

# **WEST BENGAL POWER DEVELOPMENT CO. LTD.**

**2X500 MW WBDCL, SAGARDIGHI TPP, EXTN PROJECT  
PH-II UNIT# 3&4**

**VOLUME-II B**

**TECHNICAL SPECIFICATIONS  
FOR  
VIBRATION ISOLATION SYSTEM  
FOR  
TDBFP/MDBFP FOUNDATION**

**SPECIFICATION NO. PE-TS-373-614-C001-R1**



**BHARAT HEAVY ELECTRICALS LIMITED  
Project Engineering Management  
PPEI BUILDING, HRD & ESI COMPLEX  
Plot No. 25, Sector 16A  
NOIDA, U.P. – 201301**

PROJECT TITLE: 2X 500 MW WBPDC, SAGARDIGHI TPP,EXTN PROJECT  
PH-II, UNIT #3 & 4

JOB NO: 373

DOCUMENT NO. PE-TS-373-614-C001-R1

BUILDING/SYSTEM: VIBRATION ISOLATION SYSTEM

SUBJECT: TECHNICAL SPECIFICATIONS FOR VIBRATION ISOLATION  
SYSTEM FOR TDBFP/ MDBFP FOUNDATION

REV. NO.	PARTICULARS	PREPD. BY	CHECKED BY	APPROVED BY	REMARKS
00.	NAME	PANKAJ	SKM	HM	
	SIGN	-sd-	-sd-	-sd-	
	DATE	27-07-11	27-07-11	27-07-11	
01.	NAME	BR	SKM	HM	
	SIGN	<i>BR</i>	<i>SKM</i>	<i>HM</i>	
	DATE	24-12-11	24-12-11	24-12-11	

## **CONTENTS**

1. SECTION-A SCOPE OF WORK
2. SECTION-B PROJECT INFORMATION
3. SECTION-C SPECIFIC TECHNICAL REQUIREMENTS
4. SECTION-D STANDARD TECHNICAL SPECIFICATON FOR VIS



PROJECT: 2X500 MW WBPDC, SAGARDIGHI TPP  
PH-II UNIT #3&4

**TECHNICAL SPECIFICATIONS FOR VIS  
FOR TD/MD BFP FOUNDATION**

SPECIFICATION NO. PE-TS-373-614-C001

VOLUME II B

SECTION A

REV.NO. 1 DATE 24-12-2011

Page 1 of 2

**SECTION 'A'**

**SCOPE OF WORK**



PROJECT: 2X500 MW WBDCL, SAGARDIGHI TPP  
PH-II UNIT #3&4

**TECHNICAL SPECIFICATIONS FOR VIS  
FOR TD/MD BFP FOUNDATION**

SPECIFICATION NO. PE-TS-373-614-C001

VOLUME II B

SECTION A

REV.NO. 1 DATE 24-12-2011

Page 2 of 2

**Scope of work shall include the following:**

**1. Supply of the following**

- a) Vibration Isolation System (VIS) as per Section-C
- b) Tools and facilities required for erection and commissioning including packing & transportation etc. complete.

**2. Supervision of erection and commissioning of the VIS.**

Vendor shall deploy experienced manpower for setting the VIS in position and final adjustments after machine installation. Vendor shall also confirm the readiness at site before deploying the manpower for supervision of erection.

**3. Engineering for the vibration isolation system including civil drgs.(GA & RC details) is in vendor's scope**



PROJECT : 2X500 MW WBPDC, SAGARDIGHI TPP  
PH-II UNIT #3&4

**TECHNICAL SPECIFICATIONS FOR VIS  
FOR TD/MDBFP FOUNDATION**

SPECIFICATION NO. PE-TS-373-614-C001

VOLUME II B

SECTION B

REV.NO. 1 DATE 24-12-2011

Page 1 of 2

**SECTION 'B'**

**PROJECT INFORMATION**



PROJECT : 2X500 MW WBPDC, SAGARDIGHI TPP  
PH-II UNIT #3&4

**TECHNICAL SPECIFICATIONS FOR VIS  
FOR TD/MDBFP FOUNDATION**

SPECIFICATION NO. PE-TS-373-614-C001

VOLUME II B

SECTION B

REV.NO. 1 DATE 24-12-2011

Page 2 of 2

**PROJECT INFORMATION (To be furnished by indenter)**

1. Project : 2x500 MW WBPDC, SAGARDIGHI TPP PH-II UNIT#3&4
2. Owner /Purchaser : West Bengal Power Development Co. Ltd.
3. Consultant : DCPL
4. Location : The site is located near Manigram village, approx.. 13 km  
north of Sagardighi town in the state of West Bengal.
5. Nearest Railway Station : Manigram
6. Nearest Airport : Kolkata
7. Seismic Data : As per IS:1893 Zone-III



