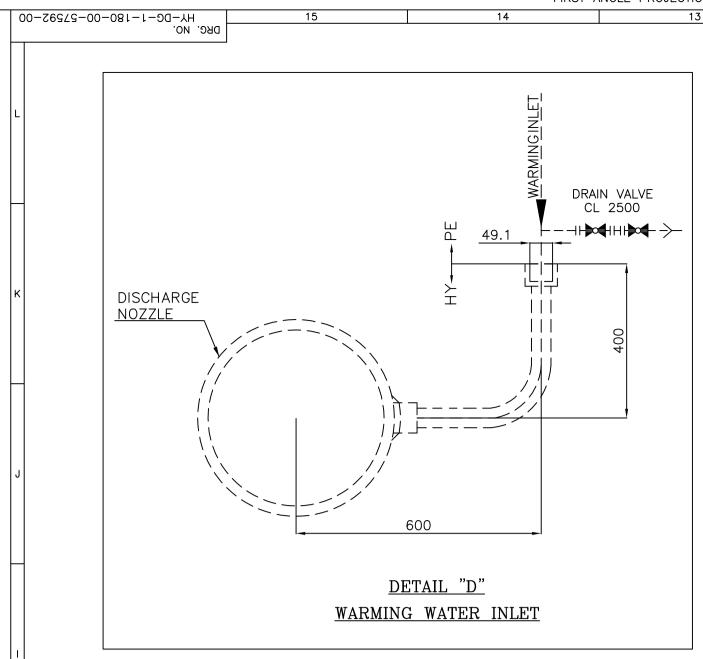
6) AA56126

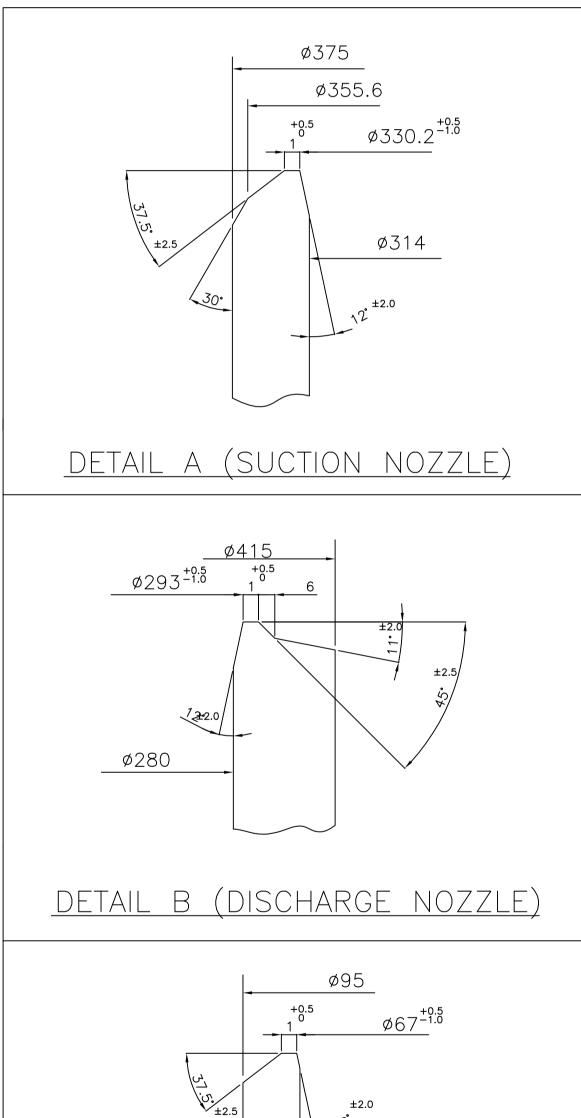
7) AA51402

8) AA51401

9) IS:1234

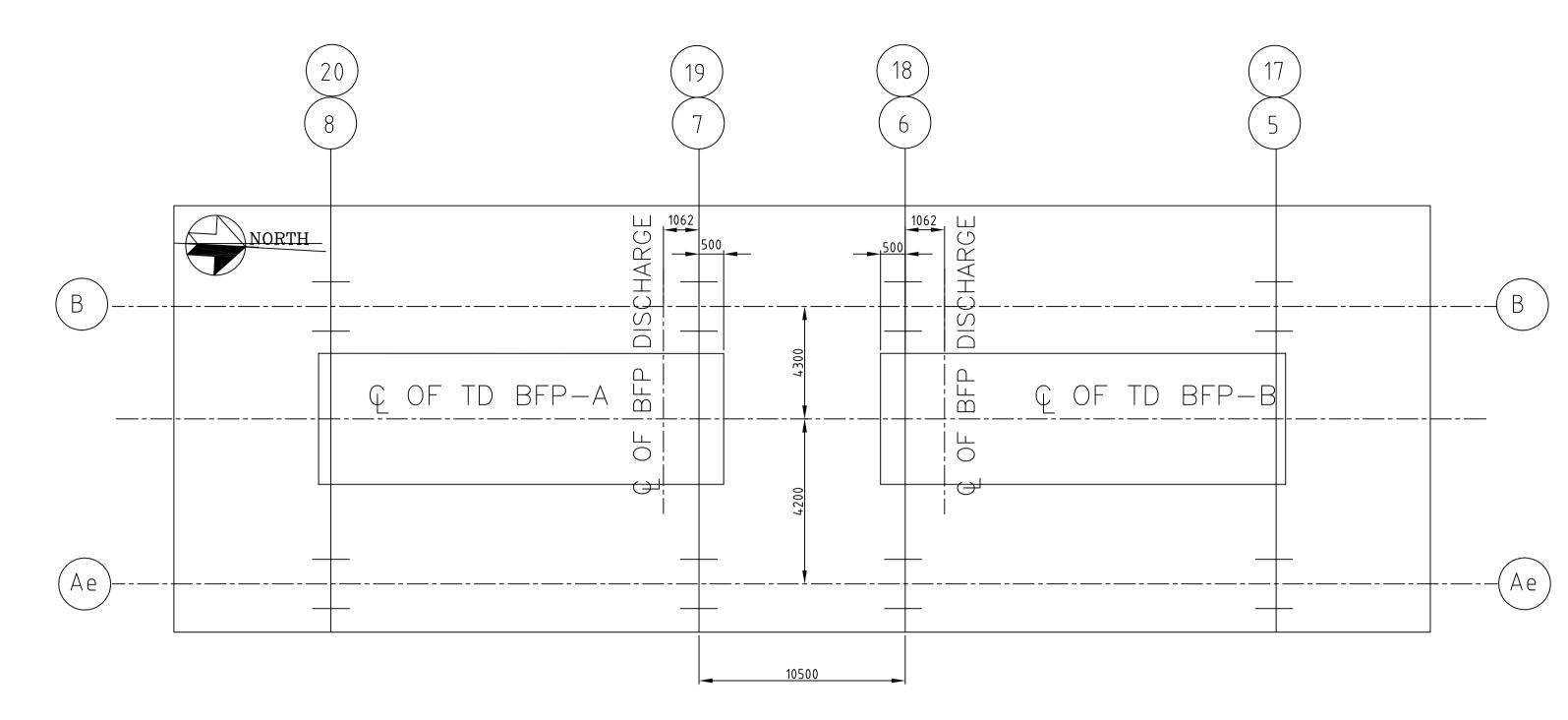








DETAIL-'C' (RH SPRAY)



