

NUCLEAR POWER CORPORATION OF INDIA LIMITED		
KAIGA UNIT-5, 6		
KAIGA-5&6/40000/ PROCUREMENT SPECIFICATION-MS-1	VOLUME-II- Section-C PART-1 C-1: GENERAL TECHNICAL REQUIREMENTS	SECTION – C-1-1
June-2018 Revision-R0	PROJECT INFORMATION	SHEET 1 OF 3

1.0 PROJECT INFORMATION

- 1.1 OWNER / PURCHASER : NUCLEAR POWER CORPORATION OF INDIA LTD. (NPCIL)
- 1.2 ENGINEER : EXECUTIVE DIRECTOR (PROCUREMENT)
- 1.3 Project Title : 2x700 MWe PHWR – KAIGA-5&6 ATOMIC POWER PROJECT
- 1.5 Location : KAIGA, UTTARA KANNADA DISDRICT, KARNATAKA
- 1.6 Elevation (RL) : RL +32m to +46m
- 1.7 Nearest Railway Stations : KARWAR (Konkan Railway)
- 1.8 Name of Railway Stations : KARWAR (Konkan Railway)
- 1.9 Ambient Air Temperatures :
- a) Maximum dry bulb temperature : +41.6 deg C,
 - b) Minimum dry bulb temperature : 10.9 deg C,
 - c) Design temperature for electrical equipment / devices : +50 deg C
- 1.10 Relative Humidity
- a) Maximum during monsoon : 99.9%
 - b) Minimum (design) : 3%
- 1.11 Air Quality : Air quality is clean and free from chemical pollutants.
- 1.12 Rainfall :
- a) Annual Average : 3649.31 mm
 - b) Highest annual rainfall : 4695.1 mm in 1988
 - c) Lowest annual rainfall : 2345.3 mm in 2016
 - d) Period : Year 1987-2017

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following supply variations *

- d) Panel Lighting fixtures, : 240 V, 1 phase, 2 wire, 50 Hz,
Space heaters AC supply with neutral lead
earthed, with
following supply variations*
- e) DC motors control and : 220 V, 2 wire, unearthed DC
protective devices supply from Station Battery /
Battery Charger, with a supply
variation of (-) 20% to (+) 10%
of rated voltage.
- f) Instrumentation controls : i) (+) 24V DC centre tap
& annunciation grounded supply for
general control purpose.
ii) 240V AC, 1 phase, 2
wire, 50 Hz, un-
interruptible power
supply source (UPS).

NOTES:

1.0

*Supply Variations

- i) Variation of supply voltage : (±) 10%
- ii) Variation in supply frequency : (±) 5%
- iii) Combined voltage and frequency : (±) 10%
variation



NUCLEAR POWER CORPORATION OF INDIA LIMITED

(A Govt. of India Enterprise)

PROJECT : KAIGA ATOMIC POWER PROJECT UNIT 5&6

DN NO. : KAIGA-5&6/PC/E/08019

BHEL REF NO : BHEL/ PE-TS-488-179-W001_R0

REVISION NO.	:	R0			
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TOTAL NO. OF PAGES (Including Cover Sheet)	:	4+34			

TECHNICAL SPECIFICATION

FOR

PLATE TYPE HEAT EXCHANGERS IN ACW SYSTEM

BHARAT HEAVY ELECTRICALS LTD.				NPCIL'S ACCEPTANCE			
	NAME	SIGN	DATE		NAME	SIGN	DATE
PREPARED BY	PA		30/06/26	CHECKED BY	Vishal Gite Sr.EE (P-TI)		29-07-2026
CHECKED BY	RN		30/06/26	REVIEWED BY	Arunava Sinha		29-07-2026
REVIEWED BY	RN		30/06/26	APPROVED BY	H.W. Pandey		20-08-2026
APPROVED BY	JP		30/06/26				

(For Revisions See Revision Control Sheet)

FILE NAME: KAIGA-5&6_PC_E_08019_R0 1

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REVISION CONTROL SHEET

DOCUMENT TYPE: PC

NO.: KAIGA-5&6/PC/E/08019

**TITLE: TECHNICAL SPECIFICATION FOR
PLATE TYPE HEAT EXCHANGERS IN ACW SYSTEM**

REV. NO. DATE	DESCRIPTION OF REVISION	BHEL			NPCIL		
		REVISED BY	REVWD BY	APPD BY	CHECKD BY	REVWD BY	APPD BY

PC/E/08019

JUN, 2026

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BHEL - REVISION RECORD SHEET**BHEL/ PE-TS-488-179-W001**

REV. NO. DATE	DESCRIPTION OF REVISION	BHEL			REMARK
		REVISED BY	REVWD BY	APPD BY	
01 / 15/07/2 6	As per NPCIL comment vide mail dated 15/07/26	PRASHAN T AGARWAL	RAHUL NIMES H	JITENDR A PAL	

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एन पी सी आई एल सम्पत्तिक

इस दस्तावेज में गोपनीय एवं सुरक्षित सूचना शामिल है और यह न्यूक्लियर पावर कारपोरेशन ऑफ़ इंडिया लिमिटेड की या निकाय द्वारा एनपीसीआईएल से लिखतकी बौद्धिक सम्पदा है। किसी भी व्य (एनपीसीआईएल) में पूर्व अनुमति किसी भी सम्पादकीय सामग्री को :तवेज के किसी भी अंश को मुख्यके बिना दस्ता, इसमें शामिल मौखिक एवं सांकेतिक चिन्हों व चित्रों को किसी भी रूप में या अब तक या आगामी आविष्कार होने वाली किसी भी इलेक्ट्रॉनिक डिजिटल या मैकेनिकल माध्यमों, जिसमें फोटोकॉपी, स्कैनिंग, रिकॉर्डिंग शामिल है, के द्वारा या किसी सूचना भण्डारण या रिट्रीवल प्रणाली के द्वारा पूनकिया जाएगा। अनधिकृत त या प्रसारित या उपयोग या प्रकाशित या भंडारित नहीं परस्तु : प्रयोग, प्रकटन या कॉपी करने के की सख्त मनाई है और ऐसा करना एक गैरकानूनी काम होगा, जिसके लिए कर्ता पर कानूनी कार्यवाही की जा सकती है। बीएचईएल को बौद्धिक संपदा के किसी भी दावे के बिना केवल भारत में लगाने वाली परमाणु विद्युत परियोजनाओं के लिए भविष्य में उपयोग हेतु इस दस्तावेज की प्रति रखने की अनुमति है।

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1. PROJECT INFORMATION

1.1	OWNER / PURCHASER	NUCLEAR POWER CORPORATION OF INDIA LTD
1.2	ENGINEER	EXECUTIVE DIRECTOR (PROCUREMENT)
1.3	Project Title	2x700 MWe PHWR – KAIGA-5&6 ATOMIC POWER PROJECT
1.4	Location	KAIGA, UTTARA KANNADA DISDRICT, KARNATAKA
1.5	Elevation (RL)	RL +32m to +46m
1.6	Nearest Railway Stations	KARWAR (Konkan Railway)
1.7	Ambient Air Temperatures	
a)	Maximum dry bulb temperature	+41.6 deg C,
b)	Minimum dry bulb temperature	10.9 deg C,
c)	Design temperature for electrical equipment /devices	+50 deg C
1.8	Relative Humidity	
a)	Maximum during monsoon	99.9%
b)	Minimum (design)	3%
1.9	Air Quality	Air quality is clean and free from chemical pollutants.
1.10	Rainfall	
	Annual Average	3649.31 mm
	Highest annual rainfall	4695.1 mm in 1988
	Lowest annual rainfall	2345.3 mm in 2016
	Period	Year 1987-2017
1.11	a) Wind Pressure:	
	Height above mean ground level, m	Design Wind Speed m/sec
	@ 10 M	5.0
	@ 100 M	13.8
	The assessment of wind loads based on the above basic wind speed shall be done as specified in IS: 875	
	b) Wind direction	Predominantly W, SW, NE & E with respect to true North
1.12	Transport	Rail & Road
1.13	Rail / Road access	About 53 km from Karwar (Konkan Railway) Station and NH 10 passes through Karwar
1.14	SEISMOLOGY	Zone III as per IS1893-2002 part I
1.15	Auxiliary Power	Auxiliary electrical equipment to be supplied against this specification shall be suitable for operation on the following supply systems
a)	For AC motors 200 kW	6600 Volts, 3 phase, 50 Hz, non-effectively

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	and above	earthed with following supply variations*
b)	For AC motors below 200 kW	415 V, 3 phase, 3 wire, 50Hz effectively earthed with following supply variations*
c)	Construction supply	415 V, 3 phase, 4 wire, 50 Hz, AC supply effectively earthed, one feeder supplied to the VENDOR at one point, as determined by the PURCHASER near the Sub-station, with following supply variations *
d)	Panel Lighting fixtures, Space heaters	240 V, 1 phase, 2 wire, 50 Hz, AC supply with neutral lead earthed, with following supply variations*
e)	DC motors control and protective devices	220 V, 2 wire, unearthed DC supply from Station Battery /Battery Charger, with a supply variation of (-) 20% to (+) 10% of rated voltage.
f)	Instrumentation controls & annunciation	i) (+) 24V DC centre tap grounded supply for general control purpose. ii) 240V AC, 1 phase, 2 wire, 50 Hz, uninterruptible power supply source (UPS).
	NOTES:	
1.0	*Supply Variations	
i)	Variation of supply voltage	(±) 10%
ii)	Variation in supply frequency	(±) 5%
iii)	Combined voltage and frequency variation	(±) 10%

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2. SCOPE OF SUPPLY:

This specification is intended to cover the requirements of design, manufacture, assembly, shop inspection and testing and delivery to site of properly packed Plate Type Heat Exchangers (PHE) for ACW System, complete with all auxiliaries and accessories as specified herein, for Nuclear Atomic Power Project. Required number of heat exchangers complete in all respects including plates with gaskets, main frames, pressure plate, carrying bar etc. as specified in data sheet.

- 2.1 Scope of supply along with PHE (Quantity as per datasheet) shall comprise of the following auxiliaries and accessories:
- Supporting arrangement complete with foundation plate channels, anchor bolts, nuts, sleeves, inserts etc.
 - Matching piece (Reducer/Expander) as required to match with connecting pipe
 - Lifting arrangement i.e., lifting lugs, eye bolts etc.
 - Earthing Cleat
 - Name Plate
 - Painting protection for all external and internal carbon steel surfaces as per specification requirement
 - One Set of Erection & Maintenance Tools (Common for two units)
 - Mandatory Spares as specified
- 2.2 **Scope of Service at Site:** Performance Guarantee Test to be demonstrated at site for all PHEs as per S.No. 10 mentioned in this specification.

3. APPLICABLE CODES & STANDARDS:

The design, material, construction, manufacture, inspection, testing, and performance of the plate type heat exchangers shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. The equipment shall also conform to the latest as on bid due date, following applicable standards in addition to any other standard specified in data sheet. Nothing in this specification shall be constructed to relieve the BIDDER of this responsibility.

3.1 American Society of Mechanical Engineers (ASME)

Boilers and pressure vessel codes:

- Section-II : Material specification
- Section-III : Rules for construction of nuclear Power plant components sub sections NC, ND, and NF
- Section-V : Non Destructive Examination
- Section- VIII : Pressure vessel code
- Section- IX : Welding and brazing qualification

3.2 American National Standard institute (ANSI)

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3.3 American Society of Testing & materials (ASTM)

4. DESIGN REQUIREMENTS:

The design conditions for the plate type heat exchangers shall be as specified in Data sheet. The plate heat exchanger shall be designed to meet the requirements of ASME section VIII (Div-1) as per Data sheet. The sub section of the code requirements shall be as specified in Data sheet. [Thermal design of the PHE shall be as per HTRI software.](#)

The plate type heat exchanger shall be counter current flow arrangement unless otherwise as specified in data sheet.

The design of plate type heat exchanger shall be such that Number of cold flow channels are more than the no of hot flow channels by one and head and tail plate side channel shall be cold flow channel.

To compensate the fouling, fouling margin of 15% or as specified in data sheet shall be provided.

The frame of heat exchanger shall be designed to permit the future installation of a minimum of 20 % additional plates or no of plates as specified in Data sheet.

The heat exchanger shall be suitable for at least 40 years of operation life and trouble free plant service.

[The PHE shall be designed for full design differential pressure. Each side of PHE shall be capable of withstanding its design pressure with the opposite side at zero pressure \(empty or depressurized\) without any permanent deformation, leakage or structural failure.](#)

Pressure drop across plate type heat exchanger shall be limited to the value indicated in data sheet. Total pressure drop distribution between nozzle and flow channel plates to be optimized resulting into required shear stress values on plates to prevent fouling. Heat exchanger nozzles pressure drop should be restricted to 40% of total heat exchanger drop specified in data sheet. Bidder shall also submit mechanical and heat transfer design calculations for plates, nozzle, and frame sizing.

5. MATERIALS:

Design requirement of components of plate heat exchanger are as follows.

The material of construction as indicated in Data sheet are the minimum acceptable. The BIDDER may offer equivalent or better materials, provided such materials are approved by the PURCHASER. The allowable stress values for the materials shall be governed by the applicable sub section of ASME section –VIII, Div-1 whichever is applicable as per Data sheet.

All material used for the fabrication of the Plate type of Heat Exchanger components shall be of tested quality.

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Material qualification tests shall be as per ASME section-II. Physical and chemical test certificates for the material of various components shall be furnished for the PURCHASER's approval.

a. Heat Transfer Plates;

Corrugated Heat Transfer Plates shall be of Min. thickness 0.5 mm.

b. Nozzles:

All inlet and outlet nozzles shall be of studded type unless other wise specified complete with counter flanges and studs. Number of studs, pitch circle diameter, bolt hole diameter and other dimensional details shall be such that it matches with drilling standard of ANSI B 16.5 150lb rating flanges or of that specified in data sheet. Nozzles openings shall be reinforced as per the rules of applicable ASME boiler and pressure vessel code sub sections.

c. Gaskets:

The materials of the gaskets shall allow an operating time of minimum ten years without replacement. In case of failure of a gasket mixing of liquids in circulation on primary and secondary side shall be avoided. [The PHE shall be provided with mechanically attached \(glueless/clip-on\) gaskets to facilitate easy replacement during maintenance.](#)

Gasket as specified in data sheet shall be of EPDM (a terpolymer of ethylene propylene diene monomer) or any other elastomer which has radiation exposure resistance equivalent to class-4 as per ASTM-D2953 or radiation value specified in data sheet.

Any lubricant or surface treatment given to gaskets shall be halogen free. The material's compressibility, recovery, adhesive to metal, hardness etc. shall be consistent with design of the equipment to provide a leak tightness barrier between the two streams.

d. Supports:

The upper and lower carrying bars shall be supported and held apart by fixed frame at one end and supporting column at the other end. Necessary anchor bolts shall be supplied. In case of seismically qualified heat exchanger pressure plate shall be supported based on the plate pack length.

e. Lifting lugs and eye bolts:

Suitable lifting lugs and eye bolts or similar device shall be provided to ensure safe and easy handling of the equipment. The design of the lifting device shall be based on the twice the maximum mass of the plate and frame heat exchanger.

f. Head Plate:

To accommodate specified nozzle loads head plate shall be designed suitably.

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6. SEISMIC REQUIREMENT:

Plate type heat exchangers, if specified in Data sheet are to be designed to withstand seismic load.

Seismic design considerations as per national code IS 1893 shall be taken for design of PHE. Seismic category 3 items should be designed for earthquake resistance according to the National practice.

The required response spectra for seismic qualification will be provided later after award of contract. The supplier shall submit design, analysis and test procedure to purchaser approval.

7. INSPECTION AND TESTING:

Quality assurance requirement shall be as per ASME section –VIII (Div-1) as specified in data sheet. Inspection of welds shall be as per ASME section IX ‘welding and brazing qualification’.

Typical QAP is enclosed with the specification. Contractor shall prepare and submit detail QAP for Purchaser approval.

Unless otherwise stated, inspection/test shall be conducted in the presence of the PURCHASER and/or his authorized representatives. All the test procedures shall be submitted by CONTRACTOR prior to testing for the PURCHASER’S approval. All the test results, including performance curves and the necessary test certificates shall be submitted immediately after the tests for the PURCHASERS approval.

For Checking of heat transfer plates, end plates, head plates, pressure plates nozzle pipes sleeves and other materials for identifying the same with mill test reports, CONTRACTOR shall supply to the INSPECTOR sufficient copies of the mill test reports for the PURCHASER’s review /approval.

Non destructive examination on various components of heat exchanger shall be as specified in data sheet.

The CONTRACTOR shall supply to the INSPECTOR sufficient copies of welding procedures and welder qualification certificates.

No weld repair without prior permission of PURCHASER is permitted for any of the pressure retaining components and nozzles.

a. Plates:

- Pressed plates shall be inspected for dimensional checks.
- 10% of the plates from each lot of the pressed plates shall be tested by liquid dye penetration test as per ASME section Vin order to check for cracks and other surface

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defects. If any defect is detected in any of these 10% plates, the whole lot shall be tested and plates without defects only shall be accepted.

- Pressed plates and gaskets assembled together. Shall be inspected for proper assembly.
- Plates and gaskets fixed in proper position in the frame along the carrying bar shall be checked for proper alignment.
- All the plate shall be absolutely free from all types of defects such as crack, pin holes etc. after pressing. This should be ascertained by subjecting each plate (including spare plates) to any one of the NDT technique such as light box test or 1% sulphur hexafluoride gas leak test or any other NDT technique approved by tenderer.
- [Austenitic SS heat transfer plates shall be tested for susceptibility to Intergranular Corrosion \(IGC\) in accordance with ASTM A262 Practice A/E.](#)

b. Gasket:

- Certificate of chemical composition of the gasket material shall be furnished to prove the quality.
- Shore hardness test shall be conducted on the gaskets & certificate shall be furnished. The hardness shall not be less than 65 on shore scale.
- Visual and dimensional check on a sampling basis shall be done by the purchaser.
- 90% of sample gaskets shall be subjected to compression set test and certificate shall be furnished.
- 10% of sample gaskets shall be subjected to cold recovery test and certificate shall be furnished.

c. Air leak test:

If specified in the data sheet, air leak test shall be conducted on the heat exchanger. Examination of the leakages shall be with a soap solution. The equipment shall be pressurized with air at a minimum pressure as specified in the data sheet and held at that pressure for 15 min.

d. Helium leak test: Not Applicable.

e. Hydro Test:

The secondary and primary sides of completed heat exchanger shall be hydrostatically tested for at least 30 min at a pressure specified in data sheet and NPC approved procedure. No leakage or distortion shall be permitted.

f. Field Tests:

Detailed test procedure for all the tests be conducted at site shall be submitted by the supplier sufficiently in advance to the purchaser for his approval. If the plate type heat exchanger supplied unassembled at site, the heat exchanger shall be hydrostatically tested

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by the supplier to the test pressure indicated in the Data sheet. Any defect detected during these tests shall be rectified by the supplier until the test results become satisfactory.

8. MANDATORY SPARE:

S.No.	Item Description	Unit of Measurement	Quantity
1.	Heat transfer plates (This shall include four sets of end plates and sealing plates)	Nos.	10% of total no. supplied in all heat exchangers of one unit.
2.	Gaskets (Plate joint of heat exchanger)	Sets	Two set for all plates joint of one heat exchanger
3.	Port Ring/Gasket	Nos.	50 % of total nos.

9. PACKING AND SHIPMENT

9.1 Packing

- The exchanger shall be thoroughly cleaned and dried before shipment.
- The exchanger shall be carefully checked to ensure that all extraneous matter such as rags, tools rubbish, foreign matter, loose scale, dirt, welding rods, studs, bolts are removed before packing.
- All finished or machined external carbon steel surfaces shall be protected against corrosion with liberal coating of an approved, easily removable compound. The compound shall be such that it will remain on the surface at temperatures normally encountered during shipment and storage. All machined surface shall be protected against mechanical damage.
- All external unfinished carbon steel surfaces shall be sand blasted and shall be coated with rust preventive primer and the brands and procedures shall be subject to the approval of purchaser.
- All openings shall be adequately sealed. Flanged openings, if any shall be covered with blank flanges held in place with at least 4 bolts and sealed with blank gaskets of natural rubber or equivalent. Butt weld openings shall be closed with seal welded slip on type temporary covers.
- Name plates shall be attached to each heat exchanger indicating size, Tag no, duty manufacturer's name, year of manufacture etc.
- All parts shall be properly packed, boxed crated or other wise protected for preventing any possible damage during transportation.
- The packing shall also include adequate cushioning, blocking, bracing, skidding, hoisting and tie down provisions.
- The packing and preparation of shipments shall be subject to Purchasers approval.

9.2 Shipment:

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- The supplier shall be responsible for ensuring that all equipment are carefully boxed and/or suitably packed for shipment so that they will arrive at the site in a satisfactory condition. No shipment shall be made unless clear instructions are received from Purchaser.
- All small loose pieces including bolting, tools, gaskets, etc. shall be adequately crated or boxed for protection during shipment.
- The supplier shall submit procedure write up for packing, mode of transport and method of transport to the Purchaser's engineer well in advance.

10. PAINTING AND PROTECTION

10.1 Surface Preparation:

In order to achieve maximum durability one or more of the following methods of surface preparation shall be followed depending on condition of steel surface. Adhesion of the paint film to surface depends largely on the degree of cleanliness of the metal surface. Proper surface preparation contributes to the success of the paint protective system.

- Manual or hand tool cleaning
- Mechanical or power tool cleaning
- Shot/Abrasive blast cleaning
- Solvent cleaning

Mill, scale, rust, rust scale and foreign matter shall be removed fully to ensure that a clean and dry surface is obtained. All other contaminants, grease, oil, etc. shall be removed by use of an aromatic solvent prior to surface cleaning.

Blast cleaning shall not be performed where dust can contaminate surfaces undergoing such cleaning, or during humid weather conditions having humidity exceeding 85%.

Irrespective of the method of surface preparation the first coat of primer must be applied by brush/spray on dry surface. This should be done immediately and in any case within 4 hours of cleaning of surface. However, at times of unfavourable weather conditions, re-cleaning may be required, before primer application is taken up. In general, during unfavourable weather conditions blasting and painting shall be avoided as far as practicable.