PROJECT : 2X500 MW WBPDCL, SAGARDIGHI  
TPP PH-II UNIT #3&4

**TECHNICAL SPECIFICATIONS FOR VIS  
FOR TD/MD BFP FOUNDATION**

SPECIFICATION NO: . PE-TS-373-614-C001

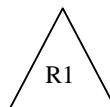
VOLUME II B

SECTION C

REV.NO. 1 DATE 24-12-2011

Page 1 of 5

**SECTION 'C'**



**SPECIFIC TECHNICAL REQUIREMENTS**





PROJECT: 2X500 MW WBPDC, SAGARDIGHI TPP,  
PH-II UNIT # 3&4

**TECHNICAL SPECIFICATIONS FOR VIS  
FOR TD/MD BFP FOUNDATION**

SPECIFICATION NO. PE-TS-373-614-C001

VOLUME II B

SECTION C

REV.NO. 1 DATE 24-12-2011

Page 2 of 5

## 1. General Requirement

- 1.01. Vendor shall supply steel helical springs and viscous dampers as vibration isolation system (VIS) for TD BFP(4 nos.) and MD BFP (2 nos.) foundations. Input drawings are attached as per details below

List of drawings:

<u>SRL</u>	<u>TITLE</u>	<u>DRAWING NO.</u>
1	G.A. OF TD BFP SET	HY-DG-1-18000-57466 (R0)
2	FOUNDATION ARRANGEMENT FOR BFP AND DRIVE TURBINE	HY-TC-MPA1022-0111 (R0) (SHEETS 1,2,3)
3	OUTLINE ARRANGEMENT OF TURBINE DRIVEN BFP	HY-DG-1-18000-57469 (R0)
4	G.A. OF MD BFP SET	HY-DG-1-18000-57467 (R0)
5	FOUNDATION ARRANGEMENT OF MOTOR DRIVEN BFP UNIT	HY-DG-1-18000-57465 (R0)
6	OUTLINE ARRANGEMENT OF MOTOR DRIVEN BFP	HY-DG-1-18000-57468 (R0)

- 1.02. The steel helical springs and viscous dampers supplied by vendor should be of proven make.

## 2. Seismic Loading:

The lateral forces will be established in accordance with the recommendations of IS-1893. The site falls in Zone-III as identified in the map of IS 1893:2002. Importance factor (I) shall be taken as 1.75 (Table 2 of IS 1893 (PART IV): 2005).

## 3. Wind Loading :

Wind loading will be in accordance with Indian Standard Code IS:875 (Part 3) for a basic wind speed of 47 m/sec. Terrain Category-2 shall be considered for all structures.

Risk coefficient (k1) shall be considered as 1.07 for all structures.

## 4. Material of construction

- Grade of Concrete M30.
- TMT steel bars of grade Fe 500 conforming to IS 1786



PROJECT: 2X500 MW WBPDC, SAGARDIGHI TPP,  
PH-II UNIT # 3&4

**TECHNICAL SPECIFICATIONS FOR VIS  
FOR TD/MD BFP FOUNDATION**

SPECIFICATION NO. PE-TS-373-614-C001

VOLUME II B

SECTION C

REV.NO. 1 DATE 24-12-2011

Page 3 of 5

**5. Documents to be submitted by vendor**

- i. Soft copies of all documents/drawings shall be furnished in pdf and AutoCAD format as applicable.
- ii. Hard copies shall also be submitted.
- iii. Submission of civil drawings/documents shall be as mentioned in the table below

	Drawing	Document
First submission	Soft copy + 5 nos hard copies	Soft copy + 3 nos hard copies
Intermediate submission	Soft copy + 1 nos hard copy	Soft copy + 1 nos hard copy
Final submission (Incorporating comments of CAT-2 &3)	Soft copy + 8 nos hard copies	Soft copy + 3 nos hard copies
Further revision on RFC	Soft copy + 8 nos hard copies	

**6. Material (Design & Supply)**

6.01. Steel helical springs and viscous dampers shall consist of:

- a. Steel helical spring units and viscous dampers along with viscous liquid including associated auxiliaries for installation of the spring units and dampers like steel shims, adhesive pads, etc.
- b. Frames for pre-stressing of spring elements.
- c. Suitable hydraulic jack system including hand operated pumps, high pressure tubes etc. required for the erection, alignment etc. of the spring units.
- d. Any other items may be required for the pre-stressing, erection, release of pre-stress, alignment and commissioning of the steel helical springs.