KEY PLAN OF TDBFP SETS

BOOSTER PUMP

MLC400

CLOCKWISE

1340

169

204

187.8

1495

1644

G 2.5

DESIGN AS PER LATEST HIS WITH COLLABORATOR MHI

GUIDELINES TESTING AS PER ANSI/HI 14.6-2016

6.1

TERMINAL POINTS

TERMINAL POINT	DESCRIPTION	NOMINAL SIZE	TERMINATED WITH	QTY.
TP-F1	SUCTION OF FEED PUMP	14"	BW END TO SUIT PIPE DIA AS PER DETAIL'A'	1
TP-F2	DISCHARGE OF FEED PUMP	16"	BW END TO SUIT PIPE DIA AS PER DETAIL'B'	1
TP-F3	R.H.SPRAY (2ND STG)	3"	BW END TO SUIT PIPE DIA AS PER DETAIL'C'	1
TP-F4	SUCTION OF BP	16'	COUNTER FL. TO SUIT PIPE DIA 406X12.7 THK	1
TP-F5	DISCHARGE OF BP	12"	COUNTER FL. TO SUIT PIPE DIA 323.85X12.7 THK	1
TP-F6	HIGH PRESS. LEAKOFF LINE	2"	SORF 2" CL 600	1
TP-F7	TURBINE MAIN STEAM INLET	10" #15	500 WNRJ, SCH=60, CS	2
TP-F8	TURBINE EXHAUST HOOD	DIA 2032 X16		

1. JOB NO :

WEIGHTS OF PUMPS

ITEM	BOILER FE	ED PUMP	BOOSTER PUMP			
	DRY (kg)	WET (kg)	DRY (kg)	WET (kg)		
PUMP	16000	16250	3500	3800		
BASE	5600	5600	2650	2650		
TOTAL	21600	21850	6150	6450		

STATIC & DYNAMIC LOADS FOR BP & BFP

		BOOSTER PUMP	BFP
STATIC LOAD (kg)	VERTICAL	6450	21850
	VERTICAL	5700	24375
DYNAMIC LOAD (kg)	HORIZONTAL	5700	24375
(kg)	AXIAL	3800	16250

FOITIDMENT DATA

EQUIPMENT DATA						
ITEM	WEIGHT (KG)					
DRIVE TURBINE	61000					
	SINGLE HEAVIEST EQUIPMENT					
GEARBOX	1030					
COUPLING B/W BFP & TURBINE	200					
COUPLING B/W BP & GEAR BOX	51					

DVC DWG NO: 2115-110-PVM-B-040

RAGHUNATHPUR THERMAL

PHASE-II (2X660 MW) PACKAGE STEAM TURBINE GENERATOR

DAMODAR VALLEY CORPORATION

SHEET NO. 02 NO OF SHEETS 02

HYDERABAD GENERAL ARRANGEMENT HY-DG-1-180-00-57592 01 OF TDBFP SET

										2. STATUS:	CONTRACT
										3. DRG./REF. NO.	. (INTERNAL)
REV. DATE ALTE	ERED REV. DATE ALT	TERED REV. DATE	ALTERED REV. DATE ALTERED	REV. DATE ALTERED	REV. DATE ALTERED	REV. DATE ALTERED: ROHIT.P	REV. DATE ALTERED:	REV. DATE ALTERED:	REV. DATE ALTERED: V KK REDDY	HY-DG-11800	0057592-00
CHD)./APPD. CH	D./APPD.	CHD./APPD. CHD./APPD.	CHD./APPD.	CHD./APPD.	CHD./APPD. M.M.R	CHD./APPD.:	CHD./APPD.:	11.04.25 CHD./APPD.: AVINASH SJK		
ZONE	ZONE	ZONE	ZONE	ZONE	ZONE	ZONE	ZONE	ZONE	ZONE REVISED AS PER CUSTOMER	4. DISTRIBUTION	l
									COMMENTS dtd:05.06.24	5. TO	
										6. No. OF	

TECHNICAL DATA OF TD BOILER FEED PUMP & TD BOOSTER PUMP

 M^{3}/hr

MLC

DEG C

MLC

RPM

RPM

BOILER FEED PUMP

CASING

MDG 405

CLOCKWISE

1340

3206

3953

187.8

43.1

5710

6281

BHEL (IN COLLABORATION WITH MHI)