Manual or Hand Tool Cleaning:

- Hand de-scaling and/or hammering
- Hand scraping
- Hand wire brushing

Rust, mill scale spatters, oil coatings and other foreign matter shall be removed by hammering, scraping tools, emery paper cleaning, wire brushing or combination of the above methods. On completion of cleaning, loose material shall be removed from the surface by clean rags and the surface shall be removed from the surface by clean rags and

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the surface shall be brushed, swept, de-dusted and blown off with oil free compressed air to remove all loose matter.

Mechanical or Power Tool Cleaning:

Power tool cleaning shall be done by mechanical striking tools, chipping hammers, grinding wheels or rotating steel wire-brushes. Excessive burnish of surface shall be avoided as it can reduce paint adhesion. On completion of cleaning, the detached rust mill scale etc. shall be removed by clean rags and/or washed by water or steam and thoroughly dried with oil free compressed air jet before application of paint.

Blast Cleaning:

The surfaces shall be blast cleaned using Abrasive shot or chilled cast iron or malleable iron and steel maintaining constant velocity and pressure. Chilled cast iron, malleable iron and steel in the form of shot or grit of size not greater than 1.5 mm maximum in case of steel and malleable iron, and 1.0 mm maximum in case of chilled iron. Compressed air shall be free from moisture and oil. On completion of blasting operation, the blasted surface shall be clean and free from any scale or rust and must show a grey white metallic luster.

10.2 Paint Application:

After the surface preparation is over, the primer shall be applied immediately and in any case within four (4) hours of surface preparation. The primer should be worked either by brush application or spraying on the cleaned surfaces to cover the crevices, corners, sharp edges etc. The number of coats shall be in accordance with paint schedule.

Finish paint in required number of coats shall be applied after the primer has dried up completely. The shades of successive coats shall be slightly different in colour in order to ensure application of individual coats. The thickness of each coat and complete coverage shall be checked as per the paint schedule, before the next coat is applied. Mechanical means of applying finish paint is preferred to manual working to ensure uniform film thickness, appearance and faster execution.

Surfaces inaccessible after assembly shall receive an additional coat of the specified paint prior to assembly. All machined surfaces shall be provided with a coat of white lead or tallow to prevent formation of rust on these surfaces.

It should be ensured that the painted surfaces of items are not abraded/scratched etc. as they leave the place of manufacture/ fabrication, and received at site in good condition. Otherwise, all damaged/abraded/scratched surfaces shall be touched-up on receipt of the item at site.

Painting details shall be as below:

PRIMER	FINISH COAT	MINIMUM TOTAL DFT IN MICRONS	Finish paint Color Code
Two coats of High build	Two coats of Chlorinated rubber	160	Aircraft grey (693)

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chlorinated rubber zinc phosphate primer - 50 microns per coat minimum	paint - 30 microns per coat minimum		
--	--	--	--

The technical particulars of the paints and accessories employed by BIDDER shall be furnished to PURCHASER for prior approval. The supply of all paints, primers, varnishes, solvents, thinners and other accessories as may be required is included in BIDDER'S scope under this contract.

10.3 Inspection and Testing:

All painting materials including primers and thinners for application shall be procured from approved manufacturers as per specifications and shall be accompanied by manufacturer's test certificates. In case such certificates are not available, materials may be tested in accordance with relevant specifications in approved laboratories.

The painting work shall be subject to inspection by Purchaser at all times. Stage wise inspection shall be performed before proceeding to the next stage. The record of inspection shall be maintained. Stages of inspection are as follows:

1. Surface preparation
2. Primer application
3. Each coat of paint

Any defect noticed during the various stages of inspection shall be rectified before proceeding further. Dry film thickness (DFT) shall be checked and recorded after application of each coat.

Final inspection shall include measurement of paint dry film thickness, check of finish and workmanship. The thickness should be measured at as many points/locations as required and shall be within 10% of the dry film thickness specified.

11. PERFORMANCE GUARANTEE

Plate type heat exchangers shall be guaranteed by the supplier to meet the requirements based on conditions specified in data sheet.

The pressure drops measured across inlets and outlets at specified flows shall not exceed the values specified in Data Sheet. Same to be demonstrated by contractor at site.

12. HISTORY DOCUMENT

History report shall be prepared for each plate type heat exchanger and submitted to the purchaser at the time of inspection and delivery of the equipment. This report shall consist of the following documents.

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- Heat transfer calculation
- Pressure vessel design qualification calculation
- Pressure drop calculation
- Seismic qualification report
- Certified material test reports
- Heat treatment records
- All NDT documents
- Hydrostatic test reports
- Helium /air leak test reports
- Any design concession request
- Shipping release copy
- PO copy
- Operation and maintenance manual

The vendor shall furnish the purchaser with user's manual (operation and maintenance manual) which shall contain following.

- Technical description
- Assembly instruction
- Operating instruction
- Installation and maintenance instruction
- Spare part list
- Data sheet and drawing (as built)

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13. DATASHEET PHE-(FILLED UP)

GENERAL INFORMATION	SYSTEM	AUXILIARY COOLING WATER SYSTEM (ACW)			
	TAG NOS.	1-7135-HX-1 TO 4 AND 2-7135-HX-1 TO 4			
	TOTAL NO. OF HEAT EXCHANGERS REQUIRED (FOR BOTH UNITS)	4+4=8			
	NO.OF HEAT EXCH. WORKING NORMALLY/PER UNIT	4 (3W+1S)			
	LOCATION	INDOOR.			
	DESIGN AMBIENT TEMPERATURE, °C	45			
	SAFETY CLASSIFICATION	NON SAFETY- NINS			
	SEISMIC QUALIFICATION REQUIREMENT	CODAL (SEISMIC CAT-3,)			
	EXPECTED RADIATION DOSE (FOR 60 YRS)	NOT APPLICABLE			
	DESIGN CODE/ STD	ASME Section VIII DIV.1			
	APPLICABLE NPCIL SPECIFICATION	PC-E-534			
PROCESS FLUID DATA	PARAMETERS		PRIMARY SIDE (ACWS)	SECONDARY SIDE (ASW)	
	TYPE OF WATER CIRCULATED		PASSIVATED DM WATER	COOLING TOWER WATER	
	TOTAL SUSPENDED SOLIDS	ppm	≤ 3	30	
	TOTAL DISSOLVED SOLIDS	ppm	≤ 1	600	
	pH VALUE		8.5 TO 9.5	8-8.5	
	CHLORIDE AS CaCO3	ppm	≤ 0.2	40	
	CALCIUM AS CaCO3	ppm	≤ 1	225	
	TOTAL HARDNESS AS CaCO3	ppm	≤ 1	360	
	M.O. ALKALINITY	ppm	≤ 1	450	
	CONDUCTIVITY,	micro-siemens/cm	≤ 50	600-900	
DISSOLVED O ₂	ppm	≤ 50	-		
HEAT EXCHANGER THERMAL DESIGN PARAMETERS	DESIGN CONDITION				
	DESIGN PRESSURE, Kg/cm ²		8	6	
	DESIGN TEMPERATURE, °C		50	50	
	DESIGN DIFFERENTIAL PRESSURE FOR PLATES, kg/cm ²		10		
	HEAT LOAD, kW		BIDDER TO ESTIMATE		
	LIQUID FLOW, m ³ /hr PER HX.		847	901	
	FOULING FACTOR (hr.m ² . °C /kcal)		0.000011	0.000011	
	ENHANCEMENT FACTOR (a)		** SEE NOTE-5		
	CHANNEL VELOCITY(m/sec)		** SEE NOTE-6		
	PRESSURE DROP IN PORT(mwc)		** SEE NOTE-7		
	MAXIMUM ALLOWABLE PRESSURE DROP INCLUDING NOZZLES AND REDUCER (mwc)		8	6.5	
	MINIMUM SHEAR STRESS VALUES ON FLOW CHANNELS (Pa)		50	50	
	TEMPERATURE, °C	INLET	42.92	34	
		OUTLET	36	40.5	
	OFF-NORMAL OPERATION (with one Pump, 2 HX in service)				
	HEAT LOAD, kW		**		
	LIQUID FLOW, m ³ /hr PER HX.		DURING DETAILED ENGINEERING		
	PRESS. DROP INCLUDING NOZZLES (mwc)		**	**	
	TEMPERATURE, °C	INLET	**	34	
		OUTLET	**	**	
CONSTRUCT ION FEATURES	NOZZLE DRILLING STD & FLANGE-CLASS		AS PER PMS		
	TYPE OF NOZZLE FLANGES		RAISED FACE WITH SERRATION		
	SYSTEM LINE SIZE		450 NB	450 NB	
	HX NOZZLE SIZE		**	**	
	POSITION OF INLET AND OUTLET NOZZLES – (VIEWED FROM FRAME PLATE)		**	**	**

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	PLATES SEALING			HOT SIDE –NITRILE GASKET		COLD SIDE- NITRILE GASKET				
	NO. OF COLD FLOW CHANNELS -			ONE CHANNEL MORE THAN HOT FLOW CHANNELS (HEAD & TAIL PLATE SHOULD BE COLD)						
	DESIGN MARGIN ON FRAME TO ACCOMMODATE ADDITIONAL HEAT TRANSFER PLATES					25 %				
	NO. OF LOW THETA PLATES					VENDOR TO SPECIFY.				
	NO. OF HIGH THETA PLATES					VENDOR TO SPECIFY				
	NOZZLE LOADS* FORCE IN kg & moment in kg.m.			Fx*	Fy*	Fz*	Mx*	My*	Mz*	
				**	**	**	**	**	**	
ACCESS TO BE PROVIDED	1. LIFTING PROVISION LIKE EYE BOLTS AND LIFTING LUGS. 2. EARTHING CLEAT, 3. ONE SET OF ERECTION AND MAINTAINANCE TOOLS.									
MATERIALS OF CONSTRUCTION	ITEM			MATERIAL			SPECIFICATION			
	HEAT TRANSFER PLATES WITH GASKET			STAINLESS STEEL			ASTM A 240 TYPE 316			
	PLATES GASKET			NITRILE RUBBER						
	NOZZLE GASKET			EPDM						
	CARRYING BAR			CARBON STEEL			ASTM A283 Gr. C *			
	PLATE TO CARRY BAR ATTACHMENT COMPONENT			STAINLESS STEEL			ASTM A 240 TYPE 304			
	TIE BAR			ALLOY STEEL			ASME A 193 Gr. B7			
	FRAME PLATE			CARBON STEEL			ASTM A283 Gr. C *			
	SUPPORTING COLUMN			CARBON STEEL			ASTM A283 Gr. C *			
	PRESSURE PLATE			CARBON STEEL			ASTM A283 Gr. C *			
	NUTS			CARBON STEEL			ASTM A194 Gr. 2H			
	BOLTS			ALLOY STEEL			ASTM A193 Gr. B7			
	GUIDING BAR (BOTTOM BAR)			STAINLESS STEEL			ASTM A240 TYPE 304,			
	COMPANION SORF FLANGES (PRIMARY)			CS			SA 105			
	COMPANION SORF FLANGES (SECOND)			CS			SA105			
	NOZZEL LINING			SS			A-240-GR-316 L			
	INSPECTION AND TESTING	ROLLER FOR PRESSURE PLATE			SS			SA-479-TP-410		
NAME PLATE			SS			SA 240 TP 304				
RAW MATERIAL		PHYSICAL & CHEMICAL TEST			ON ALL MATERIALS WITH TEST CERTIFICATES					
		ULTRASONIC EXAMINATION (100%)			ON FRAME PLATES,PRESSURE PLATES & TIGHTING BOLTS					
		LIQUID-PENETRATION TEST			ON MINIMUM 20% OF TOTAL NOS OF HEAT TRANSFER PLATES					
INSPECTION AND TESTING	FAB	MPT (100%)			TIGHTENING BOLTS & TIGHTENING RODS					
		LIGHT BOX TEST			ON HEAT TRANSFER PLATES					
		BUT WELD JOINTS			100% DP ON ROOT WELDS					
		FILLET WELD JOINTS			10% RADIOGRAPHY TEST ON FINAL WELD					
	FINAL	ON PLATE HX ASSEMBLY			TYPE OF TEST		PRESSURE, Kg/cm²		DURATION Minutes	
					HYDRO TEST		12		30	
					AIR LEAK TEST		7.0		15 Minutes	
					HELIUM LEAK TEST		Not Required		-	
					DIMENTIONAL CHECK					

* ASTM A516 Gr 70 can also be provided in replacement of ASTM A283 GrC by Bidder.

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	ACCEPTANCE STD	ASME SECTION VIII DIV.1
PAINTING	ALL CS PART SHALL BE SAND BLASTED TO SA 2.5 AND PAINTED AS SPECIFIED IN THE TENDER.	
NOTE	1.0 VENDOR SHOULD FURNISH REPLACEMENT FREQUENCY OF PLATE GASKETS. 2.0 VENDOR SHOULD FURNISH CLEANING FREQUENCY OF HX (i) MECHANICAL AND (ii) CHEMICAL 3.0 VENDOR SHOULD FURNISH THE DATA AND CALCULATIONS MARKED WITH (**). DETAIL CALCULATION OF HEAT TRANSFER AND PRESSURE DROP SHALL BE PROVIDED. 4.0 THE MAXIMUM ALLOABLE VALUE OF HEAT TRANSFER COEFFICIENT CONSIDERED FOR THERMAL DESIGN OF PLAT TYPE HEAT EXCHANGER SHALL NOT EXCEED 18000 kcal/m ² /°C. 5.0 ENHANCEMENT FACTOR SHALL BE VERIFIED WITH TEST IN A LAB TO BE APPROVED BY NPCIL. 6.0 CHANNEL VELOCITY SHALL NOT BE GREATER THEN 1 m/sec. 7.0 MAXIMUM ALLOWABLE PRESSURE DROP IN THE PORT SHALL BE LIMITED TO 0.15 TIMES OF TOTAL PRESSURE DROP ACROSS PHE)	

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14. SUGGESTED SUB-VENDOR LIST

S.No.	Item	Supplier	Supplier Address
1.	SEAMLESS PIPES (CS, AS AND SS)	1. M/S. MSL, RAIGAD	RAIGAD
		2. M/S. ISMT, PUNE	PUNE
		3. M/S. REMI METALS GUJARAT LTD, MUMBAI	MUMBAI
		4.M/S. JINDAL STEEL TUBES	KOLKATA
		5. M/S. ZENITH STEEL TUBES	MUMBAI
		6. M/S. RATNAMANI METALS AND TUBES LTD	AHMEDABAD
		7. M/S. NFC	HYDERABAD
		8. M/. SURAJ LIMITED	AHMEDABAD
2.	WELDED PIPES (CS, AS)	1. M/S. MANN INDUS.	INDORE
		2. M/S. DECCAN METAL INDUSTRIES, RAJPURA	PUNJAB
		3. M/S. LALIT PIPES & PIPES LIMITED	KASARA
		4. M/S. MSL	RAIGAD
		5. M/S. RATNAMANI	AHMEDABAD
3.	PIPING FABRICATOR	1. M/S. GUJRAT INFRA PIPES	VADODARA
		2. M/S. UNITECH MACHINES LTD	GURGAON
		3. M/S. DEE DEVELOPMENT	FARIDABAD
		4. M/S. BEND JOINTS	BHOPAL
		5. M/S. PAL ENGG., CORPORATION	YAMUNAGAR
		6. M/S. BHEL, TRICHY	TRICHY
4.	FASTENERS	1. M/S. ALCO	HUBLI
		2. M/S. BOLTMASER	VASAI
		3. M/S. GKW	MUMBAI
		4. M/S. INDUSTRIAL FASTENERS	MUMBAI
		5. M/S. MEGA ENGINEERING PVT. LTD	
		6. M/S. LAXMI PRECISION	MUMBAI
		7. M/S. PRECISION ENGINEERING INDUSTRIES	VADODARA
		8. M/S. PRECISION FASTENERS	MUMBAI
		9. M/S. TVS SUNDARAM FASTENERS	CHENNAI
		10. M/S. TCS	CHENNAI
		11. M/S. UNBRAKO	MUMBAI
		12. M/S. PRESIDENT ENGG. WORKS	MUMBAI
		13. M/S. PIONEER NUTS AND BOLTS PVT. LTD.	LUDHIANA

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		14. M/S. INDUSTRIAL ENGG. CORPORATION	VASAI
		15. M/S. INDCON	DELHI
		16. M/S. SUMMITS HYGRONIC	COIMBATORE
		17. M/S. MULTIFASTENERS	VADODARA
5.	GASKET	1. M.S. STARFLEX	GOA
		2. M/S. IGP	CHENNAI
		3. M/S. SG GASKET AND COOLING TOWER CO.	MUMBAI
		4. M/S.FLEXITALLIC	UK
6.	PLATES AND STRUCTURAL STEEL (CS & SS)	1. M/S. LLOYD STEEL	MUMBAI
		2. M/S. RASHTRIYA ISPAT NIGAM LTD	VIZAG
		3. M/S. SAIL	MUMBAI
		4. M/S. TISCO	JAMSHEDPUR
		5. M/S. JINDAL STEEL & POWER LTD.	ORISSA
		6. M/S. ESSAR STEEL INDIA LTD.	HAZIRA
7.	ANCHOR FASTENERS	1. M/S. HILTI	MUMBAI
		2. M/S. ANCHOR	MUMBAI
		3. M/S. DASH	DELHI
		4. M/S. ARISTOCRAT	BANGALORE

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15. QUALITY PLAN (PHE)

Nuclear Power Corporation of India Ltd (A Government of India Enterprise)	
Technical Specification for Plate Type Heat Exchanger	Page NO: 1 OF 7 Rev NO : 0

Typical QAP

I. STAGE INSPECTION REQUIREMENT AND QUALITY SURVEILLANCE PLAN

Sr. No.	Component	Material	Type of Test	Method and Extent of Check	Acceptance Norms	Format of Record and Agency for Inspection and Certification	Remarks
1.	Frame Plate / Pressure Plate	As per Data sheet-A	(i) Chemical Composition	Lab test one per heat	Material specification & Design std	Mill Certificate, supplier	Test certificate (T/C) will be submitted by supplier for NPCIL's approval
			(ii) Tensile Test	At ambient temp. one per heat	Material specification & Design std	T/C, supplier	To be witnessed by NPCIL, Q.S.
			(iii) Ultrasonic Examination (If specified in data sheet)	At ambient temp. 100%	Material specification & Design std	T/C, supplier	Hold point to be witnessed & cleared by NPCIL, Q.S. Engineer.
2.	Tightening Bolt / Locking Bolt	As per Data sheet-A	(i) Heat Treatment	Normalised & tempered; solution treated, after finish; 100%	Material specification & Design std	T/C, supplier	To be verified by NPCIL, QS.
			(ii) Chemical Composition	Lab test sample	Material specification & Design std	T/C, supplier	-
			(iii) Tensile Test	At ambient temp. one per heat	Material specification & Design std	T/C, supplier	To be witnessed by NPCIL, Q.S.

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Sr. No.	Component	Material	Type of Test	Method and Extent of Check	Acceptance Norms	Format of Record and Agency for Inspection and Certification	Remarks
3.	Stud Bolt for Flanged Connection	As per Data sheet- A	(i) Heat Treatment	Normalised & tempered; solution treated, after finish; 100%	Material specification & Design std	T/C, supplier	To be verified by NPCIL, Q.S.
			(ii) Chemical Composition	Lab test sample	Material specification & Design std	T/C, supplier	-
			(iii) Tensile Test	At ambient temp. one per heat	Material specification & Design std	T/C, supplier	To be witnessed by NPCIL, Q.S.
4.	Nut for Tightening Bolt / Locking Bolt	As per Data sheet- A	(i) Chemical Composition	Lab test sample	Material specification & Design std	T/C, supplier	-
			(ii) Proof Load Test	-do-	Material specification & Design std	-do-	To be witnessed by NPCIL, Q.S.
			(iii) Hardness	-do-	Material specification & Design std	-do-	-do-
			(iv) Hardness after Ageing	-do-	Material specification & Design std	-do-	-do-

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Technical Specification for Plate Type Heat Exchanger	Page NO: 3 OF 7 Rev NO : 0

Sr. No.	Component	Material	Type of Test	Method and Extent of Check	Acceptance Norms	Format of Record and Agency for Inspection and Certification	Remarks
5.	Heat Transfer Plates	As per Data sheet-A	(i) Heat Treatment	Solution Annealing, 100% (For austenitic SS plate)	Material specification & Design std	T/C, supplier	To be verified by NPCIL, QS.
			(ii) Chemical Composition	Lab test, sample	Material specification & Design std	T/C, supplier	-
			(iii) Mechanical Properties	Lab test, sample	Material specification & Design std	T/C, supplier	To be witnessed by NPCIL, Q.S.
			(iv) Intergranular Corrosion Test	Lab test, 100%	Material specification & Design std	T/C, supplier	To be witnessed by NPCIL, Q.S.
			Material Defect	(a) Light box test or (b) 1% SF6 gas leak test or (c) Equivalent to above test, 100% (subject to approval by tenderer)	Approved Document	-do-	Tested after plates are formed. Hold point to be witnessed by NPCIL, QS and cleared.