6.02. 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 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 design of the RCC deck is in the scope of the vendor.

6.03. The spring units should have definite stiffness in both vertical and horizontal directions with the horizontal stiffness not less than 30% of vertical stiffness. The



PROJECT: 2X500 MW WBPDC, SAGARDIGHI TPP,  
PH-II UNIT # 3&4

**TECHNICAL SPECIFICATIONS FOR VIS  
FOR TD/MD BFP FOUNDATION**

SPECIFICATION NO. PE-TS-373-614-C001

VOLUME II B

SECTION C

REV.NO. 1 DATE 24-12-2011

Page 4 of 5

stiffness should be such that the vertical natural frequency of any spring unit at its rated load carrying capacity is not more than 3 to 5 Hz.

- 6.04. The damper units or spring cum damper units should be of viscous type offering velocity proportional damping. The damper units should be suitable for temperatures ranging from 0 to 50° c. The damping resistance of the individual damper units should be such that the designed damping can be provided using reasonable number of units. Damper units shall have damping resistance ranging from 40kNsec/m to 750kNsec/m.
- 6.05. The sizes 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.
- 6.06. The steel helical springs and viscous dampers shall be designed for ensuring “fit and forget” guarantee.

**7. Manufacturing & Testing**

- 7.01. Complete manufacturing and testing of the steel helical springs and viscous dampers shall be done at the manufacturing shop of the vendor. For this purpose the vendor shall submit the detailed programme for approval of customer and take up the manufacturing / testing after approval of such programme. The programme shall include:
- a) Manufacturing schedule and quality check exercised during manufacturing.
  - b) Detail of test to be carried out at the manufacturing shop with its schedule.
  - c) Special requirements, if any, regarding concreting of top deck.
  - d) Complete step- by- step procedure covering the installation and commissioning of the spring system.
  - e) Manuals for erection, commissioning, testing and maintenance of the steel helical springs and viscous dampers.
  - f) A checklist for confirming the readiness of the civil fronts for erection of steel helical springs and viscous dampers.
  - g) Checklist for equipment required at each stage of erection.
  - h) Bill of materials (data sheet) of various elements such as spring units, viscous dampers, with their rating, stiffness etc. included in the supply.
  - i) 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.
  - j) Any other details which may be necessary to facilitate design and construction of the foundations / structures.
- 7.02. The springs shall conform to codes DIN 2089 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.



PROJECT: 2X500 MW WBPDC, SAGARDIGHI TPP,  
PH-II UNIT # 3&4

**TECHNICAL SPECIFICATIONS FOR VIS  
FOR TD/MD BFP FOUNDATION**

SPECIFICATION NO. PE-TS-373-614-C001

VOLUME II B

SECTION C

REV.NO. 1 DATE 24-12-2011

Page 5 of 5

## 8. Transportation

- 8.01. Steel helical springs and viscous dampers shall be suitably protected, coated, covered, boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection.
- 8.02. The vendor shall be responsible for any loss or damage during transportation, handling.

## 9. Erection and Commissioning

- 9.01. 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 trained for this purpose.
- 9.02. 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.
- 9.03. The vendor 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".

## 10. Supervision

The supervision of installation of steel helical springs and viscous dampers including pre-stressing, placing, releasing and alignment of spring units shall be done by a specialist supervisor of vendor / supplier, trained for this purpose.

## 11. Realignment of Spring System

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 commercial operation of the machine, the same shall be done by the vendor as and when asked for no extra cost of the Owner.



TITLE:

**STANDARD TECHNICAL  
SPECIFICATION FOR VIBRATION  
ISOLATION SYSTEM**

SPECIFICATION NO. PE-TS-999-600-C026

VOLUME - II B

SECTION - D

REV. NO. 0 DATE 05/07/2010

SHEET 1 OF 5

**VOLUME: II B**

**SECTION - D**

**SUB-SECTION - D26**

**VIBRATION ISOLATION SYSTEM**

**SPECIFICATION NO. PE-TS-999-600-C026**



**Bharat Heavy Electricals Limited**  
Project Engineering Management



TITLE:

**STANDARD TECHNICAL  
SPECIFICATION FOR VIBRATION  
ISOLATION SYSYTEM**

SPECIFICATION NO. PE-TS-999-600-C026

VOLUME - II B


SECTION - D

REV.NO. 0 DATE 05/07/2010

SHEET ; 2 OF 5

**C O N T E N T**

CLAUSE NO.	DESCRIPTION	SHEET NO.
1.00.00	SCOPE	3
2.00.00	Supply of VIS	3
3.00.00	Supervision of Erection and Commissioning	3
4.00.00	Design Engineering of Vibration Isolation System	3
5.00.00	Quality Plan and Test Certificate	5
6.00.00	Environmental Protection	5