2/50%

TYPE

MULTI STAGE, AXIALLY SINGLE STAGE, SPLIT INNER CASING & 2 BEARING DESIGN BARREL TYPE OUTER & DOUBLE SUCTION

PUMP TYPE

MAKE/MANUFACTURER

NO. PER UNIT/RATING

DIRECTION OF ROTATION

DESIGN CAPACITY/PUMP

DESIGN HEAD

TEMPERATURE

NPSH REQUIRED

GRADE OF BALANCING

DESIGN & TEST CODE

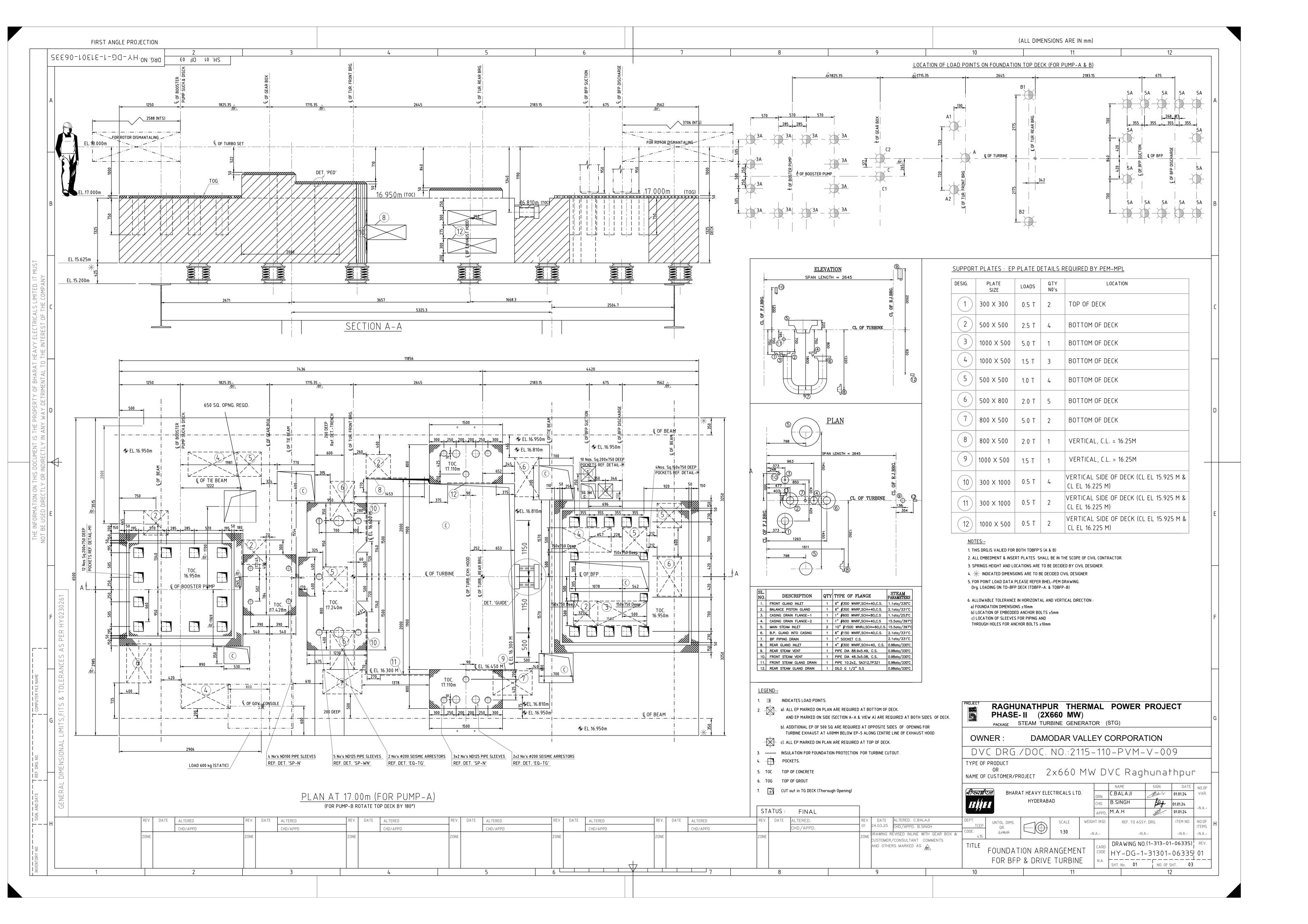
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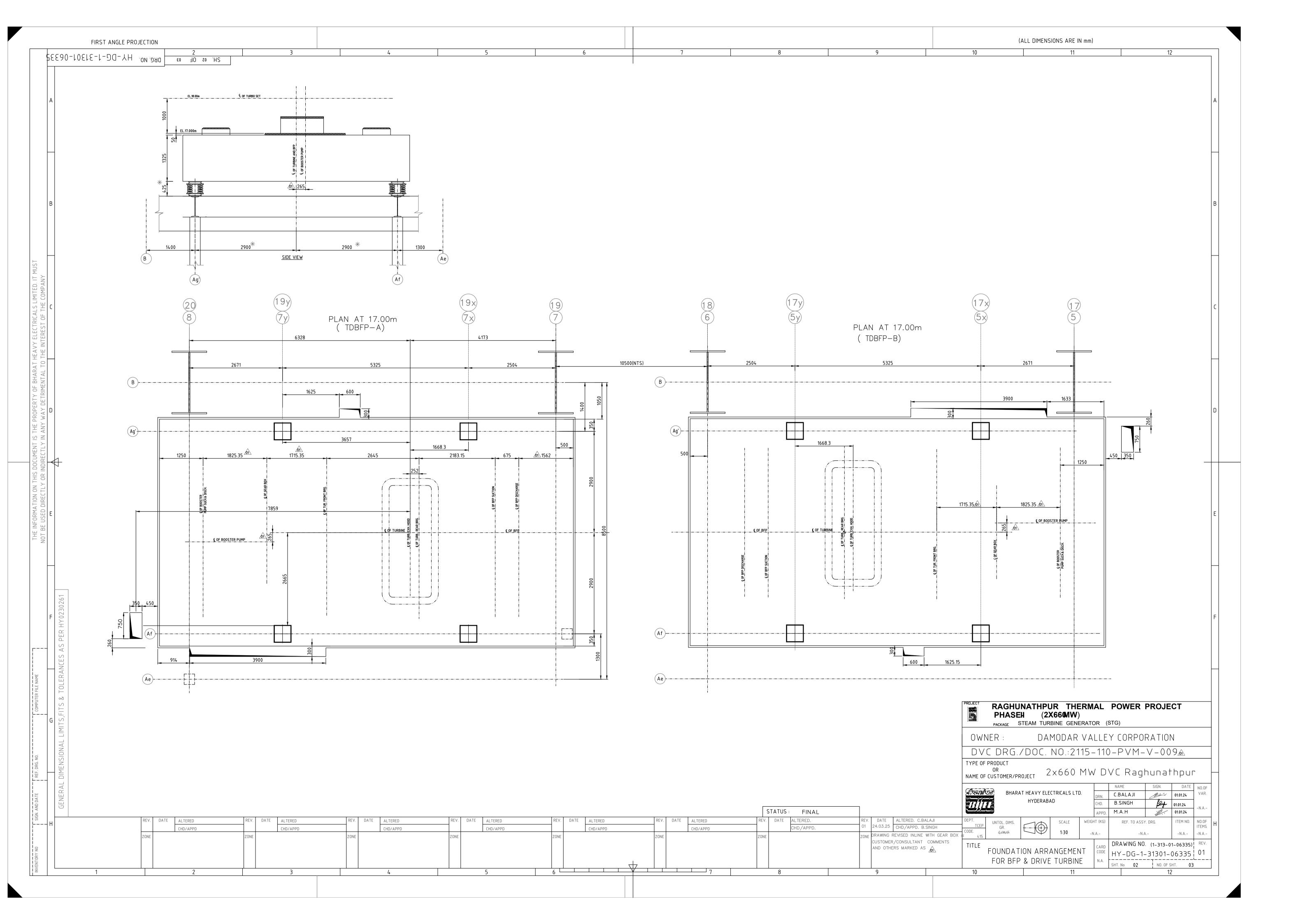
TRIP SPEED