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Technical Specification for Plate Type Heat Exchanger						Page NO: 4 OF 7 Rev NO : 0	
Sr. No.	Component	Material	Type of Test	Method and Extent of Check	Acceptance Norms	Format of Record and Agency for Inspection and Certification	Remarks
5.			(v) Surface Defects	DP test, both sides of the plate, 5% of total number of plates	No surface defects	Inspection Record, supplier	Hold point to be witnessed and clear by NPCIL, QS.
6.	Leg Support	As per Data sheet-A	(i) Chemical Composition	Lab test one per heat	Material specification & Design std	Mill Certificate, supplier	Test certificate (T/C) will be submitted by supplied
			(ii) Tensile Test	At ambient temp. one per heat	Material specification & Design std	T/C, supplier	To be witnessed by NPCIL, Q.S.
			(iii) Soundweld	D.P., 100%	Material specification & Design std	T/C, supplier	Hold Point.
7.	Gasket	As per Data sheet-A	(i) Chemical Composition	Lab test sample	Material specification & Design std	T/C, supplier	Test to be witnessed by NPCIL, QS.
			(ii) Hardness	-do-	Material specification & Design std		-do-
			(iii) Compression Set Test	Lab test, 90% of sample gaskets	Material specification & Design std		-do-
			(iv) Cold Recovery Test	Lab test 10% of sample gaskets	Material specification & Design std		-do-

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KAIGA ATOMIC POWER PROJECT UNIT 5&6 TECHNICAL SPECIFICATION FOR PLATE TYPE HEAT EXCHANGERS IN ACW SYSTEM	PAGE NO.: PAGE 27 OF 38 REV NO.: 00 DATE: 30/06/26

Nuclear Power Corporation of India Ltd (A Government of India Enterprise)	
Technical Specification for Plate Type Heat Exchanger	Page NO: 5 OF 7 Rev NO : 0

Sr. No.	Component	Material	Type of Test	Method and Extent of Check	Acceptance Norms	Format of Record and Agency for Inspection and Certification	Remarks
8.	Foundation Bolt / Nuts	As per Data sheet-A	(i) Chemical Composition	Lab Test, sample	Material specification & Design std	T/C, supplier	To be witnessed by NPCIL, Q.S.
			(ii) Tensile Test	-do-	Material specification & Design std	T/C, supplier	-
9.	Carrying Bar	As per Data sheet-A	(i) Chemical Composition	Lab test one per heat	Material specification & Design std	Mill Certificate, supplier	Test certificate (T/C) will be submitted by supplier.
			(ii) Tensile Test	At ambient temp. one per heat	Material specification & Design std	T/C, supplier	To be witnessed by NPCIL, Q.S.
10.	Component for Plate to Carrying Bar Attachment	As per Data sheet-A	(i) Heat Treatment	Solution Annealing, 100% (For austenitic SS material)	Material specification & Design std	T/C, supplier	To be verified by NPCIL, Q.S.
			(ii) Chemical Composition	Lab test, sample	Material specification & Design std	T/C, supplier	-
			(iii) Mechanical Properties	Lab test, sample	-do-	T/C, supplier	To be witnessed by NPCIL, Q.S.

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Sr. No.	Component	Material	Type of Test	Method and Extent of Check	Acceptance Norms	Format of Record and Agency for Inspection and Certification	Remarks
11.	Guiding Bar / (Bottom Bar)	As per Data sheet-A	(i) Heat Treatment	Solution Annealing, 100%	-do-	T/C, supplier	To be verified by NPCIL, Q.S.
			(ii) Chemical Composition	Lab test, sample	-do-	T/C, supplier	-
			(iii) Mechanical Properties	Lab test, sample	-do-	T/C, supplier	To be witnessed by NPCIL, Q.S.

Note:-

- For other components not covered above but which are shown in the general arrangement drawing, correlatable Material test certificates shall be furnished.
- Q.S. requirement for other components not mentioned above but included in bidder's design to be worked out by the bidder and should also be filled up in the blank space left at the end of above tabulation.

Signature, data and seal of the tenderer

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II. FINAL INSPECTION ON ASSEMBLED HEAT EXCHANGER

Sr. No.	Operation	Type of Test	Method and Extent of Check	Acceptance Norms	Format of Record and Agency for Inspection and Certification	Remarks
1.	Check Correctness of Name Plate		Visual, 100%	Approved Drawings	Supplier	NPCIL to witness & clear.
2.	Check Overall Dimensions	Dimensional Accuracy	Measurements 100%	Approved Drawings	Inspection Reports, Supplier, Purchaser	-do-
3.	Hydrostatic Test on Process Water Side	Hydro Test with Demineralised Water	With Pressure Gauge, 100%	No Leakage	T/C, Supplier, Purchaser	-do-
4.	Hydrostatic Test on Cooling Water Side	-do-	-do-	-do-	-do-	-do-
5.	Hydrostatic Test with Pressure on both Sides simultaneously	-do-	-do-	-do-	-do-	-do-
6	Air leak test(if specified in data sheet)	Air leak test	-do-	-do-	-do-	-do-
7	Helium leak test(if specified in data sheet)	Helium leak test	-do-	-do-	-do-	-do-
6.	Correctness of Plate Pack Length during Hydro test	Dimensional Measurement	100%	Approved Drawing	-do-	-do-
7.	Final Drying after Hydro test	-	Blowing Hot Air, 100%	No Moisture inside Heat Exchanger	-do-	-do-
8.	Packing Before Dispatch	Visual	100%	Sound Packing	-do-	-do-

Signature, Date and Seal of the Tenderer

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16. PLATE TYPE HEAT EXCHANGER DATA SHEET – A (TO BE SUBMITTED BY SUCCESSFUL BIDDER)

PLATE TYPE HEAT EXCHANGER DATA SHEET - A			
GENERAL INFORMATION	SYSTEM		
	TAG NOS.		
	TOTAL NO. OF HEAT EXCHANGERS REQUIRED (FOR BOTH UNITS)		
	NO.OF HEAT EXCH. WORKING NORMALLY/PER UNIT		
	LOCATION		
	DESIGN AMBIENT TEMPERATURE, °C		
	SAFETY CLASSIFICATION		
	SEISMIC QUALIFICATION REQUIREMENT		
	EXPECTED RADIATION DOSE		
	DESIGN CODE/ STD		
PROCESS FLUID DATA	PARAMETERS	PRIMARY SIDE	SECONDARY SIDE
	TYPE OF WATER CIRCULATED		
	TOTAL SUSPENDED SOLIDS ppm		
	TOTAL DISSOLVED SOLIDS ppm		
	pH VALUE		
	CHORIDE AS CaCO ₃ ppm		
	CALCIUM AS CaCO ₃ ppm		
	TOTAL HARDNESS AS CaCO ₃ ppm		
	M.O. ALKALINITY ppm		
	CONDUCTIVITY, micro-Siemens/cm		
	DISSOLVED O ₂ (SATURATED AT 30 °C) ppb		
HEAT EXCHANGER THERMAL DESIGN PARAMETERS	DESIGN CONDITION		
	DESIGN PRESSURE, Kg/cm ² (g)		
	OPERATING TEMPERATURE RANGE, °C		
	DESIGN TEMPERATURE, °C		
	DESIGN DIFFERENTIAL PRESSURE FOR PLATES, kg/cm ² (g)		
	HEAT LOAD, kW		
	LIQUID FLOW, m ³ /hr PER HX.		
	FOULING MARGIN(%)	15% IN TERMS OF AREA TO BE PROVIDED	
	SHEAR STRESS (Pa)	MIN: 50 Pa (as per API 662)	
	MAXIMUM ALLOWABLE PRESSURE DROP INCLUDING NOZZLES (mwc)		
	TEMPERATURE, °C	INLET	
		OUTLET	
	OFF-DESIGN PERFORMANCE – purchaser to furnish all off normal conditions on separate sheet as an annexure. All data indicated below with performance values and curves in all off normal conditions shall be provided by Vendor.		
	HEAT LOAD, kW		
	LIQUID FLOW, m ³ /hr PER HX.		
	RELEVANT DIRECTION OF FLUIDS	COUNTER CURRENT/COCURRENT	
	PRESS. DROP INCLUDING NOZZLES (mwc)		
	TEMPERATURE, °C	INLET	
		OUTLET	
	SHEAR STRESS VALUES ON FLOW CHANNELS		

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PLATE TYPE HEAT EXCHANGER DATA SHEET -- A							
CONSTRUCTION FEATURES	NOZZLE FLANGES- CLASS AND DRILLING STANDARD						
	TYPE OF NOZZLE FLANGES						
	SYSTEM LINE SIZE						
	POSITION OF INLET AND OUTLET NOZZLES – TOP / BOTTOM						
	SIDE AND HOT SIDE GASKETS						
	NO. OF COLD FLOW CHANNELS - 1 CHANNEL MORE THAN HOT FLOW CHANNELS(Head and tail plate should be cold)						
	DESIGN MARGIN ON FRAME TO ACCOMMODATE ADDITIONAL HEAT TRANSFER PLATES						
	NO. OF LOW THETA(Θ) PLATES						
	NO. OF HIGH THETA (Θ) PLATES						
	NOZZLE LOADS* FORCE IN kg _f & moment in kg _f .m.		Fx*	Fy*	Fz*	Mx*	My*
* THE MINIMUM LOADS TO BE CONSIDERED FOR NOZZLE DESIGN.							
ACCESSORIES TO BE PROVIDED	1. IF HX NOZZLE SIZE AND SYSTEM LINE SIZE IS MATCHING: SORF COMPANION FLANGES ALONG WITH NUTS, BOLTS & GASKETS. OR IF HX NOZZLE SIZE AND SYSTEM LINE SIZE IS NOT MATCHING: SPOOL PIECE CONSISTING OF SORF COMPANION FLANGES, EXPANDER OR REDUCER AND STRAIGHT PIECE OF 100 MM LONG WITH BUTT WELDING END.						
	2. LIFTING PROVISION LIKE EYE BOLTS AND LIFTING LUGS						
	3. THREADED BASE PLATE AND BOLT FOR EACH HX LEG TO ERECT ON HX PEDESTAL WITH EP PLATES.						
	4. EARTHING CLEAT. 5. ONE SET ERECTION AND MAINTENANCE TOOLS.						
MATERIALS OF CONSTRUCTION	ITEM		MATERIAL		SPECIFICATION		
	HEAT TRANSFER PLATES						
	PLATES GASKETS						
	FLANGED GASKETS						
	CARRYING BAR						
	PLATE TO CARRY BAR ATTACHMENT COMPONENT						
	TIE BAR						
	FRAME PLATE						
	SUPPORTING COLUMN / BEAM						
	PRESSURE PLATE						
	NUTS						
	BOLTS / FOUNDATION BOLTS						
	GUIDING BAR						
	NOZZLE FLANGES						
	LINING SLEEVE						
	ROLLER FOR PRESSURE PLATE						
	EARTHING BOSS						
NAME PLATE							

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PLATE TYPE HEAT EXCHANGER DATA SHEET -- A					
INSPECTION AND TESTING	RAW MATERIAL	PHYSICAL & CHEMICAL TEST	ON ALL MATERIALS WITH TEST CERTIFICATES		
		ULTRASONIC EXAMINATION (100%)	ON FRAME PLATES,PRESSURE PLATES & TIGHTING BOLTS		
		LIQUID-PENETRATION TEST (100%)	ON HEAT TRANSFER PLATES		
		MPT (100%)	TIGHTING BOLTS & TIGHTING RODS		
		LIGHT BOX TEST	ON HEAT TRANSFER PLATES		
	FABRI	BUT WELD JOINTS	100% DP ON ROOT WELDS 100% RADIOGRAPHY TEST ON FINAL WELD		
		FILLET WELD JOINTS	10% DP ON ROOT WELDS 100% DP ON FINAL WELD		
	FINAL	ON PLATE HX ASSEMBLY	TYPE OF TEST	PRESSURE, Kg/cm2	DURATIO N Minutes
			HYDRO TEST		
			AIR LEAK TEST		
HELIUM LEAK TEST				-	
DIMENTIONAL CHECK					
ACCEPTANCE STD					
PAINING	AS PER TENDER SPECIFICATION				
	NOTE : Spares shall be provided as per specification.				

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17. TECHNICAL PARTICULARS TO BE SUBMITTED BY BIDDER

Data Sheet B: Format for the Data to be filled by the Bidder

1.0 Manufacturer's Name and Model No.

2.0 Design parameters of individual heat exchanger units.
The following data shall be indicated wherever applicable.

	Process Water side	Cooling Water side
(a) Flow m ³ /Hr		
(b) Inlet Temperature °C		
(c) Outlet Temperature °C		
(d) Guaranteed pressure drop(without any positive tolerance)		
(i) Total pressure drop across the heat exchanger		
(ii) Pressure drop across the inlet nozzle		
(iii) Pressure drop across the outlet nozzle		
(iv) Pressure drop in Reducer /Expander if required to connect pipe		
(v) Pressure drop in plate pack		
(vi) Pressure drop across each channel		

3.0 THERMAL DESIGN DATA

- a) Heat Load. Kcal/hr
 - i) Normal operation
 - ii) Peak load operation
- b) LMTD, °C
- c) LMTD correction factor
- d) Number of Heat transfer units
 - i) Cooling water side
 - ii) Process water side
- e) Overall fouling factor m² hr °C/kcal
- f) Overall heat transfer coefficient

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- i) Clean, $\text{kcal/hr m}^2 \text{ } ^\circ\text{C}$
- ii) Fouled, $\text{kcal/hr m}^2 \text{ } ^\circ\text{C}$
- g) Heat transfer area for each unit m^2
- h) Heat transfer area per plate m^2
- i) Velocity between plates (m/s)
- j) Hydraulic diameter (mm)
- k) Hydraulic flow length (mm)
- l) Expected performance of heat exchangers under other off normal condition as specified in Data sheet-A.
- m) Expected performance of heat exchanger under normal as off normal conditions, if one of operating heat exchangers is not available and the stand by heat exchanger is also not brought into service.

4.0 TECHNICAL PARTICULARS (FOR INDIVIDUAL HEAT EXCHANGER UNIT)

a) Plates

- i) Area, m^2
- ii) Dimensions, width x height
- iii) Thickness, mm
- iv) No. of plates/unit offered
- v) No. of plates/unit, maximum that can be accommodated.
- vi) Type of corrugation
- vii) Plate chevron angle(θ)
- viii) Type of N.D. Test done on each plate, individually whether SF gas leak test or light box test or equivalent test (name it)
- ix) Maximum plate pack length, mm as per (v)
- x) Minimum plate pack length, mm as per (iv)
- xi) Average gap between two plate
- xii) Hold up volume of each passage, m^3
- xiii) Hold up volume of heat exchanger , m^3

b) Gaskets

- i) Type
- ii) Thickness of gaskets, mm
- iii) Compression required to achieve leak tightness, mm
- iv) Expected life of gasket

a) Under normal operating condition

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- b) Storage under ambient condition
 - v) Hardness of gasket
 - vi) Hardness test of gasket provided?
- c) Carrying bar
 - i) Type of construction
 - ii) Size
 - iii) Number
- d) Heat Plate, follower plate and supporting column
 - i) Type of construction
 - ii) Size
- e) Nozzle connection

	<u>Supply</u>	<u>Return</u>
i) Process water		
a) Size, mm NB b) Pressure rating & drilling standard and facing.		
ii) <u>Cooling Water Side</u>	<u>Supply</u>	<u>Return</u>
a) Size, mm NB b) Pressure rating & drilling standard and facing		
- f) Material of Construction (material specification to be indicated along with material and grade)
 - i) Plates
 - ii) Gaskets
 - iii) Frame plates, Head & Follower plates and supporting columns
 - iv) Carrying bars
 - v) Component to be used for attachment of plate to carrying bar.
 - vi) Tie bars
 - vii) Bolts
 - viii) Nuts
- g) Weight and dimensions
 - a) Weight of heat exchanger
 - i) Empty
 - ii) Flooded

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- iii) Shipping weigh
- b) Accessories
 - Weight of each plate
 - Weight of frame assembly
- h) Dimensions of heat exchanger
 - i) Length, mm
 - ii) Breadth, mm
 - iii) Height, mm
 - iv) Dimensions of packed unit, length x Breadth x Height.

5.0 DRAWINGS, CURVES, INFORMATION REQUIRED WITH PROPOSAL

The following information shall be submitted with the proposal separately.

- a) Preliminary outline drawings indicating principal dimensions material specification of components and weight of shipment offered, size and location of the various nozzle connections etc.
- b) Calculations of the overall heat transfer co-efficient, heat transfer area and pressure drop for the heat exchangers offered, along with plate thickness calculations and calculation for the natural frequency for the unit.
- c) Complete technical data on heat exchangers.
- d) Descriptive and illustrative literature covering construction of heat exchangers, handling methods, gasketing methods for plate etc.
- e) Inspection and Testing offered for various components.
- g) Type and extent of seismic analysis. (Applicable if specified in the Data sheet-A)
- h) Extent of indigenous components involved in the heat exchangers offered.
Stage Inspection chart attached herewith duly signed as a token of acceptance.
- i) Instruction for long storage of heat exchangers
 - (i) In erected condition before commissioning.
 - (ii) In packed condition before erection.
- j) Cleaning frequency of Heat exchanger (i)mechanical(ii)chemical
- k) Replacement frequency of plate gasket

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6.0 DRAWING, DATA, INSTRUCTION MANUAL, TEST REPORTS ETC. SUBMISSION SCHEDULE

The Supplier shall submit various certified drawings and data for review of the Purchaser/Consulting Engineers according to the following schedule and afterwards for final distribution in quantities and in accordance with the procedure set up in the General Conditions of Contract.

	DESCRIPTION	SUBMISSION FOR APPROVAL TIME IN WEEKS FROM RECEIPT OF ORDER
a)	General Arrangement, layout and outline dimensions of the heat exchangers including nozzle details	
b)	Foundation drawings, showing load data and anchor bolt location.	
c)	Design calculation (mechanical and heat transfer)	
d)	Inspection and test procedures.	
e)	Detailed drawings showing construction of plates Gaskets, Supports etc.	
f)	Seismic design analysis reports if applicable	
g)	Instruction manuals for installation, operation, and maintenance of all the equipment furnished by him. Instruction manuals shall give step by step procedure for any operation likely to be carried out during the life of the plant/equipment including erection, commissioning, testing, operation maintenance, dismantling and repair. Each manual shall also include a together with performance/rating curves of the equipment and test certificates wherever applicable.	
h)	Report on various tests done at shop & material tests reports.	
i)	Inspection History Document.	

7.0 TIME REQUIRED BY THE SUPPLIER

The Supplier shall state the period required for the preparation of his drawings and the time he has allowed for approval of the drawings by the Engineer in the delivery period specified.

NOTE: ABOVE SUBMISSION SCHEDULE TO BE PREPARED TO MEET THE CONTRACTUAL DELIVERY PERIOD AS PER NIT.

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8.0 PROOF OF ABILITY

Bidder shall give details of previous experience with design, manufacture and supply of similar plate heat exchangers. The bidder shall furnish in details; the list of power plants where plate type heat exchangers are supplied along with type and No. of equipments supplied, date of supply and commissioning and performance as on date.

9.0 SCHEDULE OF DEVIATIONS

If the proposal has got any deviation from the technical specification, the tendering conditions and the general conditions, of contract, tenderers shall tabulate those deviations and sign below in the format under schedule of deviations. More sheets shall be attached if required. In absence of this it will be presumed that the offer is strictly in accordance with this specification.

10.0 MANUFACTURING AND DELIVERY SCHEDULE

Time in weeks from the
date of issue of Purchase
Order.

- a) Submission of drawings for approval
- b) Start manufacture
- c) Complete manufacture
- d) Testing at manufacturer's works
- e) Complete shipment
- f) Arrival at Site

11.0 GUARANTEE PERIOD OFFERED

NOTE:

MANUFACTURING AND DELIVERY SCHEDULE TO BE PREPARED TO MEET THE CONTRACTUAL DELIVERY PERIOD AS PER NIT.

INFORMATION FURNISHED IN THE TECHNICAL PARTICULARS SUBMITTED WITH THE BID REMAINS SUBJECT TO APPROVAL BY NPCIL DURING DETAILED ENGINEERING.

Document No.: KAIGA-5&6/PC/E/08019			
Document Title: TECHNICAL SPECIFICATION FOR PLATE TYPE HEAT EXCHANGERS IN ACW SYSTEM			
Comments Received on date: 15/07/2026			
Date of Revision: 15/07/2026			
Sl. No.	pg no.	NPCIL Comments	BHEL Response
1	9 of 38	Thermal design of the PHE shall be as per HTRI software.	Incorporated.
2	9 of 38	in	Incorporated.
3	9 of 38	The PHE shall be designed for full design differential pressure. Each side of PHE shall be capable of withstanding its design pressure with the opposite side at zero pressure (empty or depressurized) without any permanent deformation, leakage or structural failure.	Incorporated.
4	10 of 38	The PHE shall be provided with mechanically attached (glueless/clip-on) gaskets to facilitate easy replacement during manitenance	Incorporated.
5	11 of 38	6. SEISMIC REQUIREMENT: Plate type heat exchangers, if specified in Data sheet are to be designed to withstand seismic load. For checking stresses due to different load combinations <u>ASME Section III/ND</u> shall be referred. <u>ACW system is designed as per ANSI B 31.1.</u> ~~The qualification of the plate type heat exchangers shall be as per NPCIL specification no PP-P-1819 titled "Technical Specification for methods & procedure for Seismic qualification of valves, panels, devices, rotating equipments, tanks, vessels, piping and supports. The specification is largely based on IEEE 382, IEEE384 and ASME-QME-1.~~ The required response spectra for seismic qualification will be provided later after award of contract. The supplier shall submit design, analysis and test procedure to purchaser approval.	Seismic Requirement updated as "Seismic design considerations as per national code IS 1893 shall be taken for design of PHE. Seismic category 3 items should be designed for earthquake resistance according to the National practice."
6	12 of 38	Austenitic SS heat transfer plates shall be tested for susceptibility to Intergranular Corrosion (IGC) in accordance with ASTM A262 Practice A/E.	Incorporated.