	TITLE:		SPECIFICATION NO. PE-TS-999-600-C026	
	<b>STANDARD TECHNICAL SPECIFICATION FOR VIBRATION ISOLATION SYSYTEM</b>		VOLUME - II B	
			SECTION - D	
			REV.NO.	0
			DATE	05/07/2010
			SHEET :	3
			OF	5

## VIBRATION ISOLATION SYSTEM

### **1.00.00 SCOPE**

This section covers supply, supervision of erection/ commissioning & design engineering of the vibration isolation system (VIS) suitable for ID/PA/FD Fans/ TDBFP/MDBFP/TURBOGENERATORS/MILLS .The vibration isolation system shall be of proven make and should be in successful operation for similar machines.

### **2.00.00 Supply of VIS**

VIS shall be supplied complete along with recommended spares if any. The selection of VIS shall be done by the vendor, in case not done by customer , so that the amplitude at bearing locations are within permissible limits as per machine supplier recommendation or ISO10816 whichever is governing and no dynamic loads are transferred to the structure supporting VIS. Minimum 90 % isolation shall be achieved and the system shall be capable of withstanding Seismic/Wind forces.

### **3.00.00 Supervision of Erection and Commissioning**

#### **3.01.00 Manual**

Vendor shall supply installation and maintenance manual indicating equipment, procedures etc. necessary for installation and replacement of VIS with downtime involved.

#### **3.02.00 Tools and facilities**

Vendor shall supply all tools and facilities as required for successful erection and commissioning of VIS. Vendor shall deploy experienced manpower to supervise successful installation of VIS

### **4.00.00 Design Engineering of Vibration Isolation System**

#### **4.01.00 Dynamic Analysis**

The dynamic analysis shall consist of free vibration analysis and forced vibration analysis. Isolation efficiency of at least 90 % shall be obtained. The fundamental natural frequency shall be sufficiently above or below the



TITLE:

**STANDARD TECHNICAL  
SPECIFICATION FOR VIBRATION  
ISOLATION SYSYTEM**

SPECIFICATION NO. PE-TS-999-600-C026

VOLUME - II B

SECTION - D

REV.NO. 0 DATE 05/07/2010

SHEET 4 OF 5

frequency corresponding to operating speed. Vibration amplitude shall be calculated at all bearing locations and shall satisfy the permissible limits as per ISO 10816 or as specified by the machine supplier. Transient analysis shall be carried out for the short circuit /blade failure condition with an appropriate force function if required by the machine supplier. The forces for which substructure is to be designed shall be furnished.

**4.02.00 Static Analysis**

The static analysis shall include the

- a) Dead weights of machine stationary parts,
- b) Dead weights of machine rotary parts
- c) Loads due to machine power torque
- d) Loads due to maximum allowable unbalance
- e) Temperature loads
- f) Loads due to blade unbalance/short circuit
- g) Erections loads
- h) Seismic Loads
- i) Any other loads given by the 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.

**4.03.00 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 for the members supporting machine shaft to satisfy the limits as given by machine supplier if any.

**4.04.00 Design of RCC deck supported on VIS**

Vendor shall provide General arrangement drawing of deck showing location and supporting detail of VIS, 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 as well IS : 456.

All documents/drawings shall be supplied in 25 (twenty five) prints. All calculations shall be supplied in 6 (six) sets. Soft copy of the drawings in Auto Cad shall be supplied along with the soft copy of the documents supplied





TITLE:

**STANDARD TECHNICAL  
SPECIFICATION FOR VIBRATION  
ISOLATION SYSYTEM**

SPECIFICATION NO. PE-TS-999-600-C026

VOLUME - II B

SECTION - D

REV.NO. 0 DATE 05/07/2010

SHEET 5 OF 5

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

**5.00.00 Quality Plan and Test Certificate**

Vendor shall furnish the quality plan and Test certificate for the hardware in their scope of supply. The quality plan shall be reviewed by BHEL /Consultant wherein the inspection and hold points shall be indicated. Vendor shall submit test certificate based on approved Quality Plan. Despatch of material by the vendor shall only take place after the receipt of Material Dispatch Clearance Certificate (MDCC) issued by BHEL/Consultant on the basis of test reports/test certificates submitted by the Vendor after manufacture.

**6.00.00 Environmental Protection**

VIS shall be suitably protected against environmental damages e.g. abrasion, discolouration, corrosion, oily water etc. to give a prolonged service matching the plant life.