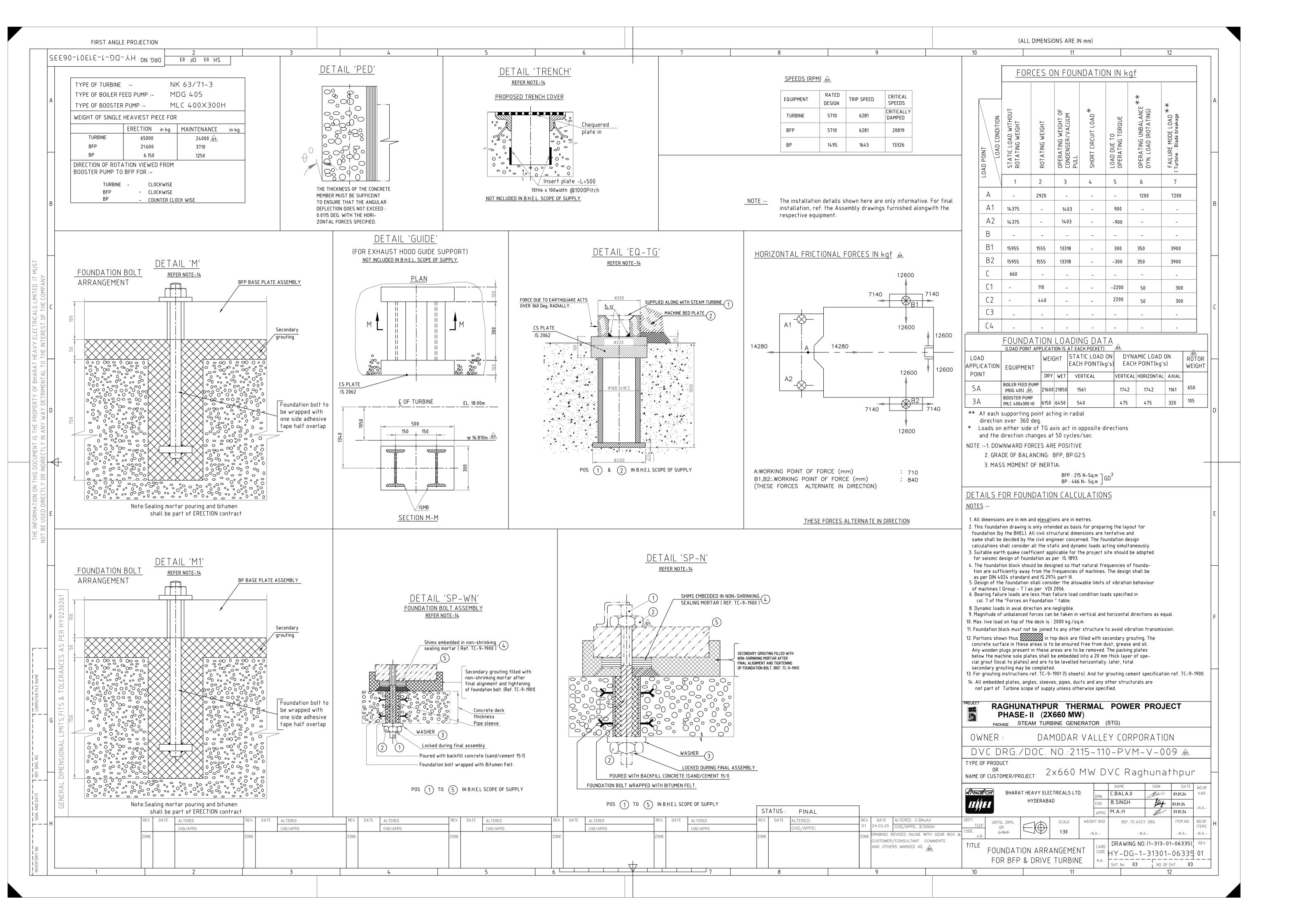
(VIEWED FROM PUMP DRIVE END)