	PRE-QUALIFYING REQUIREMENTS (TECHNICAL) - PLATE HEAT EXCHANGERS (PHE)	TECH. SPEC. NO: PE-TS-488-179-W001
		TECHNICAL PQR PLATE HEAT EXCHANGERS
		REVISION NO: 00 DATE: 22/08/2026
		SHEET: 1 of 2
FORM NO. PEM 6100-0	PROJECT: 2x700 MWe PHWR – KAIGA-5&6 ATOMIC POWER PROJECT	
	PACKAGE: PLATE HEAT EXCHANGER (PHE)	
	1. The bidder should have designed, manufactured, tested, inspected & supplied similar PHE with minimum flow of 450 cub.m/hr, which have been successfully in use for at least 1 year in nuclear or thermal power plant or similar industry/ application and bidder is in business of PHE on continuous basis.	
	2. The Bidder shall furnish following support documents for assessment of Bidder w.r.t. PQR as indicated at Sl. No. 1 above: A. Bidder's Experience list of PHE for last 5 years for assessment of bidder for supplying the PHE on regular basis for establishing business continuity in the enclosed format- Annexure -1. Bidder shall furnish the PO copy of at least one executed Contract as indicated in the experience list. B. Bidder shall furnish any one from below in support of successful performance of PHE for one year: i. Satisfactory Performance feedback certificates from End Customer (Owner) (in English) for at least one successfully executed contract which has been in use for at least one year indicating salient features like year of commissioning of PHE, rating of project, flow & heat load of PHE, project name etc., date of issue of certificate and name/ designation of the certificate issuer for power plant/similar application industry. OR ii. The bidder has been awarded one repeat contract for PHE from End Customer (Owner) / Purchaser (in English) for power plant/similar application industry. Repeat contract shall be considered when the second contract is given by the same purchaser/ owner after lapse of minimum 1 year from execution (viz. supply) of first contract. Supporting documents for execution of the first contract like dispatch^{N2} details or commissioning report or PG test report along with the PO Copy to be furnished, if bidder intends to submit the documents for Repeat Contracts. Notes:- N1 - Purchase order copy, supporting drgs/technical data sheets etc. are to be submitted along with the bid for which the bidder intends to furnish the performance feedbacks / repeat contracts for reference purpose only. N2 - Dispatch details shall include any of the following documents:	

PREPARED BY:	REVIEWED BY:	APPROVED BY:
NAME:	NAME:	NAME:
DESIGNATION / DEPT.:	DESIGNATION / DEPT.:	DESIGNATION / DEPT.:

	PRE-QUALIFYING REQUIREMENTS (TECHNICAL) - PLATE HEAT EXCHANGERS (PHE)	TECH. SPEC. NO: PE-TS-488-179-W001
		TECHNICAL PQR PLATE HEAT EXCHANGERS
		REVISION NO: 00 DATE: 22/08/2026
		SHEET: 2 of 2

	a. E-Way Bill. b. Site receipt/Receipted LR. c. Customer's material dispatch clearance certificate.
	N3 – Purchase order for spare items shall not be considered as repeat order qualifying criteria.
	Any additional document required in support of above documents to establish the correlation between the above documents and the supplied item shall be provided by the bidder.
	3. Bidder to submit all supporting documents in English. If documents submitted by bidder are in language other than English, a self-attested English translated document should also be submitted.
	4. Notwithstanding anything stated above, BHEL reserves the right to assess the capabilities and capacity of the bidder to perform the contract, should the circumstances warrant such assessment in the overall interest of BHEL.
	5. Consideration of offer shall be subject to customer's approval of bidders.

PREPARED BY:	REVIEWED BY:	APPROVED BY:
NAME:	NAME:	NAME:
DESIGNATION / DEPT.:	DESIGNATION / DEPT.:	DESIGNATION / DEPT.:

EXPERIENCE LIST

ANNEXURE-1											
EXPERIENCE LIST											
PROJECT NAME	END CUSTOMER	PHE PARAMETERS			HEAT TRANSFER AREA (sq.m.)	PHE MODEL NUMBER	No. OF PHE's SUPPLIED	TYPE OF FLUID	PLATE MATERIAL	YEAR OF SUPPLY	PERFORMANE FEEDBACK CERTIFICATE ENCLOSED (Y/N)
		FLOW	TEMP RISE	HEAT LOAD							
		(Cu M/Hr.)	(Deg. Cel.)								



To be filled by the bidder on quality and general terms. Requisite documents asked, also to be attached as annexure-F2.1 to F2.17 along with the filled response.

SUB-VENDOR QUESTIONNAIRE

i.	Item/Scope of Sub-contracting		
ii.	Address of the registered office 	Details of Contact Person (Name, Designation, Mobile, Email) 	
iii.	Name and Address of the proposed Sub-vendor's works where item is being manufactured 	Details of Contact Person: (Name, Designation, Mobile, Email) 	
iv.	Annual Production Capacity for proposed item/scope of sub-contracting		
v.	Annual production for last 3 years for proposed item/scope of sub-contracting		
vi.	Details of proposed works		
1.	Year of establishment of present works		
2.	Year of commencement of manufacturing at above works		
3.	Details of change in Works address in past (if any)		
4.	Total Area		
	Covered Area		
5.	Factory Registration Certificate	Details attached at Annexure – F2.1	
6.	Design/ Research & development set-up (No. of manpower, their qualification, machines & tools employed etc.)	Applicable / Not applicable if manufacturing is as per Main Contractor/purchaser design Details attached at Annexure – F2.2 (if applicable)	
7.	Overall organization Chart with Manpower Details (Design/Manufacturing/Quality etc)	Details attached at Annexure – F2.3	
8.	After sales service set up in India, in case of foreign sub-vendor (Location, Contact Person, Contact details etc.)	Applicable / Not applicable Details attached at Annexure – F2.4	
9.	Manufacturing process execution plan with flow chart indicating various stages of manufacturing from raw material to finished product including outsourced process, if any	Details attached at Annexure – F2.5	
10.	Sources of Raw Material/Major Bought Out Item	Details attached at Annexure – F2.6	
11.	Quality Control exercised during receipt of raw material/BOI, in-process, Final Testing, packing	Details attached at Annexure – F2.7	
12.	Manufacturing facilities (List of machines, special process facilities, material handling etc.)	Details attached at Annexure – F2.8	



ANNEXURE-2

SUB-VENDOR QUESTIONNAIRE

13.	Testing facilities (List of testing equipment)	Details attached at Annexure – F2.9
14.	If manufacturing process involves fabrication then-	Applicable / Not applicable
	List of qualified Welders	Details attached at Annexure – F2.10
	List of qualified NDT personnel with area of specialization	(if applicable)
15.	List of out-sourced manufacturing processes with Sub-Vendors' names & addresses	Applicable / Not applicable Details attached at Annexure. –F2.11 (if applicable)
16.	Supply reference list including recent supplies	Details attached at Annexure – F2.12 (as per format given below)
Project/ package	Customer Name	Supplied Item (Type/Rating/Model /Capacity/Size etc)
PO ref no/date	Supplied Quantity	Date of Supply
17.	Product satisfactory performance feedback letter/certificates/End User Feedback	Attached at annexure - F2.13
18.	Summary of Type Test Report (Type Test Details, Report No, Agency, Date of testing) for the proposed product (similar or higher rating) Note:- Reports need not to be submitted	Applicable / Not applicable Details attached at Annexure – F2.14 (if applicable)
19.	Statutory / mandatory certification for the proposed product	Applicable / Not applicable Details attached at Annexure – F2.15 (if applicable)
20.	Copy of ISO 9001 certificate (if available)	Attached at Annexure – F2.16
21.	Product technical catalogues for proposed item (if available)	Details attached at Annexure – F2.17
Name:	Desig:	Sign:
Date:		

Company's Seal/Stamp:-

NUCLEAR POWER CORPORATION OF INDIA LIMITED	
KAIGA ATOMIC POWER PROJECT UNIT 5&6 DRAWING/DOCUMENT SUBMISSION SCHEDULE FOR PLATE TYPE HEAT EXCHANGERS IN ACW SYSTEM	PAGE NO.: PAGE 1 OF 2 REV NO.: 00 DATE: 14/09/26

ANNEXURE-A

(DRAWING/DOCUMENT SUBMISSION SCHEDULE)

S.No.	DESCRIPTION	FIRST SUBMISSION FOR APPROVAL (TIME IN WEEKS FROM RECEIPT OF ORDER)
a)	Technical Datasheet & General Arrangement, layout and outline dimensions of the heat exchangers including nozzle details	4 Weeks from PO date
b)	Foundation drawings, showing load data and anchor bolt location.	4 Weeks from PO date
c)	Design calculation (mechanical and heat transfer) & Performance Curves	4 Weeks from PO date
d)	Inspection and test procedures & Manufacturing Quality Plan	4 Weeks from PO date
e)	Detailed drawings showing construction of Plates, Gaskets, Supports etc.	6 Weeks from PO date
f)	Seismic design analysis reports if applicable	8 Weeks from PO date
g)	Instruction manuals for installation, operation, and maintenance of all the equipment furnished by him. Instruction manuals shall give step by step procedure for any operation likely to be carried out during the life of the plant/equipment including erection, commissioning, testing, operation maintenance, dismantling and repair. Each manual shall also include a together with performance/rating curves of the equipment and test certificates wherever applicable.	2 Weeks after approval/acceptance of all above documents (a to f)
h)	Report on various tests done at shop & material tests reports.	1 week after completion of all inspection activities
i)	Inspection History Document.	2 Weeks after approval/acceptance of all above documents (a to h)
j)	PG Test Procedure	2 Weeks after approval/acceptance of all above documents (a to h)

NUCLEAR POWER CORPORATION OF INDIA LIMITED	
KAIGA ATOMIC POWER PROJECT UNIT 5&6 DRAWING/DOCUMENT SUBMISSION SCHEDULE FOR PLATE TYPE HEAT EXCHANGERS IN ACW SYSTEM	PAGE NO.: PAGE 2 OF 2 REV NO.: 00 DATE: 14/09/26

NOTE:

1. Items listed above from S.No. (a) to (g) only are required to start Manufacturing.
2. BHEL comments on first submission: Within 10 days of Vendor submission
3. BHEL/Customer comments/approval on revised submission: Within 10 days of Vendor submission
4. Re-submission by Vendor: Within 7 days of BHEL / Customer comments

PRICE ADJUSTEMENT-PVC payment terms and conditions

The price adjustment provisions shall be applicable separately for price components relating to Supply of Equipment/Mandatory spare (as applicable), as per price break-up furnished by the Contractor in price schedule.

Price adjustment amounts towards aforesaid components of Contract Price shall be paid in the respective currencies of Contract(INR).

PVC payment shall be linked with Delivery period defined as per NIT terms & conditions. PVC shall be applicable from the month of date of issuance of Purchase Order.

The total amount of PVC payable shall not exceed 10 % of the BASIC contract value for respective order. Negative price variation (without any limit) shall be passed on to BHEL.

PRICE ADJUSTMENT FORMULA FOR SUPPLY AND MANDATORY SPARES –

The amount of price adjustment towards variable portion payable/recoverable on each shipment/despatch shall be computed as under:

EC = EC1 - EC0, EC1 will be computed as follows:

$$EC1 = EC0 \{F + a \times A_1 / A_0 + L_b \times L_1 / L_0\}$$

Where

EC = Adjustment to Ex-Works supply and mandatory spare Price Component expressed in the currency of The Contract (INR) payable to the contractor for each shipment/despatch.

EC1 = Adjusted Amount of Ex-Works supply and mandatory spare Price Component expressed in the currency of the Contract (INR) payable to the Contractor for each shipment/despatch.

EC0 = Ex-Works supply and mandatory spares Price expressed in the currency of the Contract (INR), shipment/despatch wise.

- “F” shall be fixed portion of the Ex-Works Component of the Contract and shall be considered as 0.15.

- “a” shall be co-efficient of major materials/items involved in the Ex-Works Component of the Contract Price and shall be considered as 0.6.

- ‘A’ shall be published price indices of corresponding major materials/items. For this purpose, indices available at Office of the Economic Advisor for Wholesale Price Index (WPI) of Stainless-Steel Coils, Strips & Sheets (<https://eaindustry.nic.in/>).

- ‘L’ shall be per Other consumer price index number for industrial workers (All India Monthly Average) as published (https://rbi.org.in/Scripts/BS_ViewBulletin.aspx)

- 'Lb' shall be co-efficient for labour component in the Ex-Works Component of the Contract Price which shall be considered as 0.25.

Price Indices to be considered:

Material	Index	Base Year
Stainless-Steel Coils, Strips & Sheets	WPI Index at Office of the Economic Advisor	2022-23
Industrial labour	Table No. 19, Sl. no.1 (RBI)	2016

For the indices,

Subscript '0' refers to indices of the month of date of issuance of Purchase Order.

Subscript '1' refers to indices as on month before actual delivery date/month of Shipment / despatch.



NUCLEAR POWER CORPORATION OF INDIA LIMITED

(A Government of India Enterprise)

PROJECT : KAIGA ATOMIC POWER PROJECT – 5 & 6

BHEL DOCUMENT NO : PE-DC-488-613-C2005 (RA)

NPCIL DOCUMENT NO. : KAIGA-6/DC/22000/00064

REVISION NO. :	R0				
DATE OF ISSUE (dd/mm/yy) :	18/07/2026				
TOTAL NO. OF PAGES (Including Cover Sheet & Appendix)	2+100				

TG FOUNDATION - REPORT ON FRS (UNIT 6)

BHARAT HEAVY ELECTRICALS LIMITED				NPCIL'S ACCEPTANCE			
	NAME	SIGN	DATE		NAME	SIGN	DATE
PREPARED BY	K. NEGI		18/07/2026	CHECKED BY	Vijay Singh		19/08/26
CHECKED BY	V. SHARMA		18/07/2026				
REVIEWED BY	S. MISHRA		18/07/2026	REVIEWED BY	V.S. Palaye		19/08/26
APPROVED BY	A. DAS		18/07/2026				
PROOF CONSULTANT (For Civil only)				APPROVED BY	Amit Vijaywargiya		19/08/26
APPROVED BY	AS		10.08.2026				

(For Revision see Revision Control sheet)

issued by



TI Package Contractor:
BHARAT HEAVY ELECTRICALS LTD
 Project Engineering Management
 Power Sector, Plot No. 25, Sector 16A,
 Noida (U.P.)-201301

		DEVELOPMENT CONSULTANTS PVT. LIMITED
Document is approved in conformance to Codal provisions & NPCIL Technical Specifications.		
ACTION	1	
☒	APPROVED	
☐	2 COMMENTED	
☐	3 FOR INFORMATION	
REVIEWED BY : ANIRBAN SARKAR		
SIGNATURE:		
DATE : 10.08.2026		

File name: KAIGA-6/DC/22000/00064.doc

Not for Publication/Presentation outside NPCIL

NUCLEAR POWER CORPORATION OF INDIA LIMITED		
	KAIGA- 5&6 FRS REPORT ON TG FOUNDATION – FOR UNIT 5	Page 8 of 100 Rev. No.: R0 Date: 07 February 2026

Chapter 1. INTRODUCTION

1.1 General

The proposed project of KAIGA-5&6 consisting of two units of 700 MWe PHWR type Nuclear Reactors, to be set up by Nuclear Power Generation Corporation Limited (NPCIL) in Kaiga Village, Karwar Taluka, Uttara Kannada District, Karnataka state.

The TG foundation is housed inside the Turbine Building (refer Figure 1 below) is of reinforced concrete (RC) and consists of top deck, columns and TG mat. Top deck supports the turbine, generator and the exciter. The columns of TG foundation, independent columns supporting the intermediate platforms and retaining walls are supported on the TG mat. The condenser is supported over beams spanning between TG column pedestals. The TG foundation is isolated from the main Turbine Building (TB) by an all-round clear gap (based on analyses) at the operating floor level (EL 118 m) so as to avoid transmission of vibrations to the TB.

1.2 Objective

The objective of the present work is to develop floor response spectra (FRS) for RCC TG deck floor, TG Raft and Condenser beam for Unit-5 of KAIGA-5&6 TI Package.

The floor response spectra will be used for evaluating inertial forces in secondary support systems mounted at TG raft level, Condenser support level and TG deck level, under seismic conditions.

1.3 Scope

The scope includes the generation of compatible time history with reference to IS 1893 [1] [2] under defined support springs by using building sap file “TG_LB_DYN_DBE [R6], TG_UB_DYN_DBE [R7]”, analysis of model, abstraction and presentation of the nodal floor response spectra, its broadening and enveloping and generation of FRS.

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1.4 Report Layout

For presentation purpose, the report has been divided into following chapters:

Chapter-1: Introduction

This chapter covers the general description, objective and scope of the report. The report layout is also furnished in this chapter.

Chapter-2: Generation of floor response spectra

This chapter covers the detail procedure of generation of floor response spectra from ground spectra of IS:1893 (Part-I) by developing compatible time history data from SAP 2000.

Chapter-3: Discussion and Conclusion

This chapter covers the discussion and conclusion used in the report.

Chapter-4: References

This chapter covers references used in the report.

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Chapter 2. GENERATION OF FLOOR RESPONSE SPECTRA

2.1 Brief Approach

This chapter covers the detail procedure of generation of floor response spectra explained in 5 steps as described below. These steps explain about the input references, generation of compatible time history for IS 1893[1], selection of nodal points at different elevation on TG foundation structure, analysis of model in SAP-2000 version 24 and extraction of acceleration time history at selected node points and enveloping and generation of floor response spectra.

2.2 Step 1 (Input – Ground Response Spectrum)

Input Response Spectra (RS) corresponding to IS 1893[1] based on following parameters is considered at Bottom of Raft level (RL (+) 87.00m of TG Foundation.

Zone factor (Z) = 0.16 (For Zone III)

Soil Type = Type-I (Rock/Hard Soil).

Damping = 5% for RCC

2% for Steel

Note: - I and R factors are not incorporated in the input spectrum

Figure 1 gives the Ground Response spectrum (GRES) used for generation of FRS by mode superposition Method and digitized values for GRES for NS & EW Directions are given in Table 1. Input Spectrum Ordinate = $(Z/2) * S_a$

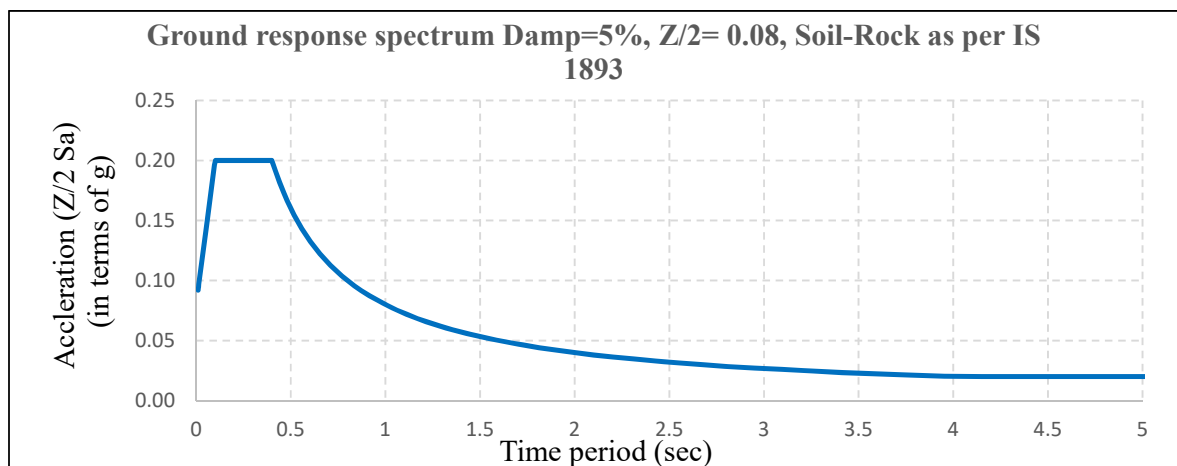


Figure 1- Ground response spectrum (GRES)

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In Vertical direction the input time history is obtained by multiplying compatible time history with a scale factor of 2/3.

Table 1- Input ground response spectrum table –IS 1893

Time period-second	(GRES) Acceleration Z/2*Sa (in terms of g) Damping-5%
0.010	0.092
0.011	0.093
0.013	0.095
0.014	0.097
0.017	0.100
0.020	0.104
0.022	0.107
0.025	0.110
0.027	0.112
0.029	0.115
0.030	0.116
0.032	0.118
0.033	0.120
0.035	0.122
0.037	0.124
0.038	0.126
0.040	0.128
0.042	0.131
0.045	0.133
0.047	0.136
0.049	0.139
0.052	0.142
0.054	0.145
0.057	0.148
0.060	0.152
0.063	0.155
0.066	0.159
0.069	0.163
0.072	0.167
0.076	0.171
0.080	0.176

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Time period-second	(GRES) Acceleration Z/2*Sa (in terms of g) Damping-5%
0.084	0.181
0.088	0.186
0.092	0.191
0.097	0.196
0.102	0.200
0.107	0.200
0.112	0.200
0.118	0.200
0.124	0.200
0.130	0.200
0.137	0.200
0.143	0.200
0.151	0.200
0.158	0.200
0.166	0.200
0.174	0.200
0.183	0.200
0.192	0.200
0.202	0.200
0.212	0.200
0.223	0.200
0.234	0.200
0.245	0.200
0.258	0.200
0.270	0.200
0.284	0.200
0.298	0.200
0.313	0.200
0.329	0.200
0.345	0.200
0.362	0.200
0.381	0.200
0.400	0.200
0.420	0.191
0.441	0.182
0.463	0.173

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Time period-second	(GRES) Acceleration Z/2*Sa (in terms of g) Damping-5%
0.486	0.165
0.510	0.157
0.535	0.149
0.562	0.142
0.590	0.136
0.620	0.129
0.651	0.123
0.683	0.117
0.717	0.112
0.754	0.106
0.791	0.101
0.831	0.096
0.872	0.092
0.916	0.087
0.962	0.083
1.009	0.079
1.060	0.075
1.112	0.072
1.168	0.068
1.227	0.065
1.289	0.062
1.353	0.059
1.421	0.056
1.493	0.054
1.565	0.051
1.645	0.049
1.727	0.046
1.812	0.044
1.905	0.042
2.000	0.040
2.101	0.038
2.203	0.036
2.315	0.035
2.427	0.033
2.551	0.031
2.681	0.030

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Time period-second	(GRES) Acceleration Z/2*Sa (in terms of g) Damping-5%
2.809	0.028
2.950	0.027
3.096	0.026
3.257	0.025
3.413	0.023
3.584	0.022
3.774	0.021
3.953	0.020
4.149	0.020
4.367	0.020
4.587	0.020
4.808	0.020
5.051	0.020
5.291	0.020
5.556	0.020
5.848	0.020
6.135	0.020
6.452	0.020
6.757	0.020
7.092	0.020
7.463	0.020
7.813	0.020
8.197	0.020
8.621	0.020
9.091	0.020
9.524	0.020
10.000	0.020

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2.3 Step 2 Generation of Compatible Time History from IS 1893

First, the compatible time history for IS:1893[1] spectrum developed using SAP 2000 that has the characteristic of peak ground acceleration and frequency contents are in such a way that it qualifies IS 1893[1] ground response spectra GRES. The graphical representation of IS 1893[1] compatible time history is shown in figure-2 and the frequency content of matched time history is shown in figure-3.

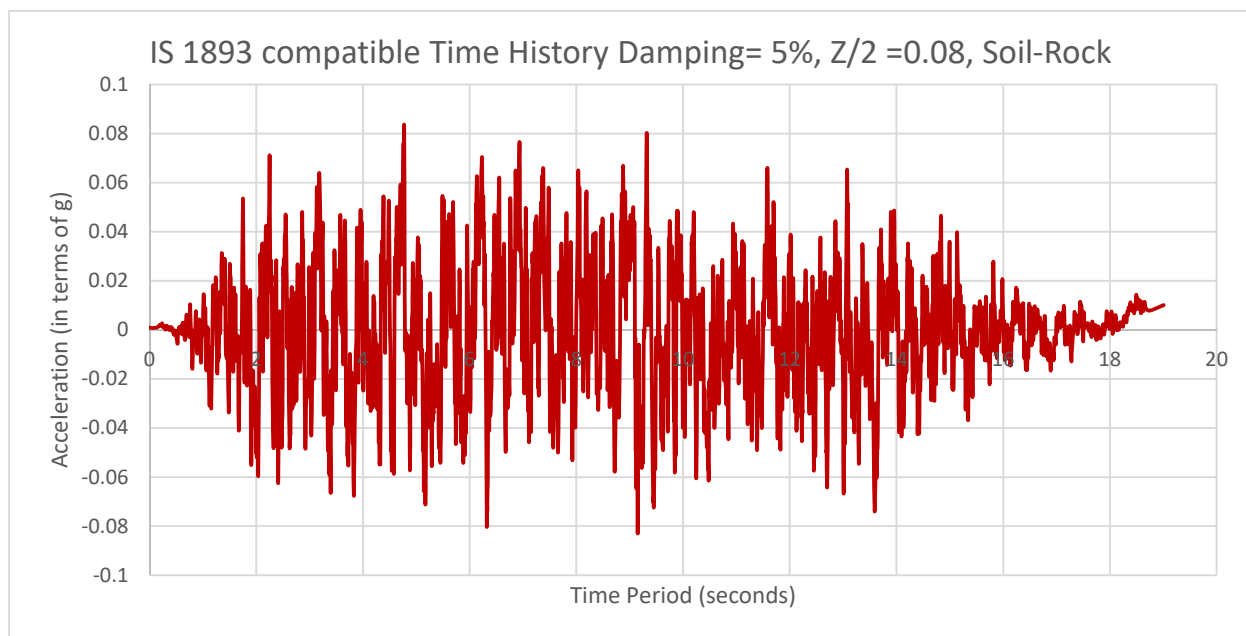


Figure 2- IS 1893: Compatible time history

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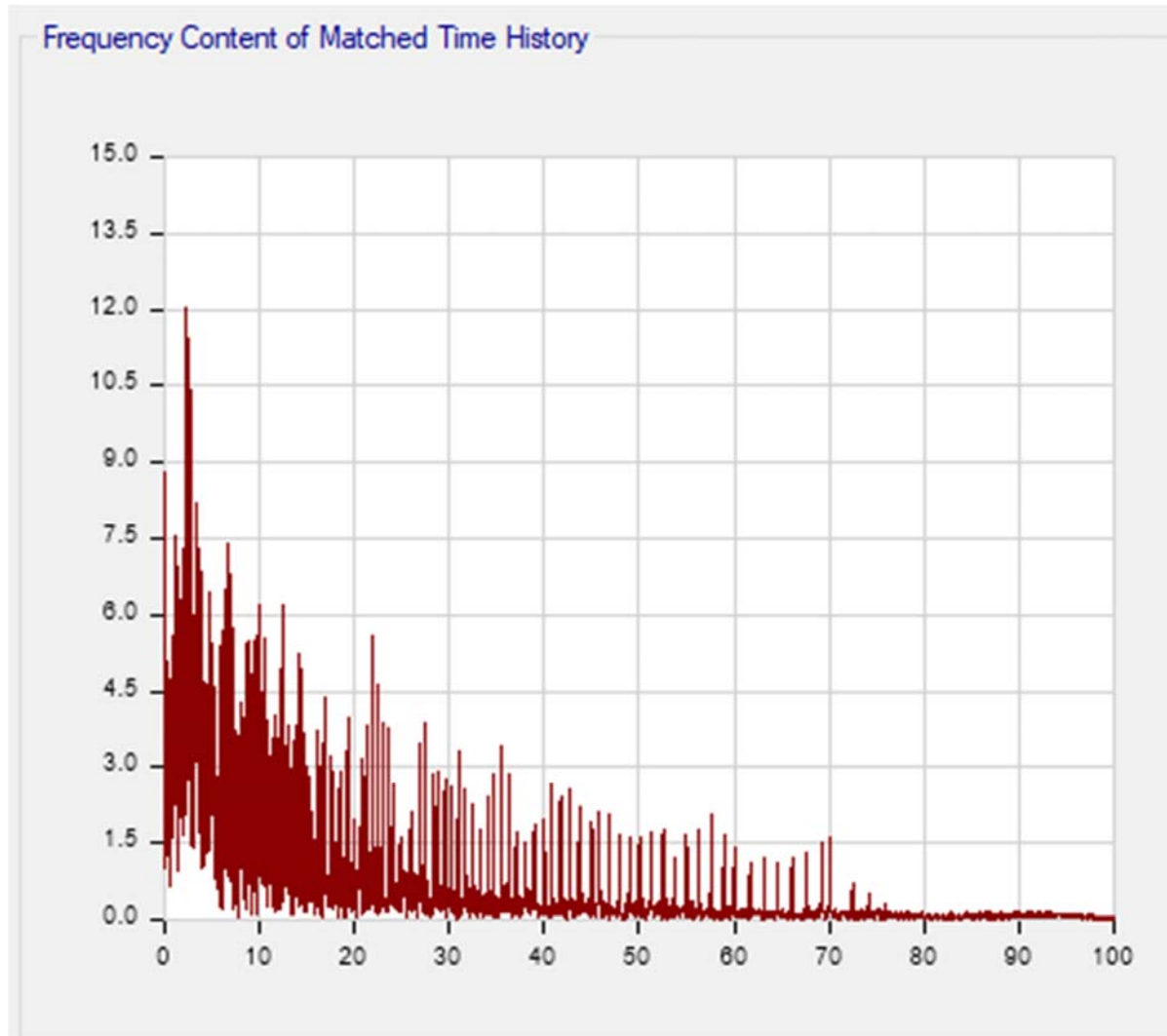


Figure 3- IS 1893: Compatible time history - Frequency content vs Frequency (Hz)

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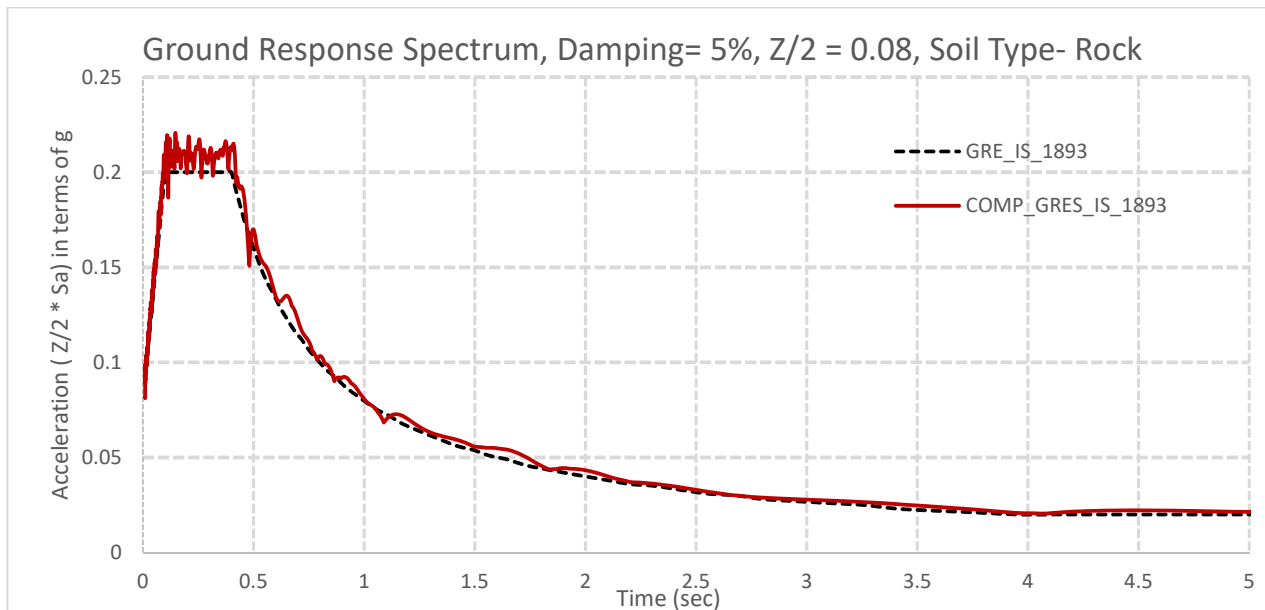


Figure 4- Compatible GRES developed using compatible time history data and compared with GRES of IS:1893

Compatible GRES data is graphically represented in Figure 4 above.

2.4 Step 3 Selection of Nodal Points at floor for FRS generation:

Selective Nodes on Raft level, Condenser Beam Level and all nodes on TG deck level are grouped under Floor name set data in SAP file to analyse the FRS data.

Figure-5 to Figure-9 presents the points considered for FRS generation at various levels.

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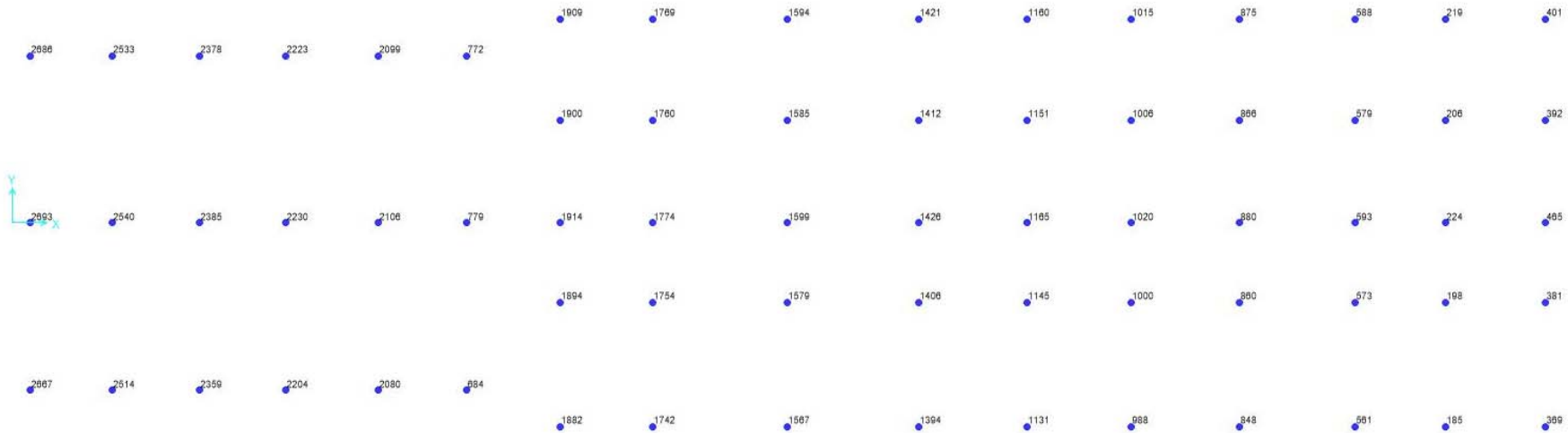
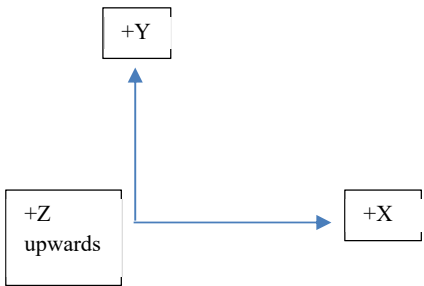


Figure 5- Nodal Points for FRS generation at EL (+) 87.0m



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2.5 Step 4 Generation of Nodal response Spectra:

Modal analysis is performed up to 750 modes in SAP-2000 software for compatible time history for lower bound and upper bound case. The floor nodal response spectra of various floors for selected nodes are generated and graphically represented with 15% broadening in line with the provision of ASCE-4 [3].

The modal mass participation versus frequency data and its graphical representation has been shown in Appendix C for lower bound and upper bound case.

2.6 Step 5 Enveloping and Development of Design Floor Response Spectra:

The FRS is generated by joining the upper outline enveloping of nodal response spectra for respective floor. The upper out line enveloping is done so as to cover the response of entire extend floor in a single spectrum.

This generated Floor Response Spectra (FRS) in X, Y and Z directions for floors of TG (Unit-5) is presented in graphical form and has to be multiplied by I/R , where I –Importance factor and R - Response Reduction Factor [1 & 2] for purpose of seismic qualification of floor mounted equipment.

Floor response for all nodal points are enveloped considering maximum values for a particular frequency (The frequency interval of 0.1Hz is considered). Also, in case of any dip in floor response spectra, the same has been ignored.

The graphical representation of floor response spectra in each direction represented in figure 10 to figure 19 in Appendix-A and enveloped data of FRS is presented in Appendix -D (Table-6 to Table-7).

2.7 Result of Time History Analysis:

Results of Time History Analysis for TG (Unit-5) are presented below in the form of maximum nodal displacement values at floor locations in Table 2. The nodal displacement values obtained from SAP model are divided by $g \times R/ I$ to bring it equivalent to GRES spectre.

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Permissible lateral displacements are calculated as $0.004 \times H$ as per clause No. 7.11.1 of IS 1893 [1].

Permissible displacement for seismic load = $0.004 \times 29 = 116\text{mm}$ (clause 6.3.9 of DBR.)

Where H is the height of TG deck from bottom of base Raft, $H = 29\text{m}$ (i.e. $116\text{m} - 87\text{m}$)

Maximum displacement is less than permissible displacement.

PLATE HEAT EXCHANGERS ARE LOCATED AT EL 93.3 M

Table 2- Maximum Nodal Displacement

Case No.	EL (m)	EQ Direction	Displacement as per Time History SAP file (Δ) (mm)	Displacement (mm) = $R \times (\Delta)$ ($R=3$)	Allowable Displacement(mm) =
Lower Bound	87	X	0.050	0.150	116
		Y	0.064	0.192	116
		Z	0.073	0.219	116
	93.3*	X	0.050	0.150	116
		Y	0.064	0.192	116
		Z	0.073	0.219	116
	99.85	X	3.23	9.69	116
		Y	3.28	9.84	116
		Z	0.11	0.33	116
	109.3	X	16.52	49.56	116
		Y	10.35	31.05	116
		Z	1.06	3.18	116
	114.65	X	17.04	51.12	116
		Y	16.32	48.96	116
		Z	0.36	1.08	116
	118	X	17.17	51.51	116
		Y	17.02	51.06	116
		Z	0.46	1.38	116

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Case No.	EL (m)	EQ Direction	Displacement as per Time History SAP file (Δ) (mm)	Displacement (mm) = $R \times (\Delta)$ ($R=3$)	Allowable Displacement(mm) =
Upper Bound	87	X	0.027	0.081	116
		Y	0.037	0.111	116
		Z	0.041	0.123	116
	93.3*	X	0.027	0.081	116
		Y	0.037	0.111	116
		Z	0.041	0.123	116
	99.85	X	3.165	9.495	116
		Y	2.968	8.904	116
		Z	0.08	0.24	116
	109.3	X	16.47	49.41	116
		Y	10.09	30.27	116
		Z	1.00	3.00	116
	114.65	X	16.95	50.85	116
		Y	15.35	46.05	116
		Z	0.32	1.77	116
	118	X	17.08	51.24	116
		Y	15.96	47.88	116
		Z	0.41	1.23	116

*Note- Grade Floor @ EL (+)93.30m is supported on Fillcrete over top of TG raft. Hence, displacement of Grade Floor @ EL (+)93.30m is considered same as of TG Raft @ EL (+)87.0m.

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Chapter 3. CONCLUSION

FRS, as generated in this document, does not consider any Response Reduction effect (i.e., the FRS is generated by a ground time history which has not been multiplied by I/R where I – Importance factor and R is Response reduction factor) (Refer Cl.no. 8.6 of IS: 1893 Part-IV-2015).

Enveloped/broadened FRS as presented in Appendix-A shall be used for analysis of any equipment/system supported at TG top deck level, after multiplying the FRS by an appropriate I/R value pertaining to the respective equipment/system.

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Chapter 4. REFERENCES

4.1 Applicable Codes and Reference Documents

4.1.1 Applicable Codes

S.No.	Codes and Standards	
1	IS:1893 (Part 1)-2016	Criteria for Earthquake Resistant Design of structures: Part 1 General Provisions and Buildings
2	IS:1893 (Part 4)-2015	Criteria for Earthquake Resistant Design of structures: Part 4 Industrial Structures including Stack-like Structures
3	ASCE 4-98	Seismic Analysis of Nuclear Safety Related Nuclear Structures and Commentary.

4.1.2 Reference Documents

S. No.	Input Drawings / Documents	Document Title
R1	KAIGA-5&6/40000/PROCUREMENT SPECIFICATION/MS-1	SPECIFIC TECHNICAL REQUIREMENTS OF CIVIL STRUCTURES
R2	KAIGA-5&6/40000/PROCUREMENT SPECIFICATION/MS-1	SECTION C -2-1: SPECIFIC TECHNICAL REQUIREMENTS OF CIVIL STRUCTURES: ADDENDUM -2
R3	KAIGA-5&6-10000-5001-GA	MAIN PLANT LAYOUT
R4	KAIGA-5/DC/22000/00042	TG FOUNDATION- REPORT ON STATIC ANALYSIS
R5	KAIGA-5/DC/22000/00043	TG FOUNDATION- REPORT ON SEISMIC ANALYSIS
R6	TG_LB_DYN_DBE	SAP FILE FOR TG FOUNDATION – LOWER BOUND
R7	TG_UB_DYN_DBE	SAP FILE FOR TG FOUNDATION – UPPER BOUND

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Appendix –A

FRS PLOTS OF TG FOUNDATION

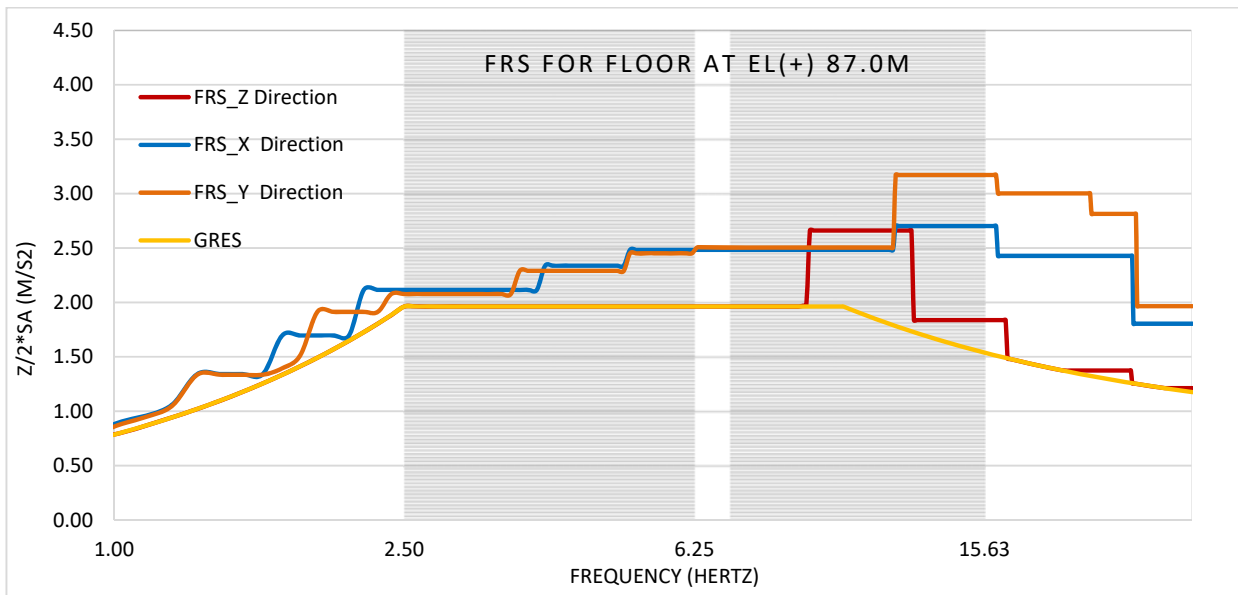


Figure 10- FRS plot for TG Raft at EL 87.0m in LB

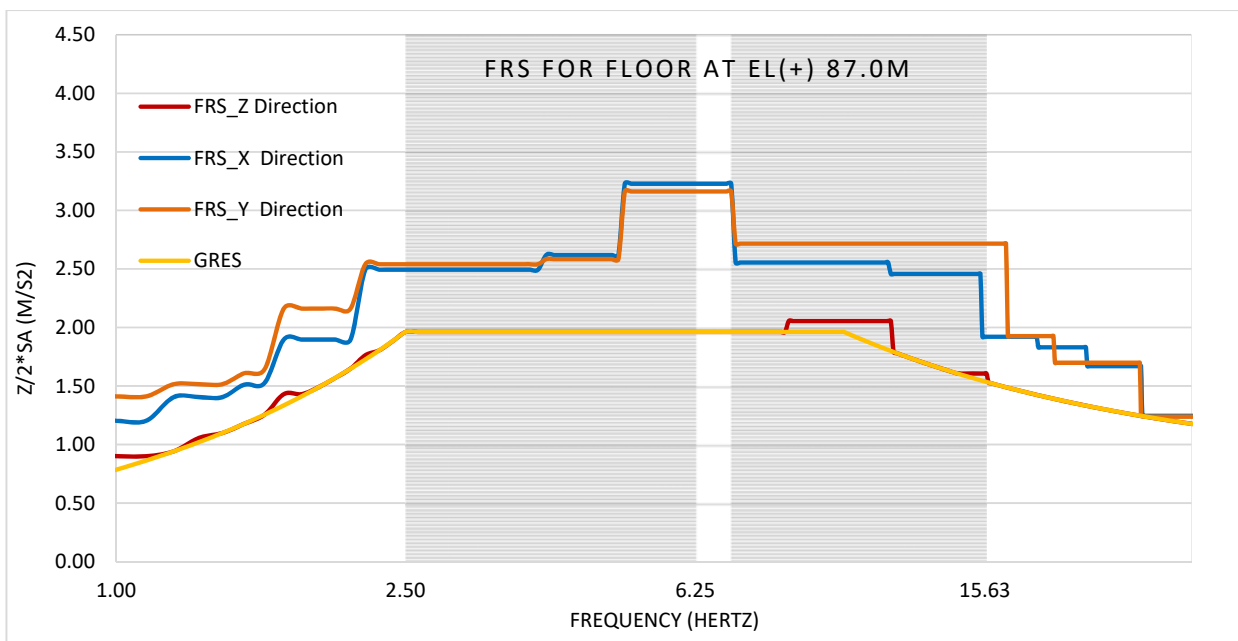


Figure 11- FRS plot for TG Raft at EL 87.0m in UB

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Appendix –B

Table 3- GRES Data for Compatible Time History

Time Period (sec)	Acceleration Z/2 * Sa (m/sec ²) (in terms of g) Damping – 5%
0.010	0.0817
0.011	0.0936
0.012	0.0983
0.014	0.0981
0.017	0.1019
0.020	0.1048
0.022	0.1088
0.025	0.1161
0.027	0.1138
0.029	0.1201
0.030	0.1203
0.032	0.1195
0.033	0.1256
0.035	0.1281
0.037	0.1285
0.038	0.1306
0.040	0.1357
0.042	0.1368
0.045	0.1382
0.047	0.1411
0.049	0.1460
0.052	0.1494
0.054	0.1499
0.057	0.1536
0.060	0.1529
0.063	0.1624
0.066	0.1638
0.069	0.1714
0.072	0.1739
0.076	0.1790
0.080	0.1840
0.084	0.1908
0.088	0.1949
0.092	0.2003
0.097	0.2044