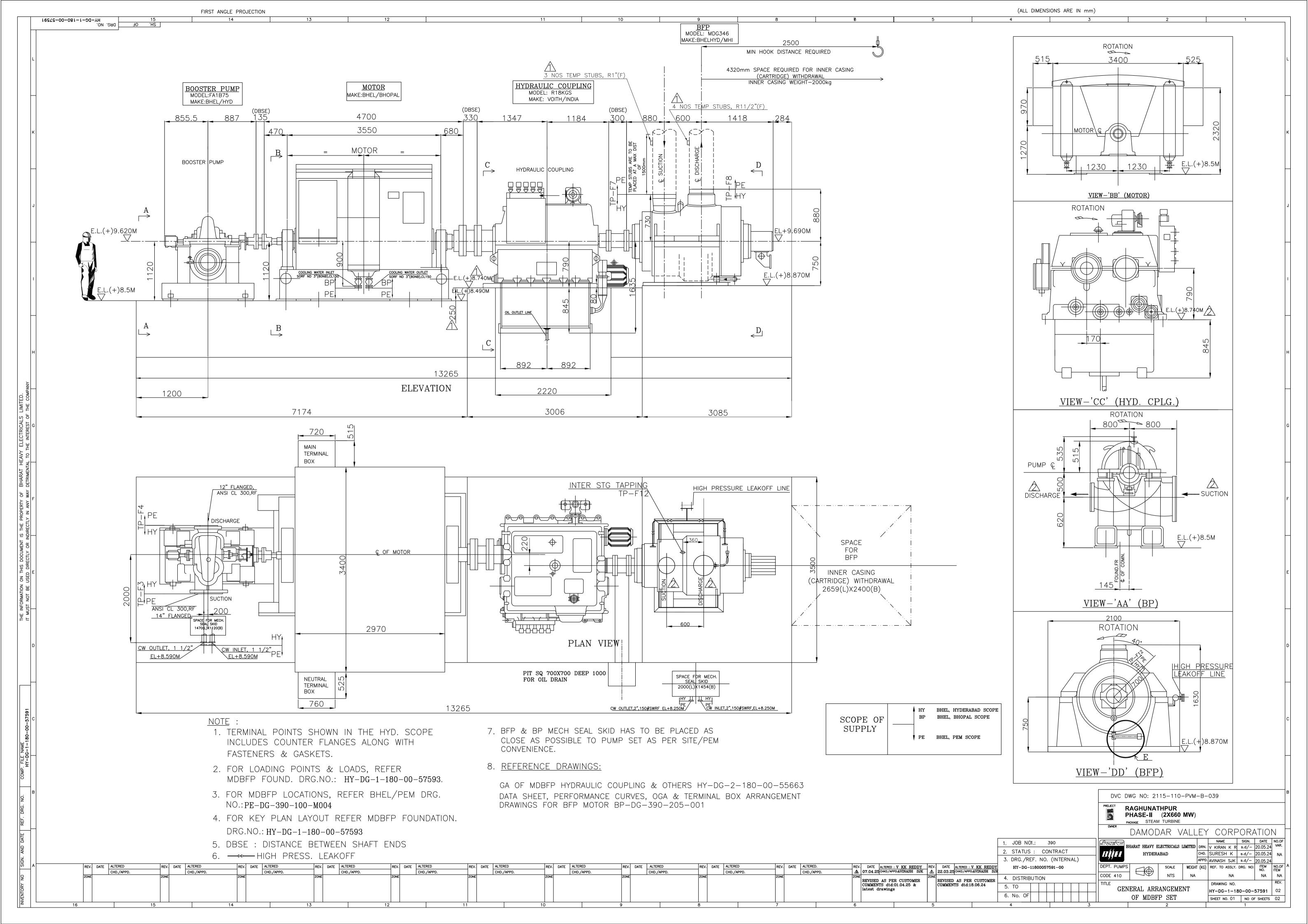
SHUT-OFF HEAD @ Design Point

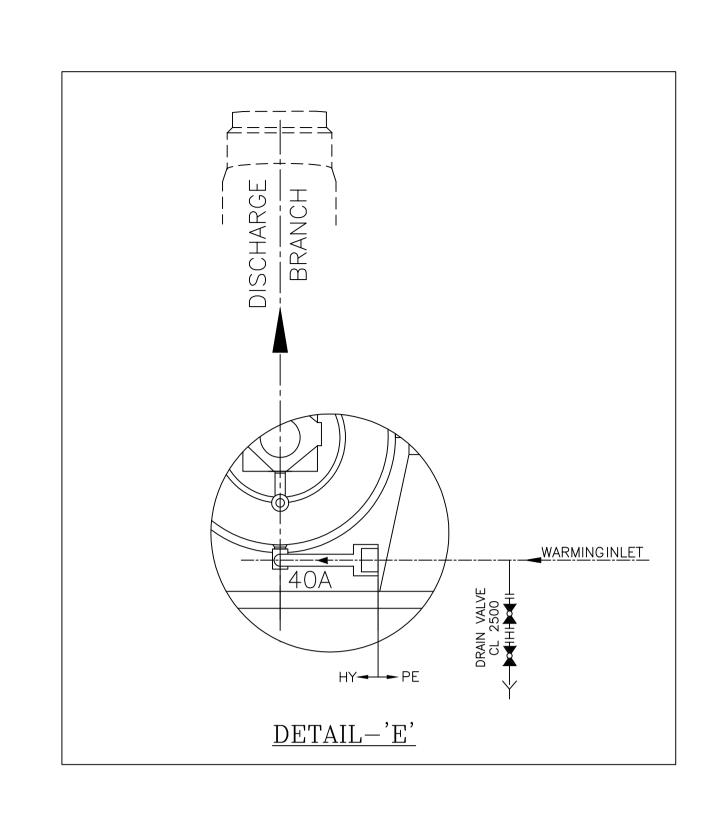
MODEL











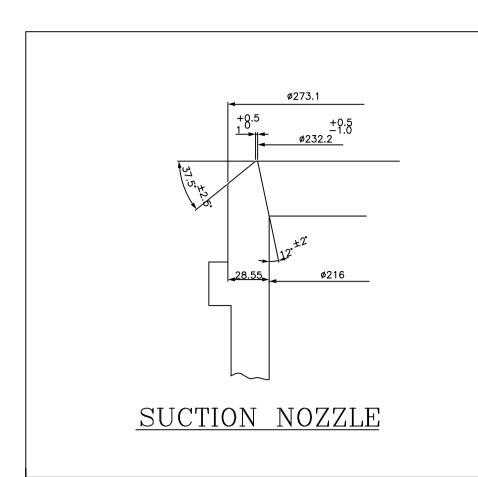
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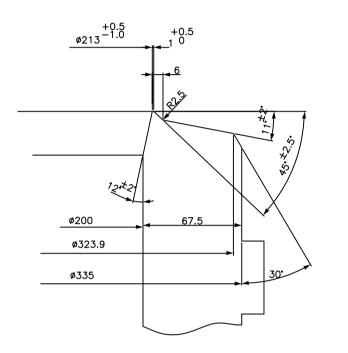
THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED.

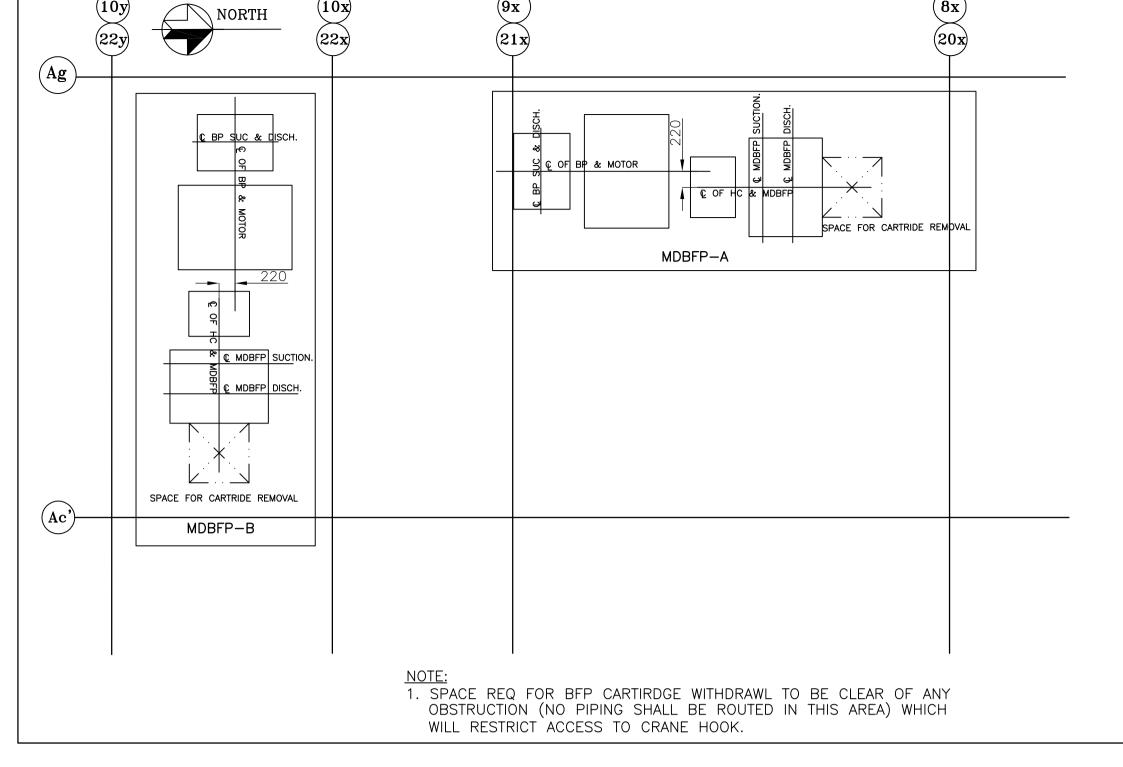
IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPA

TO DESCRIPTION OF THE INTEREST OF THE COMPA

TO DESCRIPTION OF THE COMPA



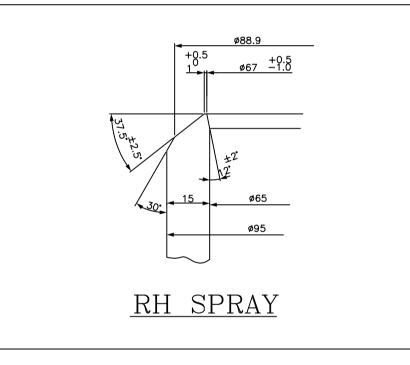




EQUIPMENT WEIGHTS

SNO	EQUIPMENT	WEIGHT (Kgs)
1	BOILER FEED PUMP incl. BASE PLATE	17000(DRY) 17300(WET)
2	HYDRAULIC COUPLING	10000 (WITHOUT OIL) 12500 (WITH OIL)
3	MOTOR	30700 SINGLE HEAVIEST EQUIPMENT
4	BOOSTER PUMP incl. BASE PLATE	4600