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Time Period (sec)	Acceleration $Z/2 * S_a$ (m/sec ²) (in terms of g) Damping – 5%
0.102	0.2094
0.107	0.2067
0.112	0.2081
0.118	0.2121
0.124	0.2090
0.130	0.2086
0.137	0.2107
0.143	0.2080
0.151	0.2066
0.158	0.2083
0.166	0.2103
0.174	0.2094
0.183	0.2104
0.192	0.2071
0.202	0.2066
0.212	0.2098
0.223	0.2087
0.234	0.2063
0.245	0.2123
0.258	0.2159
0.270	0.2091
0.284	0.2075
0.298	0.2078
0.313	0.2054
0.329	0.2096
0.344	0.2097
0.362	0.2105
0.380	0.2125
0.399	0.2132
0.420	0.1986
0.440	0.1913
0.462	0.1825
0.484	0.1575
0.509	0.1655
0.534	0.1542
0.560	0.1496
0.590	0.1386
0.619	0.1320
0.648	0.1350

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Time Period (sec)	Acceleration $Z/2 * S_a$ (m/sec ²) (in terms of g) Damping – 5%
0.683	0.1280
0.717	0.1168
0.749	0.1111
0.796	0.1031
0.834	0.0987
0.873	0.0916
0.914	0.0923
0.957	0.0876
1.005	0.0801
1.059	0.0743
1.106	0.0707
1.157	0.0726
1.227	0.0678
1.275	0.0645
1.343	0.0615
1.419	0.0593
1.483	0.0565
1.552	0.0551
1.627	0.0545
1.710	0.0515
1.803	0.0455
1.906	0.0444
1.981	0.0436
2.063	0.0415
2.198	0.0372
2.300	0.0363
2.411	0.0347
2.532	0.0323
2.668	0.0302
2.741	0.0293
2.900	0.0283
3.079	0.0275
3.177	0.0270
3.390	0.0256
3.509	0.0247
3.776	0.0224
3.922	0.0210
4.084	0.0205
4.257	0.0218

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Time Period (sec)	Acceleration $Z/2 * S_a$ (m/sec²) (in terms of g) Damping – 5%
4.447	0.0222
4.655	0.0221
4.880	0.0216
5.129	0.0213
5.408	0.0216
5.718	0.0216
6.065	0.0213
6.071	0.0213
6.456	0.0209
6.901	0.0209
7.413	0.0213
7.420	0.0213
8.004	0.0210
8.011	0.0210
8.701	0.0212
8.709	0.0212
10.000	0.0199

Appendix –D

Table 6- Design Floor response spectra for TG in LB

Frequency (HZ)	Acceleration in X -Direction Z/2*Sa (m/s2)					Acceleration in Y -Direction Z/2*Sa(m/s2)					Acceleration in Z -Direction Z/2*Sa (m/s2)				
	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M
0.10	0.23	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.20	0.20	0.20	0.20	0.20
0.20	0.23	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.20	0.20	0.20	0.20	0.20
0.30	0.26	0.26	0.31	0.31	0.31	0.26	0.26	0.28	0.28	0.28	0.24	0.24	0.24	0.24	0.24
0.40	0.33	0.36	0.37	0.37	0.37	0.33	0.32	0.35	0.40	0.40	0.31	0.31	0.31	0.31	0.31
0.50	0.44	0.46	0.66	0.67	0.67	0.44	0.42	0.50	0.52	0.52	0.39	0.39	0.39	0.39	0.39
0.60	0.56	0.55	0.88	0.90	0.90	0.56	0.59	0.70	0.83	0.84	0.47	0.47	0.47	0.47	0.47
0.70	0.58	0.65	1.13	1.15	1.16	0.58	0.65	0.81	0.88	0.89	0.55	0.55	0.55	0.55	0.55
0.80	0.65	0.72	1.44	1.47	1.48	0.65	0.73	0.92	1.16	1.19	0.63	0.63	0.63	0.63	0.63
0.90	0.71	0.86	1.99	2.03	2.04	0.71	0.78	1.13	1.42	1.46	0.74	0.80	0.71	0.71	0.71
1.00	0.88	1.23	6.54	6.73	6.78	0.86	0.96	1.49	2.05	2.09	0.78	0.80	0.78	0.78	0.78
1.10	0.95	1.71	6.54	6.73	6.78	0.94	1.25	2.02	3.01	3.11	0.86	0.86	0.86	0.86	0.86
1.20	1.06	1.71	6.54	6.73	6.78	1.05	1.40	6.28	7.67	7.99	0.94	0.94	0.94	0.94	0.94
1.30	1.34	1.71	6.54	6.73	6.78	1.34	1.94	6.28	7.67	7.99	1.02	1.02	1.02	1.02	1.02
1.40	1.34	1.71	6.54	6.73	6.78	1.34	1.94	6.28	7.67	7.99	1.10	1.10	1.10	1.10	1.10
1.50	1.34	1.71	3.58	3.36	3.37	1.34	1.94	6.28	7.67	7.99	1.18	1.18	1.18	1.18	1.18
1.60	1.34	1.71	3.58	2.90	2.92	1.34	1.94	6.28	7.67	7.99	1.26	1.26	1.26	1.26	1.26
1.70	1.70	1.71	3.58	2.58	2.59	1.39	1.94	6.28	7.67	7.99	1.33	1.33	1.33	1.33	1.33
1.80	1.70	1.71	3.58	2.38	2.39	1.51	1.94	6.28	7.67	7.99	1.41	1.41	1.41	1.41	1.41
1.90	1.70	1.71	3.58	2.18	2.19	1.91	1.94	5.09	5.41	5.76	1.49	1.49	1.49	1.49	1.49
2.00	1.70	1.71	3.58	2.15	2.17	1.91	1.94	5.09	5.41	5.76	1.57	2.14	1.57	1.57	1.57
2.10	1.70	1.71	3.58	1.93	1.95	1.91	1.94	5.09	5.41	5.76	1.65	2.14	1.65	1.65	1.65
2.20	2.12	2.63	3.58	1.91	1.87	1.91	1.94	5.09	5.41	5.76	1.73	2.14	1.83	1.73	1.73
2.30	2.12	2.63	3.58	1.91	1.87	1.91	1.94	5.09	5.41	5.76	1.81	2.14	1.83	1.81	1.81
2.40	2.12	2.63	3.58	1.91	1.88	2.08	1.94	5.09	5.41	5.76	1.88	2.14	1.88	1.88	1.88
2.50	2.12	2.63	3.58	1.96	1.96	2.08	1.96	5.09	5.41	5.76	1.96	2.14	1.96	1.96	1.96
2.60	2.12	2.63	3.58	1.96	1.96	2.08	1.96	5.09	5.41	5.76	1.96	2.14	1.96	1.96	1.96
2.70	2.12	2.63	3.58	1.96	1.96	2.08	1.96	5.09	5.41	5.76	1.96	2.14	1.96	1.96	1.96
2.80	2.12	2.79	3.58	1.96	1.96	2.08	1.96	5.09	5.41	5.76	1.96	2.34	1.96	1.96	1.96
2.90	2.12	2.79	3.58	1.96	1.96	2.08	1.96	5.09	5.41	5.76	1.96	2.34	1.96	1.96	1.96
3.00	2.12	2.79	3.58	1.96	1.96	2.08	1.96	5.09	5.41	5.76	1.96	2.34	1.96	1.96	1.96
3.10	2.12	2.79	3.58	1.96	1.96	2.08	1.96	5.09	5.41	5.76	1.96	2.34	1.96	1.96	1.96
3.20	2.12	2.79	3.58	1.96	1.96	2.08	1.96	5.09	5.41	5.76	1.96	2.34	2.17	1.96	1.96
3.30	2.12	2.79	3.58	1.96	1.96	2.08	1.96	5.09	5.41	5.76	1.96	2.34	2.25	1.96	1.96

Frequency (HZ)	Acceleration in X -Direction Z/2*Sa (m/s2)					Acceleration in Y -Direction Z/2*Sa(m/s2)					Acceleration in Z -Direction Z/2*Sa (m/s2)				
	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M
3.40	2.12	3.28	3.58	1.96	1.96	2.08	1.96	5.09	5.41	5.76	1.96	2.34	2.52	1.96	1.96
3.50	2.12	3.28	3.58	1.96	1.96	2.08	1.96	5.09	5.41	5.76	1.96	2.34	2.52	1.96	1.96
3.60	2.12	3.28	3.58	1.96	1.96	2.29	2.17	5.09	5.41	5.76	1.96	2.34	2.52	1.96	1.96
3.70	2.12	3.28	3.58	1.96	1.96	2.29	2.17	5.09	5.41	5.76	1.96	2.34	2.52	1.96	1.96
3.80	2.12	3.28	3.58	1.96	1.96	2.29	2.17	5.09	5.41	5.76	1.96	2.34	2.52	1.96	1.96
3.90	2.34	3.28	3.58	1.96	1.96	2.29	2.17	5.09	5.41	5.76	1.96	2.34	2.52	1.96	1.96
4.00	2.34	3.28	3.58	1.96	1.96	2.29	2.17	5.09	5.41	5.76	1.96	2.49	2.52	2.04	1.96
4.10	2.34	4.30	3.58	1.96	1.96	2.29	2.17	5.09	5.41	5.76	1.96	2.49	3.92	2.04	1.96
4.20	2.34	4.30	3.58	1.96	1.96	2.29	2.17	5.09	5.41	5.76	1.96	2.49	3.92	2.04	1.96
4.30	2.34	4.30	3.58	1.96	1.96	2.29	2.17	5.09	5.41	5.76	1.96	2.49	3.92	2.04	1.96
4.40	2.34	4.30	3.58	1.96	1.96	2.29	2.17	5.09	5.41	5.76	1.96	2.49	3.92	2.04	1.96
4.50	2.34	4.30	3.58	1.96	1.96	2.29	2.30	5.09	5.41	5.76	1.96	2.49	3.92	2.04	1.96
4.60	2.34	4.30	3.58	1.96	1.96	2.29	2.79	5.09	5.41	5.76	1.96	2.49	3.92	2.04	2.26
4.70	2.34	4.30	3.58	1.96	1.96	2.29	2.79	5.09	5.41	5.76	1.96	2.49	3.92	2.04	2.26
4.80	2.34	4.30	3.58	1.96	1.96	2.29	2.79	5.09	5.41	5.76	1.96	2.49	3.92	2.04	2.26
4.90	2.34	4.30	3.58	1.96	1.96	2.29	2.79	5.09	5.41	5.76	1.96	2.49	3.92	2.04	2.26
5.00	2.34	4.35	3.58	1.96	1.96	2.29	2.79	5.09	5.41	5.76	1.96	2.49	3.92	2.04	2.26
5.10	2.48	4.44	3.58	1.96	1.96	2.45	2.79	5.09	5.41	5.76	1.96	2.49	3.92	2.04	2.26
5.20	2.48	12.02	3.58	1.96	1.96	2.45	2.79	5.09	5.41	5.76	1.96	2.49	3.92	2.30	2.26
5.30	2.48	12.02	3.58	1.96	1.96	2.45	2.79	5.09	5.41	5.76	1.96	2.49	4.03	2.30	2.26
5.40	2.48	12.02	3.58	1.96	1.96	2.45	2.79	5.09	5.41	5.76	1.96	2.49	4.06	2.30	2.26
5.50	2.48	12.02	3.58	1.96	1.96	2.45	2.79	5.09	5.41	5.76	1.96	2.49	4.23	2.30	2.26
5.60	2.48	12.02	3.58	1.96	1.96	2.45	2.79	5.09	5.41	5.76	1.96	2.49	4.41	2.30	2.26
5.70	2.48	12.02	3.58	1.96	1.96	2.45	2.87	5.09	5.41	5.76	1.96	2.49	14.21	2.30	2.26
5.80	2.48	12.02	3.58	1.96	1.96	2.45	3.17	5.09	5.41	5.76	1.96	2.49	14.21	2.30	2.38
5.90	2.48	12.02	3.58	1.96	1.96	2.45	3.42	5.09	5.41	5.76	1.96	2.49	14.21	2.30	2.53
6.00	2.48	12.02	3.58	1.96	1.96	2.45	3.54	5.09	5.41	5.76	1.96	2.49	14.21	2.30	3.43
6.10	2.48	12.02	3.58	1.96	1.96	2.45	3.79	5.09	5.41	5.76	1.96	2.49	14.21	2.30	3.43
6.20	2.48	12.02	3.58	1.96	1.96	2.45	5.59	5.09	5.41	5.76	1.96	2.49	14.21	2.30	3.43
6.30	2.48	12.02	3.58	1.96	1.96	2.50	5.59	5.09	5.41	5.76	1.96	2.61	14.21	2.30	3.43
6.40	2.48	12.02	3.58	1.96	1.96	2.50	5.59	5.09	5.41	5.76	1.96	2.61	14.21	2.45	3.43
6.50	2.48	12.02	3.58	1.96	1.96	2.50	5.59	5.09	5.41	5.76	1.96	2.61	14.21	2.59	3.43
6.60	2.48	12.02	3.58	1.96	1.96	2.50	5.59	5.09	5.41	5.76	1.96	2.61	14.21	2.61	3.43
6.70	2.48	12.02	3.58	1.96	1.96	2.50	5.59	5.09	5.41	5.76	1.96	2.61	14.21	2.67	3.43
6.80	2.48	12.02	3.58	1.96	1.96	2.50	5.59	5.09	5.41	5.76	1.96	2.61	14.21	2.74	3.43
6.90	2.48	12.02	3.58	1.96	1.96	2.50	5.59	5.09	5.41	5.76	1.96	2.61	14.21	2.84	3.43
7.00	2.48	12.02	3.58	1.96	1.96	2.50	5.59	5.09	5.41	5.76	1.96	2.61	14.21	2.97	3.43

Frequency (HZ)	Acceleration in X -Direction Z/2*Sa (m/s2)					Acceleration in Y -Direction Z/2*Sa(m/s2)					Acceleration in Z -Direction Z/2*Sa (m/s2)				
	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M
7.10	2.48	12.02	3.58	1.96	1.96	2.50	5.59	5.09	5.41	5.76	1.96	2.61	14.21	2.99	3.43
7.20	2.48	12.02	3.58	1.96	1.96	2.50	5.59	5.09	5.41	5.76	1.96	2.61	14.21	3.17	3.61
7.30	2.48	7.86	3.58	1.96	1.96	2.50	5.59	5.09	5.41	5.76	1.96	2.61	14.21	3.34	3.80
7.40	2.48	7.86	3.58	1.96	1.96	2.50	5.59	5.09	5.41	5.76	1.96	2.61	14.21	3.46	3.95
7.50	2.48	7.86	3.58	1.96	1.96	2.50	5.59	5.09	5.41	5.76	1.96	2.61	14.21	3.55	4.06
7.60	2.48	7.86	3.58	1.96	1.96	2.50	5.59	5.09	5.41	5.76	1.96	2.61	14.21	7.01	4.16
7.70	2.48	7.86	3.58	1.96	1.96	2.50	5.59	5.09	5.41	5.76	1.96	2.61	14.21	7.01	8.88
7.80	2.48	7.86	3.58	1.96	1.96	2.50	5.59	5.09	5.41	5.76	1.96	3.07	14.21	7.01	8.88
7.90	2.48	7.86	3.58	1.96	1.96	2.50	5.59	2.85	3.90	4.46	1.96	3.07	14.21	7.01	8.88
8.00	2.48	7.86	3.58	1.96	1.96	2.50	5.59	2.72	3.71	4.27	1.96	3.07	7.11	7.01	8.88
8.10	2.48	7.86	3.58	1.96	1.96	2.50	5.59	2.56	3.57	4.06	1.96	3.07	6.92	7.01	8.88
8.20	2.48	7.86	3.58	1.96	1.96	2.50	5.59	2.46	3.35	3.79	1.96	3.07	6.64	7.01	8.88
8.30	2.48	7.86	3.58	1.96	1.96	2.50	5.59	2.40	3.29	3.59	1.96	3.07	6.30	7.01	8.88
8.40	2.48	7.86	3.58	1.96	1.96	2.50	5.59	2.35	3.18	3.47	1.96	3.07	6.25	7.01	8.88
8.50	2.48	7.86	3.58	1.96	1.96	2.50	4.77	2.34	3.02	3.30	1.96	3.07	6.18	7.01	8.88
8.60	2.48	7.86	3.58	1.96	1.96	2.50	4.68	2.34	2.85	3.11	1.96	3.07	6.04	7.01	8.88
8.70	2.48	7.86	3.58	1.96	1.96	2.50	4.50	2.34	2.81	3.07	1.96	3.07	5.81	7.01	8.88
8.80	2.48	7.86	3.58	1.96	1.96	2.50	4.22	2.34	2.73	2.98	1.97	3.07	5.52	7.01	8.88
8.90	2.48	7.86	3.58	1.96	1.96	2.50	3.92	2.34	2.63	2.86	1.98	3.07	5.24	7.01	8.88
9.00	2.48	7.86	3.58	1.96	1.96	2.50	3.68	2.34	2.54	2.75	2.66	3.07	5.15	7.01	8.88
9.10	2.48	7.86	3.58	1.96	1.96	2.50	3.51	2.34	2.46	2.67	2.66	3.07	5.15	7.01	8.88
9.20	2.48	7.86	3.58	1.96	1.96	2.50	3.44	2.34	2.39	2.60	2.66	3.07	5.15	7.01	8.88
9.30	2.48	7.86	3.58	1.96	1.96	2.50	3.43	2.34	2.35	2.53	2.66	3.07	5.15	7.01	8.88
9.40	2.48	7.86	3.58	1.96	1.96	2.50	3.42	2.34	2.29	2.47	2.66	3.07	5.15	7.01	8.88
9.50	2.48	7.86	3.58	1.96	1.96	2.50	3.38	2.34	2.28	2.42	2.66	3.07	5.15	7.01	8.88
9.60	2.48	7.86	3.58	1.96	1.96	2.50	3.32	2.34	2.28	2.39	2.66	3.07	5.15	7.01	8.88
9.70	2.48	7.86	3.58	1.96	1.96	2.50	3.22	2.34	2.28	2.38	2.66	3.07	5.15	7.01	8.88
9.80	2.48	7.86	3.58	1.96	1.96	2.50	3.21	2.34	2.28	2.34	2.66	3.07	5.15	7.01	8.88
9.90	2.48	7.86	3.58	1.96	1.96	2.50	3.21	2.34	2.28	2.28	2.66	3.07	5.15	7.01	8.88
10.00	2.48	7.86	3.58	1.96	1.96	2.50	3.21	2.34	2.28	2.28	2.66	3.07	5.15	7.01	8.88
10.10	2.48	7.86	3.58	1.95	1.95	2.50	3.21	2.34	2.28	2.28	2.66	3.07	5.15	7.01	8.88
10.20	2.48	7.86	3.58	1.94	1.94	2.50	3.21	2.34	2.28	2.28	2.66	3.07	5.15	7.01	8.88
10.30	2.48	7.86	3.58	1.93	1.93	2.50	3.21	2.34	2.28	2.28	2.66	3.07	5.15	7.01	8.88
10.40	2.48	7.86	3.58	1.92	1.92	2.50	3.21	2.34	2.28	2.28	2.66	3.07	5.15	7.01	8.88
10.50	2.48	7.86	3.58	1.91	1.91	2.50	3.21	2.34	2.28	2.28	2.66	3.07	5.15	5.20	8.88
10.60	2.48	7.86	3.58	1.90	1.90	2.50	3.21	2.34	2.28	2.28	2.66	3.07	5.15	5.20	8.77
10.70	2.48	7.86	3.58	1.88	1.88	2.50	3.21	2.34	2.28	2.28	2.66	2.74	5.15	5.20	8.77

Frequency (HZ)	Acceleration in X -Direction Z/2*Sa (m/s2)					Acceleration in Y -Direction Z/2*Sa(m/s2)					Acceleration in Z -Direction Z/2*Sa (m/s2)				
	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M
10.80	2.48	7.86	3.58	1.87	1.87	2.50	3.21	2.34	2.28	2.28	2.66	2.74	5.15	5.20	8.77
10.90	2.48	7.86	3.58	1.86	1.86	2.50	3.21	2.34	2.28	2.28	2.66	2.74	5.15	5.20	8.77
11.00	2.48	7.86	3.58	1.85	1.85	2.50	3.21	2.34	2.28	2.28	2.66	2.74	5.15	5.20	8.77
11.10	2.48	7.86	3.58	1.85	1.85	2.50	3.21	2.34	2.28	2.28	2.66	2.74	5.15	5.20	8.77
11.20	2.48	6.36	3.58	1.84	1.84	2.50	3.21	2.34	1.93	2.28	2.66	2.74	5.15	5.20	8.77
11.30	2.48	6.23	3.58	1.83	1.83	2.50	3.21	2.34	1.91	2.28	2.66	2.74	3.48	5.20	8.77
11.40	2.48	6.05	1.98	1.82	1.82	2.50	3.21	2.34	1.90	2.28	2.66	2.74	3.48	5.20	8.77
11.50	2.48	5.85	1.92	1.81	1.81	2.50	3.21	2.34	1.89	2.28	2.66	2.74	3.48	5.20	8.77
11.60	2.48	5.64	1.85	1.80	1.80	2.50	3.21	2.34	1.88	2.28	2.66	2.74	3.48	5.20	8.77
11.70	2.48	5.45	1.79	1.79	1.79	2.50	3.21	2.34	1.87	2.07	2.66	2.74	3.48	5.20	8.77
11.80	2.70	5.30	1.78	1.78	1.78	3.17	3.21	2.34	1.87	2.07	2.66	2.74	3.48	5.20	8.77
11.90	2.70	5.24	1.77	1.77	1.77	3.17	3.21	2.34	1.87	2.07	2.66	2.74	3.48	5.20	8.77
12.00	2.70	5.24	1.77	1.77	1.77	3.17	3.21	2.34	1.87	2.07	2.66	2.74	3.48	5.20	8.77
12.10	2.70	5.16	1.76	1.76	1.76	3.17	3.21	2.34	1.87	2.07	2.66	2.74	3.48	5.20	8.77
12.20	2.70	5.03	1.75	1.75	1.75	3.17	3.21	2.34	1.87	2.07	2.66	2.74	3.48	5.20	8.77
12.30	2.70	4.84	1.74	1.74	1.74	3.17	3.21	2.34	1.87	2.07	2.66	2.74	3.48	5.20	8.77
12.40	2.70	4.61	1.73	1.73	1.73	3.17	3.21	2.34	1.87	2.07	2.66	2.74	3.48	5.20	8.77
12.50	2.70	4.48	1.73	1.73	1.73	3.17	3.21	2.34	1.87	2.07	1.84	2.74	3.48	3.97	8.77
12.60	2.70	4.40	1.72	1.72	1.72	3.17	3.21	2.34	1.87	2.07	1.84	2.74	3.48	3.97	6.38
12.70	2.70	4.25	1.71	1.71	1.71	3.17	3.21	2.34	1.87	2.07	1.84	2.67	3.48	3.97	6.07
12.80	2.70	4.04	1.70	1.70	1.70	3.17	3.21	2.34	1.87	2.07	1.84	2.62	3.48	3.97	5.74
12.90	2.70	3.86	1.70	1.70	1.70	3.17	3.21	2.34	1.87	2.07	1.84	2.54	3.48	3.97	5.65
13.00	2.70	3.76	1.69	1.69	1.69	3.17	3.21	2.34	1.87	2.07	1.84	2.48	3.48	3.97	5.54
13.10	2.70	3.66	1.68	1.68	1.68	3.17	3.21	2.34	1.87	2.07	1.84	2.48	3.48	3.97	5.42
13.20	2.70	3.57	1.68	1.68	1.68	3.17	3.21	2.34	1.87	2.07	1.84	2.48	3.48	3.97	5.29
13.30	2.70	3.48	1.67	1.67	1.67	3.17	3.21	2.34	1.87	2.07	1.84	2.48	3.48	3.97	5.17
13.40	2.70	3.40	1.66	1.66	1.66	3.17	3.21	2.34	1.87	2.07	1.84	2.48	3.48	3.97	5.05
13.50	2.70	3.33	1.66	1.66	1.66	3.17	3.21	2.34	1.87	2.07	1.84	2.48	3.48	3.97	5.04
13.60	2.70	3.26	1.65	1.65	1.65	3.17	3.21	2.34	1.87	2.07	1.84	2.48	3.48	3.97	5.04
13.70	2.70	3.19	1.64	1.64	1.64	3.17	3.21	2.34	1.87	2.07	1.84	2.48	3.48	3.97	5.04
13.80	2.70	3.17	1.64	1.64	1.64	3.17	3.21	2.34	1.87	2.07	1.84	2.48	3.48	3.97	5.04
13.90	2.70	3.14	1.63	1.63	1.63	3.17	3.21	2.34	1.87	2.07	1.84	2.48	3.48	3.97	5.04
14.00	2.70	3.08	1.63	1.63	1.63	3.17	3.21	2.34	1.87	2.07	1.84	2.48	3.48	3.97	5.04
14.10	2.70	3.07	1.62	1.62	1.62	3.17	3.21	2.34	1.87	2.07	1.84	2.48	3.48	3.97	5.04
14.20	2.70	3.04	1.61	1.61	1.61	3.17	3.21	2.34	1.87	2.07	1.84	2.48	3.48	3.97	5.04
14.30	2.70	2.99	1.61	1.61	1.61	3.17	3.21	2.34	1.87	2.07	1.84	2.48	3.48	3.97	5.04
14.40	2.70	2.95	1.60	1.60	1.60	3.17	3.21	2.34	1.87	2.07	1.84	2.48	3.48	3.97	5.04

Frequency (HZ)	Acceleration in X -Direction Z/2*Sa (m/s2)					Acceleration in Y -Direction Z/2*Sa(m/s2)					Acceleration in Z -Direction Z/2*Sa (m/s2)				
	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M
14.50	2.70	2.93	1.60	1.60	1.60	3.17	3.21	2.34	1.81	2.07	1.84	2.48	3.48	3.97	5.04
14.60	2.70	2.90	1.59	1.59	1.59	3.17	3.21	2.34	1.81	2.07	1.84	2.48	3.48	3.97	5.04
14.70	2.70	2.87	1.59	1.59	1.59	3.17	3.21	2.34	1.81	2.07	1.84	2.48	3.48	3.97	5.04
14.80	2.70	2.87	1.58	1.58	1.58	3.17	3.21	2.34	1.81	2.07	1.84	2.48	3.48	3.97	5.04
14.90	2.70	2.87	1.57	1.57	1.57	3.17	3.21	2.34	1.81	2.07	1.84	2.48	3.48	3.97	5.04
15.00	2.70	2.87	1.57	1.57	1.57	3.17	3.21	2.34	1.81	2.07	1.84	2.48	3.48	3.97	5.04
15.10	2.70	2.87	1.56	1.56	1.57	3.17	3.21	2.34	1.81	2.07	1.84	2.48	3.48	3.97	5.04
15.20	2.70	2.87	1.56	1.56	1.57	3.17	3.21	2.34	1.81	2.07	1.84	2.48	3.48	3.97	5.04
15.30	2.70	2.87	1.55	1.55	1.57	3.17	3.21	2.34	1.81	2.07	1.84	2.48	3.48	3.97	5.04
15.40	2.70	2.87	1.55	1.55	1.57	3.17	3.21	2.34	1.81	2.07	1.84	2.48	3.48	3.97	5.04
15.50	2.70	2.87	1.54	1.55	1.57	3.17	3.21	1.84	1.81	2.07	1.84	2.48	3.48	3.97	5.04
15.60	2.70	2.87	1.54	1.55	1.57	3.17	3.21	1.84	1.81	2.07	1.84	2.48	3.48	3.97	5.04
15.70	2.70	2.87	1.53	1.55	1.57	3.17	3.21	1.84	1.81	2.07	1.84	2.48	3.48	3.97	5.04
15.80	2.70	2.87	1.53	1.55	1.57	3.17	3.21	1.84	1.81	2.07	1.84	2.48	3.48	3.97	5.04
15.90	2.70	2.87	1.53	1.55	1.57	3.17	3.21	1.84	1.81	2.07	1.84	2.31	3.48	3.97	5.04
16.00	2.70	2.87	1.52	1.55	1.57	3.17	3.21	1.84	1.81	2.07	1.84	2.26	3.48	3.97	5.04
16.10	2.70	2.87	1.52	1.55	1.57	3.17	3.21	1.84	1.81	2.07	1.84	2.26	3.48	3.97	5.04
16.20	2.70	2.87	1.51	1.55	1.57	3.17	3.21	1.84	1.81	2.07	1.84	2.26	3.48	3.97	5.04
16.30	2.43	2.87	1.51	1.55	1.57	3.00	3.21	1.84	1.81	2.07	1.84	2.26	3.48	3.97	5.04
16.40	2.43	2.87	1.50	1.55	1.57	3.00	2.31	1.84	1.81	2.07	1.84	2.26	3.48	3.97	5.04
16.50	2.43	2.87	1.50	1.55	1.57	3.00	2.27	1.84	1.81	2.07	1.84	2.26	3.48	3.97	5.04
16.60	2.43	2.87	1.49	1.55	1.49	3.00	2.24	1.84	1.81	2.07	1.84	2.26	3.48	3.97	5.04
16.70	2.43	2.87	1.49	1.55	1.49	3.00	2.22	1.84	1.81	2.07	1.84	2.26	3.48	3.97	5.04
16.80	2.43	2.87	1.49	1.55	1.49	3.00	2.22	1.84	1.81	2.07	1.49	2.26	3.48	3.97	5.04
16.90	2.43	2.87	1.48	1.55	1.48	3.00	2.22	1.84	1.81	2.07	1.48	2.26	3.48	3.97	5.04
17.00	2.43	2.87	1.48	1.55	1.48	3.00	2.22	1.84	1.81	2.07	1.48	2.26	3.48	3.97	5.04
17.10	2.43	2.87	1.47	1.55	1.47	3.00	2.22	1.84	1.81	1.75	1.47	2.26	3.48	3.97	5.04
17.20	2.43	2.87	1.47	1.55	1.47	3.00	2.22	1.84	1.81	1.74	1.47	2.26	3.48	3.97	5.04
17.30	2.43	2.87	1.47	1.55	1.47	3.00	2.22	1.84	1.81	1.73	1.47	2.26	3.48	3.97	5.04
17.40	2.43	2.87	1.47	1.55	1.46	3.00	2.22	1.84	1.81	1.72	1.46	2.26	2.45	2.16	3.40
17.50	2.43	2.87	1.47	1.55	1.46	3.00	2.22	1.84	1.81	1.70	1.46	2.26	2.45	2.12	3.25
17.60	2.43	2.87	1.47	1.55	1.45	3.00	2.22	1.84	1.81	1.68	1.45	2.26	2.45	2.11	3.08
17.70	2.43	2.87	1.47	1.55	1.45	3.00	2.22	1.84	1.81	1.66	1.45	2.26	2.45	2.11	2.90
17.80	2.43	2.87	1.47	1.55	1.45	3.00	2.22	1.84	1.81	1.65	1.45	2.26	2.45	2.11	2.72
17.90	2.43	2.87	1.47	1.55	1.44	3.00	2.22	1.84	1.81	1.65	1.44	2.26	2.45	2.11	2.72
18.00	2.43	2.87	1.47	1.55	1.44	3.00	2.22	1.84	1.81	1.65	1.44	2.26	2.45	2.11	2.72
18.10	2.43	2.87	1.47	1.55	1.44	3.00	2.22	1.84	1.64	1.65	1.44	2.26	2.45	2.11	2.72

Frequency (HZ)	Acceleration in X -Direction Z/2*Sa (m/s2)					Acceleration in Y -Direction Z/2*Sa(m/s2)					Acceleration in Z -Direction Z/2*Sa (m/s2)				
	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M
18.20	2.43	2.87	1.47	1.55	1.43	3.00	2.22	1.84	1.64	1.65	1.43	2.26	2.45	2.11	2.72
18.30	2.43	2.87	1.47	1.55	1.43	3.00	2.22	1.84	1.64	1.65	1.43	2.26	2.45	2.11	2.72
18.40	2.43	2.87	1.47	1.55	1.42	3.00	2.22	1.84	1.64	1.65	1.42	2.26	2.45	2.11	2.72
18.50	2.43	2.87	1.47	1.55	1.42	3.00	2.22	1.79	1.64	1.65	1.42	2.26	2.45	2.11	2.72
18.60	2.43	2.87	1.47	1.55	1.42	3.00	2.22	1.78	1.64	1.65	1.42	2.26	2.45	2.11	2.72
18.70	2.43	2.87	1.47	1.55	1.42	3.00	2.22	1.78	1.64	1.65	1.41	2.26	2.45	2.11	2.72
18.80	2.43	2.87	1.47	1.55	1.42	3.00	2.22	1.78	1.64	1.65	1.41	2.26	2.45	2.11	2.72
18.90	2.43	2.87	1.47	1.55	1.42	3.00	2.22	1.77	1.64	1.65	1.41	2.26	2.45	2.11	2.72
19.00	2.43	2.87	1.47	1.55	1.42	3.00	2.22	1.76	1.64	1.65	1.40	2.26	2.45	2.11	2.72
19.10	2.43	2.87	1.47	1.55	1.42	3.00	2.22	1.74	1.64	1.65	1.40	2.26	2.45	2.11	2.72
19.20	2.43	2.87	1.47	1.55	1.42	3.00	2.22	1.73	1.64	1.65	1.40	2.26	2.45	2.11	2.72
19.30	2.43	2.87	1.47	1.55	1.42	3.00	2.22	1.72	1.64	1.65	1.39	2.26	2.45	2.11	2.72
19.40	2.43	2.87	1.47	1.55	1.42	3.00	2.22	1.72	1.64	1.65	1.39	2.26	2.45	2.11	2.72
19.50	2.43	2.87	1.47	1.55	1.42	3.00	2.22	1.72	1.64	1.65	1.39	2.26	2.45	2.11	2.72
19.60	2.43	2.87	1.47	1.55	1.42	3.00	2.22	1.72	1.64	1.65	1.39	2.26	2.45	2.11	2.72
19.70	2.43	2.87	1.47	1.55	1.42	3.00	2.22	1.72	1.64	1.65	1.38	2.26	2.45	2.11	2.72
19.80	2.43	2.87	1.47	1.55	1.42	3.00	2.22	1.72	1.64	1.65	1.38	2.26	2.45	2.11	2.72
19.90	2.43	2.87	1.47	1.55	1.42	3.00	2.22	1.72	1.64	1.65	1.38	2.26	2.45	2.11	2.72
20.00	2.43	2.87	1.47	1.55	1.42	3.00	2.22	1.72	1.64	1.65	1.37	2.26	2.45	2.11	2.72
20.10	2.43	2.87	1.47	1.55	1.42	3.00	1.84	1.72	1.64	1.65	1.37	2.26	2.45	2.11	2.72
20.20	2.43	2.87	1.47	1.55	1.42	3.00	1.83	1.72	1.64	1.65	1.37	2.26	2.45	2.11	2.72
20.30	2.43	2.87	1.47	1.55	1.42	3.00	1.81	1.72	1.64	1.65	1.37	2.26	2.45	2.11	2.72
20.40	2.43	2.87	1.47	1.55	1.42	3.00	1.79	1.72	1.64	1.65	1.37	2.26	2.45	2.11	2.72
20.50	2.43	2.87	1.47	1.55	1.42	3.00	1.77	1.72	1.64	1.65	1.37	2.26	2.45	2.11	2.72
20.60	2.43	2.87	1.47	1.55	1.42	3.00	1.75	1.72	1.64	1.65	1.37	2.26	2.45	2.11	2.69
20.70	2.43	2.87	1.47	1.55	1.42	3.00	1.74	1.72	1.64	1.65	1.37	2.26	2.45	2.11	2.69
20.80	2.43	2.87	1.47	1.55	1.42	3.00	1.72	1.72	1.64	1.65	1.37	2.26	2.45	2.11	2.69
20.90	2.43	2.87	1.47	1.55	1.35	3.00	1.70	1.72	1.64	1.65	1.37	2.26	2.45	2.11	2.69
21.00	2.43	2.87	1.47	1.55	1.35	3.00	1.68	1.72	1.64	1.65	1.37	2.26	2.45	2.11	2.69
21.10	2.43	2.87	1.47	1.55	1.34	3.00	1.67	1.72	1.64	1.65	1.37	2.26	2.45	2.11	2.69
21.20	2.43	2.87	1.47	1.55	1.34	3.00	1.67	1.72	1.64	1.65	1.37	2.26	2.45	2.11	2.69
21.30	2.43	2.87	1.47	1.55	1.34	3.00	1.66	1.72	1.64	1.65	1.37	2.26	2.45	2.11	2.69
21.40	2.43	2.87	1.47	1.55	1.33	3.00	1.66	1.72	1.64	1.65	1.37	2.26	2.45	2.11	2.69
21.50	2.43	2.87	1.47	1.55	1.33	3.00	1.65	1.72	1.64	1.65	1.37	2.26	2.45	2.11	2.69
21.60	2.43	2.87	1.47	1.55	1.33	3.00	1.65	1.72	1.64	1.65	1.37	2.26	2.45	2.11	2.69
21.70	2.43	2.87	1.47	1.55	1.33	3.00	1.64	1.72	1.64	1.65	1.37	2.26	2.45	2.11	2.69
21.80	2.43	2.87	1.47	1.55	1.32	3.00	1.64	1.72	1.64	1.65	1.37	2.26	2.45	2.11	2.69

Frequency (HZ)	Acceleration in X -Direction Z/2*Sa (m/s2)					Acceleration in Y -Direction Z/2*Sa(m/s2)					Acceleration in Z -Direction Z/2*Sa (m/s2)				
	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M
21.90	2.43	2.87	1.47	1.55	1.32	2.81	1.63	1.72	1.64	1.59	1.37	2.26	2.45	2.11	2.69
22.00	2.43	2.87	1.47	1.55	1.32	2.81	1.62	1.72	1.64	1.59	1.37	2.26	2.45	2.11	2.69
22.10	2.43	2.87	1.47	1.55	1.32	2.81	1.61	1.72	1.64	1.59	1.37	2.26	2.45	2.11	2.69
22.20	2.43	2.87	1.47	1.55	1.32	2.81	1.60	1.72	1.64	1.59	1.37	2.26	2.45	2.11	2.69
22.30	2.43	2.87	1.47	1.55	1.31	2.81	1.59	1.72	1.64	1.59	1.37	2.26	2.45	2.11	2.69
22.40	2.43	2.87	1.47	1.55	1.31	2.81	1.59	1.72	1.64	1.59	1.37	2.26	2.45	2.11	2.69
22.50	2.43	2.87	1.47	1.55	1.31	2.81	1.59	1.72	1.64	1.59	1.37	2.26	2.45	2.11	2.69
22.60	2.43	2.87	1.47	1.55	1.31	2.81	1.59	1.72	1.64	1.58	1.37	2.26	2.45	2.11	2.69
22.70	2.43	2.87	1.47	1.55	1.30	2.81	1.59	1.72	1.64	1.58	1.37	2.26	2.45	2.11	2.69
22.80	2.43	2.87	1.47	1.55	1.30	2.81	1.59	1.72	1.64	1.58	1.37	2.26	2.45	2.11	2.69
22.90	2.43	2.87	1.47	1.55	1.30	2.81	1.59	1.72	1.64	1.58	1.37	2.26	2.45	2.11	2.69
23.00	2.43	2.87	1.47	1.55	1.30	2.81	1.59	1.72	1.64	1.58	1.37	2.26	2.45	2.11	2.69
23.10	2.43	2.87	1.47	1.55	1.29	2.81	1.59	1.72	1.54	1.58	1.37	2.26	2.45	2.11	2.69
23.20	2.43	2.87	1.47	1.55	1.29	2.81	1.59	1.72	1.54	1.57	1.37	2.26	2.27	2.11	2.69
23.30	2.43	2.87	1.47	1.55	1.29	2.81	1.59	1.72	1.53	1.57	1.37	2.26	2.26	2.11	2.69
23.40	2.43	2.87	1.47	1.55	1.29	2.81	1.59	1.72	1.53	1.57	1.37	2.26	2.25	2.11	2.69
23.50	2.43	2.87	1.47	1.55	1.29	2.81	1.59	1.67	1.53	1.57	1.37	2.26	2.25	2.11	2.69
23.60	2.43	2.87	1.47	1.55	1.28	2.81	1.59	1.67	1.53	1.57	1.37	2.26	2.24	2.11	2.69
23.70	2.43	2.87	1.47	1.55	1.28	2.81	1.59	1.66	1.53	1.57	1.37	2.26	2.23	2.11	2.69
23.80	2.43	2.87	1.47	1.55	1.28	2.81	1.59	1.65	1.53	1.57	1.37	2.26	2.22	2.11	2.69
23.90	2.43	2.87	1.47	1.55	1.28	2.81	1.59	1.64	1.53	1.57	1.37	2.26	2.21	2.11	2.69
24.00	2.43	2.87	1.47	1.55	1.28	2.81	1.59	1.63	1.53	1.57	1.37	2.26	2.20	2.11	2.69
24.10	2.43	2.87	1.47	1.55	1.28	2.81	1.59	1.61	1.53	1.57	1.37	2.26	2.19	2.11	2.69
24.20	2.43	2.87	1.47	1.55	1.28	2.81	1.59	1.58	1.53	1.57	1.37	2.26	2.18	2.11	2.69
24.30	2.43	2.87	1.47	1.55	1.28	2.81	1.59	1.55	1.53	1.57	1.37	2.26	2.17	2.11	2.69
24.40	2.43	2.87	1.47	1.55	1.28	2.81	1.59	1.53	1.53	1.57	1.37	2.26	2.16	2.11	2.69
24.50	2.43	2.87	1.47	1.55	1.28	2.81	1.59	1.52	1.53	1.57	1.37	2.26	2.15	2.11	2.69
24.60	2.43	2.87	1.47	1.55	1.28	2.81	1.59	1.52	1.53	1.57	1.37	2.26	2.14	2.11	2.69
24.70	2.43	2.87	1.47	1.55	1.28	2.81	1.59	1.52	1.53	1.57	1.37	2.26	2.14	2.11	2.69
24.80	2.43	2.87	1.47	1.55	1.28	2.81	1.59	1.52	1.53	1.57	1.37	2.26	2.14	2.11	2.69
24.90	2.43	2.87	1.47	1.55	1.28	2.81	1.59	1.52	1.53	1.57	1.26	2.26	2.14	2.11	2.69
25.00	1.80	2.87	1.47	1.55	1.28	2.81	1.59	1.52	1.53	1.57	1.26	2.26	2.14	2.11	2.69
25.10	1.80	2.87	1.47	1.55	1.28	2.81	1.59	1.52	1.53	1.57	1.25	2.26	2.14	2.11	2.69
25.20	1.80	2.87	1.47	1.55	1.28	2.81	1.59	1.52	1.53	1.57	1.25	2.26	2.14	2.11	2.69
25.30	1.80	2.87	1.47	1.55	1.28	1.97	1.59	1.52	1.53	1.57	1.25	2.26	2.14	2.11	2.69
25.40	1.80	2.87	1.47	1.55	1.28	1.97	1.59	1.52	1.53	1.57	1.25	2.26	2.14	2.11	2.69
25.50	1.80	2.87	1.47	1.55	1.28	1.97	1.59	1.52	1.53	1.57	1.25	2.26	2.14	2.11	2.69