DISCHARGE NOZZLE



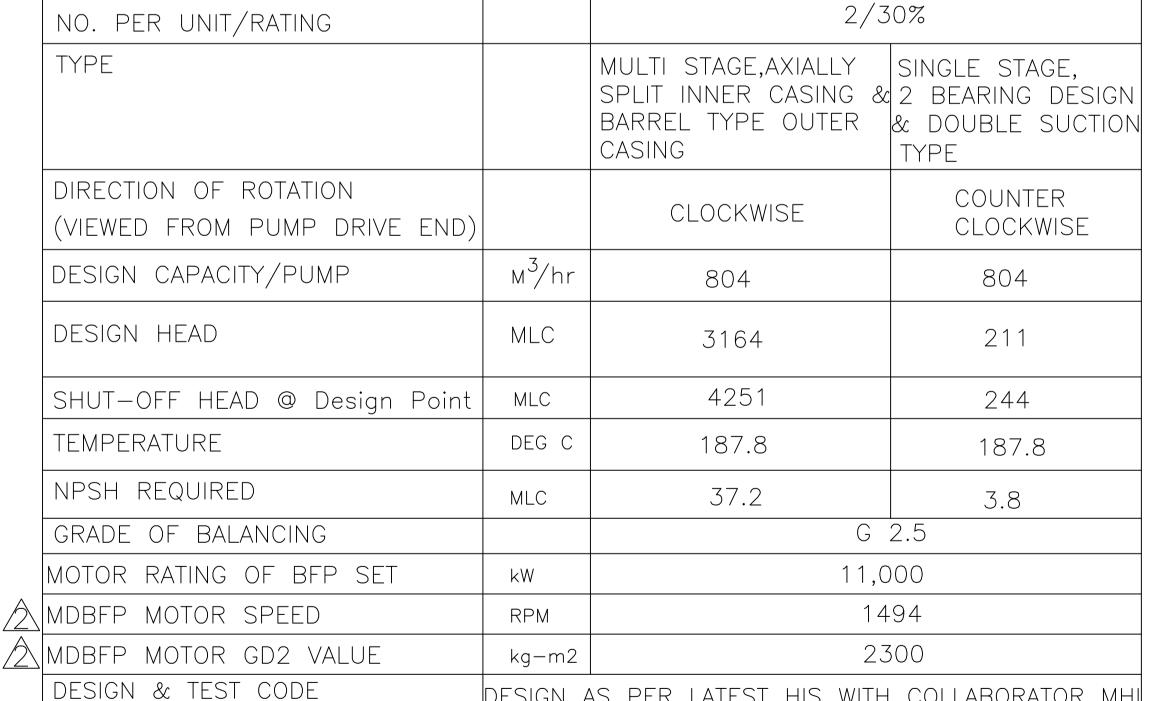
WELD EDGE PREPARATION

KEY PLAN LAYOUT OF MDBFP-A & MDBFP B AT 8.5m

TECHNICAL DATA OF MD BOILER FEED PUMP & MD BOOSTER PUMP						
PUMP TYPE	UNITS	BOILER FEED PUMP	BOOSTER PUMP			
MODEL		MDG 346	FA1B75			
MAKE/MANUFACTURER		BHEL (IN COLLABORATI	ON WITH MHI)			
NO. PER UNIT/RATING		2/3	0%			
TYPE			SINGLE STAGE, 2 BEARING DESIGN & DOUBLE SUCTION TYPE			
DIRECTION OF ROTATION (VIEWED FROM PUMP DRIVE END)		CLOCKWISE	COUNTER CLOCKWISE			
DESIGN CAPACITY/PUMP	м ³ /hr	804	804			
DESIGN HEAD	MLC	3164	211			
SHUT-OFF HEAD @ Design Point	MLC	4251	244			
TEMPERATURE	DEG C	187.8	187.8			
NPSH REQUIRED	MLC	37.2	3.8			
GRADE OF BALANCING		G	2.5			
MOTOR RATING OF BFP SET	kW	11,000				
MDBFP MOTOR SPEED	RPM	14	94			
MDBFP MOTOR GD2 VALUE	kg-m2	23	500			
DESIGN & TEST CODE		AS PER LATEST HIS WITH ES TESTING AS PER ANS				

TERMINAL POINTS

TERMINAL POINT	DESCRIPTION	TERMINATED WITH	QTY.
TP-F7	SUCTION OF FEED PUMP	NOZZLE, (10")250A B.W	1
TP-F8	DISCHARGE OF FEED PUMP	NOZZLE, (12")300A B.W	1
TP-F12	INTER STAGE TAPPING (2nd STG)	NOZZLE, 80A B.W,TO SUIT PIPE Ø88.9 X 11.13 MM	1
TP-F3	SUCTION OF BOOSTER PUMP	COUNTER FLANGE, 14" ANSI, B 16.5, WNRF, CL300	1
TP-F4	DISCHARGE OF BOOSTER PUMP	COUNTER FLANGE, 12" ANSI, B 16.5, WNRF, CL300	1



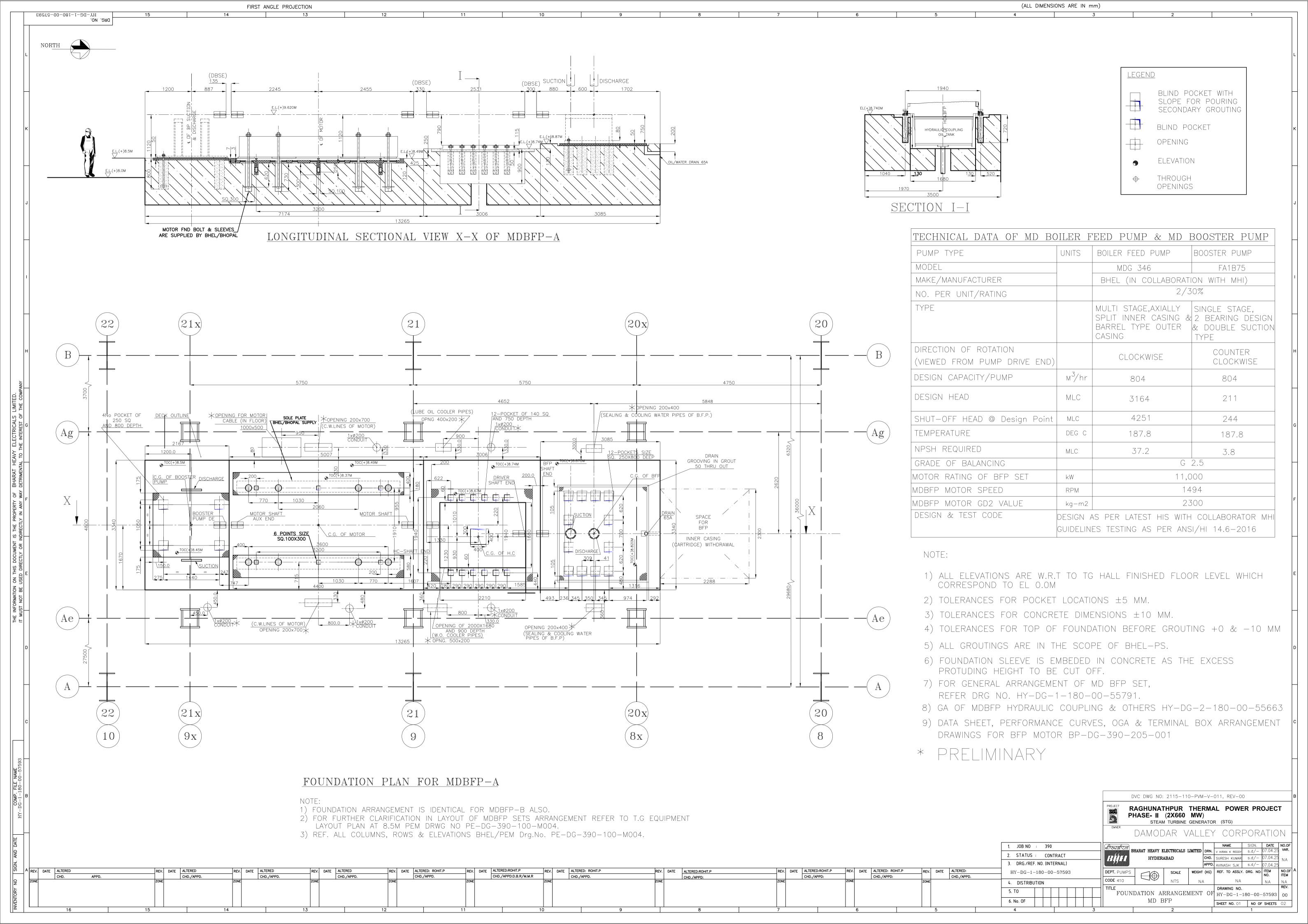
REVISED AS PER CUSTOMER COMMENTS dtd:01.04.25 & latest drawings

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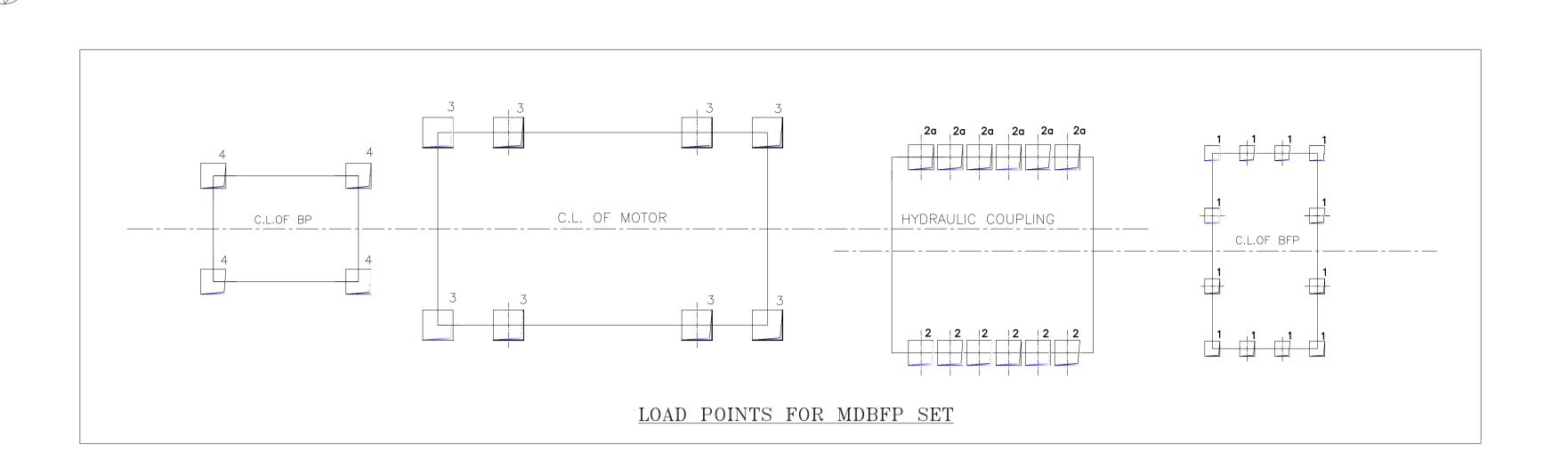
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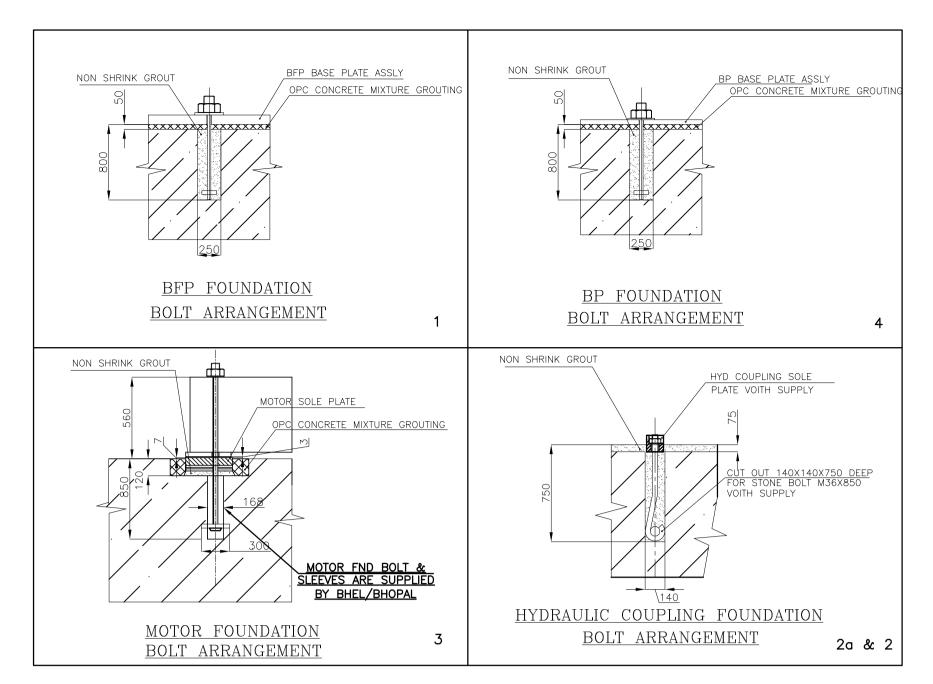
RAGHUNATHPUR PHASE-II (2X660 MW)

PACKAGE STEAM TURBINE



FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN mm)





	SPEEDS	S AT OPI	ERATING P	OINTS	S (RPM)		
EQUIPMENT	DESIGN POINT	95% UNIT LOAD UNDER MSP	RUN OUT POINT	BEP	EMERGENCY POINT	UNDER FREQ-1	UNDER FREQ-2
BFP	6215	6000	5355	5860	6345	6405	6380
BOOSTER PUMP	1494	1494	1494	1494	1494	1494	1494
MOTOR	1494	1494	1494	1494	1494	1494	1494
HYDRAULIC COUP. (INPUT SHAFT)	1494	1494	1494	1494	1494	1494	1494
HYDRAULIC COUP (OUTPUT SHAFT)	6215	6000	5355	5860	6345	6405	6380

	FOUNDATION LOADING								
LOAD APPLICATION POINT	STATIC * LOADING ON LOADING ON EQUIPMENT FACH POINT			EQPT. WEIGHT (Kgs)		ROTOR WEIGHT			
LOAD APPL POINT	EQUI MENT	EACH POINT (Kgs.)	VERTI CAL	HORIZO NTAL	AXIAL	DRY	WET	(Kgs)	
1	BOILER FEED PUMP	17300	20700	20700	13800	17000	17300	500	
4	BOOSTER PUMP	1200	394	394		4600	4800	280	
2	HYDRAULIC COUPLING	985	505	505		10000	12500	INPUT ROTOR =1965 PRIMARY ROTOR=505	
2a	R18KGS	900	460	460		12000	SECONDARYROTOR=460 OUTPUT ROTOR=314		
3	MOTOR WITH BASE PLATE	9500	REI	TER NOTE	-A	30700		8800	

* INCLUDES ROTOR WEIGHTS.

NOTE-A

MOTOR FOUNDATION DETAILS

HX-DG-1-180-00-25233

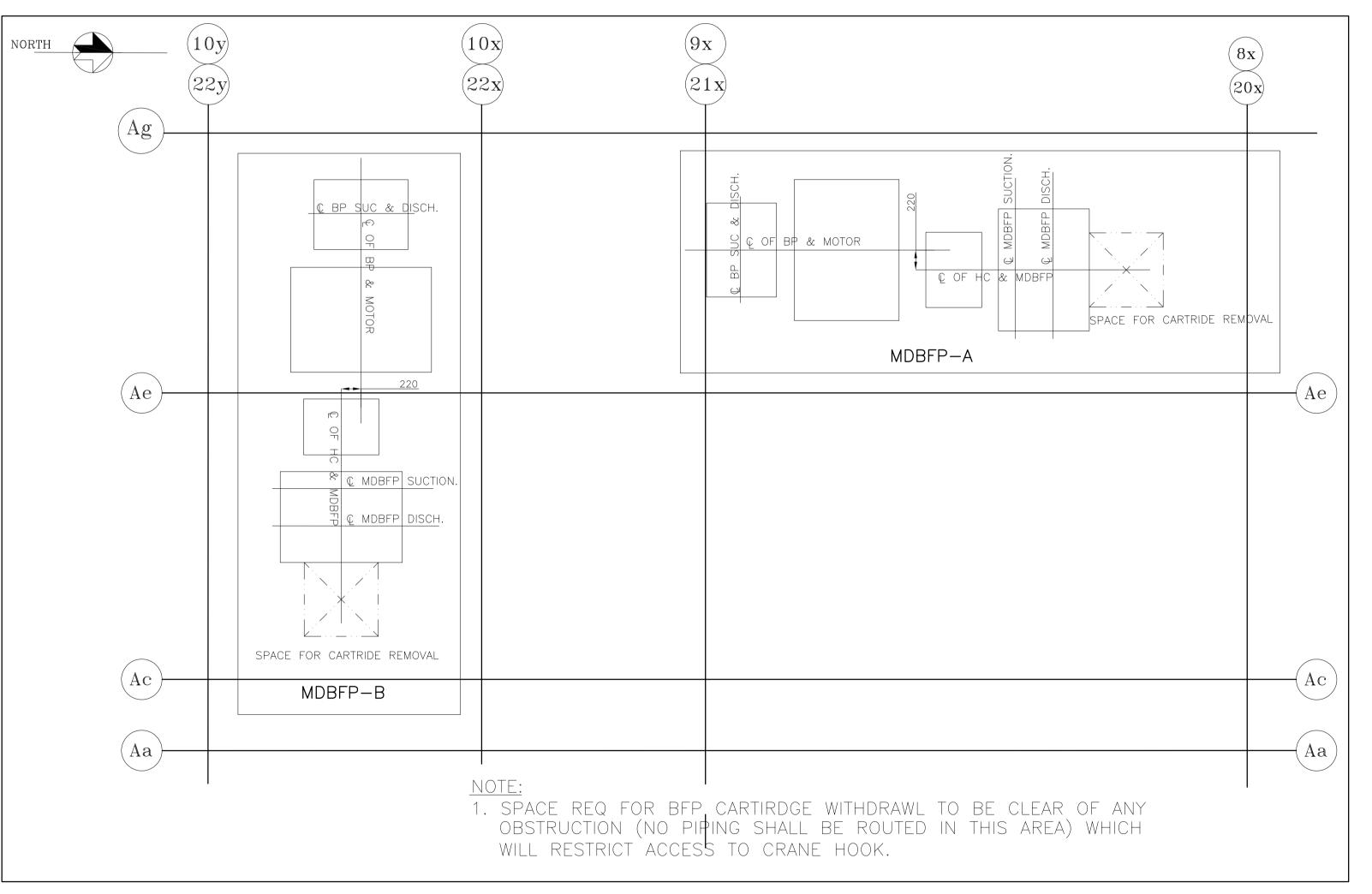
1. MAX. FORCE CALCULATED FROM THE MAX. SUDDEN TORQUE (100% RESIDUAL FIELD), $M_{\rm S} = 517 {\rm KN}$.

2. FORCE EXERTED BY THE WEIGHT ON EACH SIDE, G = 135 kN.

3. FOUNDATION LOAD ON EACH SIDE

| 3. FOUNDATION LOAD ON EACH SIDE | COMPRESSIVE STRESS, A = Ms+G = 652 kN; TENSILE STRESS, B = Ms-G = 382 kN.

MASS MOMENT OF INERTIA (GD2)	Kg.M²
BFP (Including Coupling)	15
BOOSTER PUMP	8.4
MOTOR	2300
HYDRAULIC COUP. INPUT SHAFT & PRIMARY PARTS	1440
HYDRAULIC COUP. OUTPUT SHAFT & SECONDARY PARTS REFERRED TO MOTOR SPEED.	40.8



KEY PLAN LAYOUT OF MDBFP-A & MDBFP B AT 8.5m

DVC DWG NO: 2115-110-PVM-V-011, REV-00

PHASE- II (2X660 MW)

RAGHUNATHPUR THERMAL POWER PROJECT