Frequency (HZ)	Acceleration in X -Direction Z/2*Sa (m/s2)					Acceleration in Y -Direction Z/2*Sa(m/s2)					Acceleration in Z -Direction Z/2*Sa (m/s2)				
	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M
25.60	1.80	2.62	1.47	1.55	1.28	1.97	1.59	1.52	1.53	1.57	1.24	2.26	2.14	2.11	2.69
25.70	1.80	2.62	1.47	1.55	1.28	1.97	1.59	1.52	1.53	1.57	1.24	2.26	2.14	2.11	2.69
25.80	1.80	2.62	1.47	1.55	1.28	1.97	1.59	1.52	1.53	1.57	1.24	2.26	2.14	2.11	2.69
25.90	1.80	2.62	1.47	1.55	1.28	1.97	1.59	1.52	1.53	1.57	1.24	2.26	2.14	1.62	2.18
26.00	1.80	2.62	1.47	1.55	1.28	1.97	1.59	1.52	1.53	1.57	1.24	2.26	2.14	1.62	2.18
26.10	1.80	2.62	1.47	1.55	1.28	1.97	1.59	1.52	1.53	1.57	1.24	2.26	2.14	1.62	2.18
26.20	1.80	2.62	1.47	1.55	1.28	1.97	1.59	1.52	1.53	1.57	1.23	2.26	2.14	1.62	2.18
26.30	1.80	2.62	1.47	1.55	1.28	1.97	1.59	1.52	1.53	1.57	1.23	2.26	2.14	1.62	2.18
26.40	1.80	2.62	1.47	1.33	1.28	1.97	1.59	1.52	1.53	1.57	1.23	2.26	2.14	1.62	2.18
26.50	1.80	2.62	1.47	1.33	1.28	1.97	1.59	1.52	1.53	1.57	1.23	2.26	2.14	1.62	2.18
26.60	1.80	2.62	1.47	1.33	1.28	1.97	1.59	1.52	1.53	1.57	1.23	2.09	2.14	1.62	2.18
26.70	1.80	2.62	1.47	1.33	1.23	1.97	1.59	1.52	1.53	1.57	1.23	2.09	2.14	1.62	2.18
26.80	1.80	2.62	1.47	1.33	1.22	1.97	1.59	1.52	1.53	1.57	1.22	2.09	2.14	1.62	2.18
26.90	1.80	2.62	1.47	1.33	1.22	1.97	1.59	1.52	1.53	1.57	1.22	2.09	2.14	1.62	2.18
27.00	1.80	2.62	1.47	1.33	1.22	1.97	1.59	1.52	1.53	1.57	1.22	2.09	2.14	1.62	2.18
27.10	1.80	2.62	1.47	1.33	1.22	1.97	1.59	1.52	1.53	1.57	1.22	2.09	2.14	1.62	2.18
27.20	1.80	2.62	1.47	1.33	1.22	1.97	1.59	1.52	1.53	1.57	1.22	2.09	2.14	1.62	2.18
27.30	1.80	2.62	1.47	1.33	1.22	1.97	1.59	1.52	1.53	1.57	1.22	2.09	2.14	1.62	2.18
27.40	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
27.50	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
27.60	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
27.70	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
27.80	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
27.90	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
28.00	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
28.10	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
28.20	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
28.30	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
28.40	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
28.50	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
28.60	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
28.70	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
28.80	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
28.90	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
29.00	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
29.10	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
29.20	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18

Frequency (HZ)	Acceleration in X -Direction Z/2*Sa (m/s2)					Acceleration in Y -Direction Z/2*Sa(m/s2)					Acceleration in Z -Direction Z/2*Sa (m/s2)				
	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M
29.30	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
29.40	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
29.50	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
29.60	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
29.70	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
29.80	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
29.90	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18
30.00	1.80	2.62	1.47	1.33	1.21	1.97	1.59	1.52	1.53	1.57	1.21	2.09	2.14	1.62	2.18

Table 7- Design Floor response spectra for TG in UB

Frequency (HZ)	Acceleration in X -Direction Z/2*Sa (m/s2)					Acceleration in Y -Direction Z/2*Sa(m/s2)					Acceleration in Z -Direction Z/2*Sa (m/s2)				
	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M
0.10	0.22	0.26	0.23	0.24	0.24	0.22	0.24	0.23	0.24	0.24	0.20	0.20	0.20	0.20	0.20
0.20	0.22	0.26	0.23	0.24	0.24	0.23	0.24	0.23	0.24	0.24	0.20	0.20	0.20	0.20	0.20
0.30	0.29	0.27	0.31	0.31	0.32	0.31	0.26	0.29	0.29	0.29	0.24	0.43	0.24	0.24	0.24
0.40	0.44	0.38	0.37	0.40	0.40	0.47	0.33	0.34	0.40	0.40	0.31	0.43	0.31	0.31	0.31
0.50	0.48	0.45	0.66	0.66	0.67	0.51	0.43	0.50	0.52	0.53	0.39	0.43	0.39	0.39	0.39
0.60	0.63	0.55	0.88	0.89	0.90	0.68	0.59	0.69	0.81	0.85	0.47	0.47	0.47	0.47	0.47
0.70	0.64	0.65	1.14	1.15	1.16	0.68	0.64	0.79	0.88	0.88	0.55	0.55	0.55	0.55	0.55
0.80	0.70	0.72	1.44	1.47	1.48	0.74	0.72	0.91	1.16	1.15	0.63	0.63	0.63	0.63	0.63
0.90	1.20	0.86	1.93	1.99	2.00	1.41	0.78	1.09	1.44	1.45	0.90	1.11	0.71	0.71	0.71
1.00	1.20	1.23	6.55	6.73	6.78	1.41	1.00	1.38	1.94	2.05	0.90	1.11	0.78	0.78	0.78
1.10	1.20	1.70	6.55	6.73	6.78	1.41	1.18	1.80	2.74	2.88	0.90	1.11	0.86	0.86	0.86
1.20	1.41	1.70	6.55	6.73	6.78	1.52	1.36	6.04	7.99	8.33	0.94	1.25	0.94	0.94	0.94
1.30	1.41	1.70	6.55	6.73	6.78	1.52	2.00	6.04	7.99	8.33	1.06	1.25	1.02	1.02	1.02
1.40	1.41	1.70	6.55	6.73	6.78	1.52	2.00	6.04	7.99	8.33	1.10	1.25	1.10	1.10	1.10
1.50	1.51	1.70	3.60	3.40	3.43	1.61	2.00	6.04	7.99	8.33	1.18	1.25	1.18	1.18	1.18
1.60	1.53	1.70	3.60	2.96	2.99	1.64	2.00	6.04	7.99	8.33	1.26	1.26	1.26	1.26	1.26
1.70	1.90	1.70	3.60	2.63	2.66	2.16	2.00	6.04	7.99	8.33	1.43	1.33	1.33	1.33	1.33
1.80	1.90	1.70	3.60	2.44	2.46	2.16	2.00	6.04	7.99	8.33	1.43	1.41	1.41	1.41	1.41
1.90	1.90	2.42	3.60	2.24	2.25	2.16	2.00	4.02	5.11	5.32	1.49	1.49	1.49	1.49	1.49
2.00	1.90	2.42	3.60	2.20	2.23	2.16	2.00	4.02	4.92	5.14	1.57	2.49	1.57	1.57	1.57
2.10	1.90	2.42	3.60	1.99	2.03	2.16	2.00	4.02	4.84	4.96	1.65	2.49	1.65	1.65	1.65
2.20	2.49	2.42	3.60	1.85	1.86	2.54	2.00	4.02	4.70	4.82	1.76	2.49	1.82	1.73	1.73
2.30	2.49	2.42	3.60	1.85	1.86	2.54	2.00	4.02	4.70	4.82	1.81	2.49	1.82	1.81	1.81
2.40	2.49	2.42	3.60	1.88	1.88	2.54	2.00	4.02	4.70	4.82	1.88	2.49	1.88	1.88	1.88
2.50	2.49	2.60	3.60	1.96	1.96	2.54	2.00	3.80	4.70	4.82	1.96	2.49	1.96	1.96	1.96
2.60	2.49	2.63	3.60	1.96	1.96	2.54	2.00	3.80	4.70	4.82	1.96	2.49	1.96	1.96	1.96
2.70	2.49	3.04	3.60	1.96	1.96	2.54	2.00	3.80	4.28	4.51	1.96	2.49	1.96	1.96	1.96
2.80	2.49	3.04	3.60	1.96	1.96	2.54	2.00	3.80	4.28	4.51	1.96	2.49	1.96	1.96	1.96
2.90	2.49	3.04	3.60	1.96	1.96	2.54	2.00	3.80	4.28	4.51	1.96	2.49	1.96	1.96	1.96
3.00	2.49	3.04	3.60	1.96	1.96	2.54	2.00	3.80	4.28	4.51	1.96	2.49	1.96	1.96	1.96
3.10	2.49	3.04	3.60	1.96	1.96	2.54	2.00	3.80	4.28	4.51	1.96	2.49	1.96	1.96	1.96
3.20	2.49	3.04	3.60	1.96	1.96	2.54	2.00	3.80	4.28	4.51	1.96	2.59	2.14	1.96	1.96
3.30	2.49	3.04	3.60	1.96	1.96	2.54	2.00	3.80	4.28	4.51	1.96	2.59	2.22	1.96	1.96
3.40	2.49	3.23	3.60	1.96	1.96	2.54	2.00	3.80	4.28	4.51	1.96	2.59	2.48	1.96	1.96
3.50	2.49	3.23	3.60	1.96	1.96	2.54	2.00	3.80	4.28	4.51	1.96	2.59	2.48	1.96	1.96

Frequency (HZ)	Acceleration in X -Direction Z/2*Sa (m/s2)					Acceleration in Y -Direction Z/2*Sa(m/s2)					Acceleration in Z -Direction Z/2*Sa (m/s2)				
	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M
3.60	2.49	3.23	3.60	1.96	1.96	2.54	2.23	3.80	4.28	4.51	1.96	2.59	2.48	1.96	1.96
3.70	2.49	3.23	3.60	1.96	1.96	2.54	2.23	3.80	4.28	4.51	1.96	2.59	2.48	1.96	1.96
3.80	2.49	3.23	3.60	1.96	1.96	2.54	2.23	3.80	4.28	4.51	1.96	2.59	2.48	1.96	1.96
3.90	2.62	3.23	3.60	1.96	1.96	2.58	2.23	3.80	4.28	4.51	1.96	2.59	2.48	1.96	1.96
4.00	2.62	3.23	3.60	1.96	1.96	2.58	2.23	3.80	4.28	4.51	1.96	2.59	2.48	1.96	2.08
4.10	2.62	3.25	3.60	1.96	1.96	2.58	2.23	3.80	4.28	4.51	1.96	3.22	3.80	1.96	2.08
4.20	2.62	4.41	3.60	1.96	1.96	2.58	2.23	3.80	4.28	4.51	1.96	3.22	3.80	1.96	2.08
4.30	2.62	4.41	3.60	1.96	1.96	2.58	2.23	3.80	4.28	4.51	1.96	3.22	3.80	1.96	2.08
4.40	2.62	4.41	3.60	1.96	1.96	2.58	2.23	3.80	4.28	4.51	1.96	3.22	3.80	1.96	2.08
4.50	2.62	4.41	3.60	1.96	1.96	2.58	2.29	3.80	4.28	4.51	1.96	3.22	3.80	1.96	2.08
4.60	2.62	4.41	3.60	1.96	1.96	2.58	2.50	3.80	4.28	4.51	1.96	3.22	3.80	2.07	2.08
4.70	2.62	4.41	3.60	1.96	1.96	2.58	2.68	3.80	4.28	4.51	1.96	3.22	3.80	2.07	2.08
4.80	2.62	4.41	3.60	1.96	1.96	2.58	2.83	3.80	4.28	4.51	1.96	3.22	3.80	2.07	2.08
4.90	2.62	4.41	3.60	1.96	1.96	2.58	2.83	3.80	4.28	4.51	1.96	3.22	3.80	2.07	2.08
5.00	3.23	4.41	3.60	1.96	1.96	3.16	2.83	3.80	4.28	4.51	1.96	3.22	3.80	2.07	2.08
5.10	3.23	4.41	3.60	1.96	1.96	3.16	2.83	3.80	4.28	4.51	1.96	3.22	3.80	2.07	2.13
5.20	3.23	4.45	3.60	1.96	1.96	3.16	2.83	3.80	4.28	4.51	1.96	3.22	3.80	2.07	2.20
5.30	3.23	11.53	3.60	1.96	1.96	3.16	2.83	3.80	4.28	4.51	1.96	3.22	3.86	2.07	2.21
5.40	3.23	11.53	3.60	1.96	1.96	3.16	2.83	3.80	4.28	4.51	1.96	3.22	3.88	2.07	2.56
5.50	3.23	11.53	3.60	1.96	1.96	3.16	2.83	3.80	4.28	4.51	1.96	3.22	4.08	2.07	2.56
5.60	3.23	11.53	3.60	1.96	1.96	3.16	2.83	3.80	4.28	4.51	1.96	3.42	4.22	2.30	2.56
5.70	3.23	11.53	3.60	1.96	1.96	3.16	2.83	3.80	4.28	4.51	1.96	3.42	4.82	2.30	2.56
5.80	3.23	11.53	3.60	1.96	1.96	3.16	2.95	3.80	4.28	4.51	1.96	3.42	13.43	2.30	2.56
5.90	3.23	11.53	3.60	1.96	1.96	3.16	3.13	3.80	4.28	4.51	1.96	3.42	13.43	2.30	2.56
6.00	3.23	11.53	3.60	1.96	1.96	3.16	3.19	3.80	4.28	4.51	1.96	3.42	13.43	2.30	2.56
6.10	3.23	11.53	3.60	1.96	1.96	3.16	3.52	3.80	4.28	4.51	1.96	3.42	13.43	2.30	2.56
6.20	3.23	11.53	3.60	1.96	1.96	3.16	3.57	3.80	4.28	4.51	1.96	3.42	13.43	2.30	2.56
6.30	3.23	11.53	3.60	1.96	1.96	3.16	5.97	3.80	4.28	4.51	1.96	3.42	13.43	2.30	2.56
6.40	3.23	11.53	3.60	1.96	1.96	3.16	5.97	3.80	4.28	4.51	1.96	3.42	13.43	2.30	2.56
6.50	3.23	11.53	3.60	1.96	1.96	3.16	5.97	3.80	4.28	4.51	1.96	3.42	13.43	2.30	2.69
6.60	3.23	11.53	3.60	1.96	1.96	3.16	5.97	3.80	4.28	4.51	1.96	3.42	13.43	2.30	2.69
6.70	3.23	11.53	3.60	1.96	1.96	3.16	5.97	3.80	4.28	4.51	1.96	3.42	13.43	2.44	2.80
6.80	3.23	11.53	3.60	1.96	1.96	3.16	5.97	3.80	4.28	4.51	1.96	3.42	13.43	3.29	3.94
6.90	3.23	11.53	3.60	1.96	1.96	3.16	5.97	3.80	4.28	4.51	1.96	3.42	13.43	3.29	3.94
7.00	3.23	11.53	3.60	1.96	1.96	3.16	5.97	3.80	4.28	4.51	1.96	3.42	13.43	3.29	3.94
7.10	2.56	11.53	3.60	1.96	1.96	2.72	5.97	3.80	4.28	4.51	1.96	3.42	13.43	3.29	3.94
7.20	2.56	11.53	3.60	1.96	1.96	2.72	5.97	3.80	4.28	4.51	1.96	3.42	13.43	3.29	3.94

Frequency (HZ)	Acceleration in X -Direction Z/2*Sa (m/s2)					Acceleration in Y -Direction Z/2*Sa(m/s2)					Acceleration in Z -Direction Z/2*Sa (m/s2)				
	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M
7.30	2.56	11.53	3.60	1.96	1.96	2.72	5.97	3.80	4.28	4.51	1.96	3.42	13.43	3.29	3.94
7.40	2.56	7.15	3.60	1.96	1.96	2.72	5.97	3.80	4.28	4.51	1.96	3.42	13.43	3.29	3.94
7.50	2.56	7.15	3.60	1.96	1.96	2.72	5.97	3.80	4.28	4.51	1.96	3.42	13.43	3.29	3.94
7.60	2.56	7.15	3.60	1.96	1.96	2.72	5.97	3.80	4.28	4.51	1.96	3.42	13.43	3.29	3.94
7.70	2.56	7.15	3.60	1.96	1.96	2.72	5.97	3.80	4.28	4.51	1.96	3.42	13.43	3.29	3.94
7.80	2.56	7.15	3.60	1.96	1.96	2.72	5.97	3.80	4.28	4.51	1.96	3.76	13.43	3.29	3.94
7.90	2.56	7.15	3.60	1.96	1.96	2.72	5.97	2.81	4.28	4.51	1.96	3.76	13.43	3.29	3.94
8.00	2.56	7.15	3.60	1.96	1.96	2.72	5.97	2.72	3.17	3.76	1.96	3.76	13.43	3.29	3.94
8.10	2.56	7.15	3.60	1.96	1.96	2.72	5.97	2.55	3.08	3.70	1.96	3.76	6.42	6.23	3.94
8.20	2.56	7.15	3.60	1.96	1.96	2.72	5.97	2.39	2.94	3.52	1.96	3.76	6.16	6.23	7.95
8.30	2.56	7.15	3.60	1.96	1.96	2.72	5.97	2.36	2.77	3.40	1.96	3.76	5.90	6.23	7.95
8.40	2.56	7.15	3.60	1.96	1.96	2.72	5.97	2.31	2.62	3.22	2.05	3.76	5.88	6.23	7.95
8.50	2.56	7.15	3.60	1.96	1.96	2.72	5.97	2.21	2.58	3.11	2.05	3.76	5.82	6.23	7.95
8.60	2.56	7.15	3.60	1.96	1.96	2.72	5.97	2.09	2.54	3.08	2.05	3.76	5.68	6.23	7.95
8.70	2.56	7.15	3.60	1.96	1.96	2.72	5.97	1.99	2.47	2.99	2.05	3.76	5.46	6.23	7.95
8.80	2.56	7.15	3.60	1.96	1.96	2.72	4.90	1.99	2.37	2.86	2.05	3.76	5.20	6.23	7.95
8.90	2.56	7.15	3.60	1.96	1.96	2.72	4.58	1.99	2.27	2.73	2.05	3.76	4.94	6.23	7.95
9.00	2.56	7.15	3.60	1.96	1.96	2.72	4.22	1.99	2.18	2.61	2.05	3.76	4.81	6.23	7.95
9.10	2.56	7.15	3.60	1.96	1.96	2.72	4.08	1.99	2.12	2.52	2.05	3.76	4.81	6.23	7.95
9.20	2.56	7.15	3.60	1.96	1.96	2.72	4.08	1.99	2.07	2.44	2.05	3.76	4.81	6.23	7.95
9.30	2.56	7.15	3.60	1.96	1.96	2.72	4.08	1.99	2.05	2.37	2.05	3.76	4.81	6.23	7.95
9.40	2.56	7.15	3.60	1.96	1.96	2.72	4.08	1.99	2.05	2.27	2.05	3.76	4.81	6.23	7.95
9.50	2.56	7.15	3.60	1.96	1.96	2.72	4.08	1.99	2.05	2.17	2.05	3.76	4.81	6.23	7.95
9.60	2.56	7.15	3.60	1.96	1.96	2.72	4.08	1.99	2.05	2.17	2.05	3.76	4.81	6.23	7.95
9.70	2.56	7.15	3.60	1.96	1.96	2.72	4.08	1.99	2.05	2.17	2.05	3.76	4.81	6.23	7.95
9.80	2.56	7.15	3.60	1.96	1.96	2.72	4.08	1.99	2.05	2.17	2.05	3.76	4.81	6.23	7.95
9.90	2.56	7.15	3.60	1.96	1.96	2.72	4.08	1.99	2.05	2.17	2.05	3.76	4.81	6.23	8.15
10.00	2.56	7.15	3.60	1.96	1.96	2.72	4.08	1.99	2.05	2.17	2.05	3.76	4.81	6.23	8.15
10.10	2.56	7.15	3.60	1.95	1.95	2.72	4.08	1.99	2.05	2.17	2.05	3.76	4.81	6.23	8.15
10.20	2.56	7.15	3.60	1.94	1.94	2.72	4.08	1.99	2.05	2.17	2.05	3.76	4.81	6.23	8.15
10.30	2.56	7.15	3.60	1.93	1.93	2.72	4.08	1.99	2.05	2.17	2.05	3.76	4.81	6.23	8.15
10.40	2.56	7.15	3.60	1.92	1.92	2.72	4.08	1.99	2.05	2.17	2.05	3.76	4.81	6.23	8.15
10.50	2.56	7.15	3.60	1.91	1.91	2.72	4.08	1.99	2.05	2.17	2.05	3.76	4.81	6.23	8.15
10.60	2.56	7.15	3.60	1.90	1.90	2.72	3.11	1.99	2.05	2.17	2.05	3.76	4.81	6.23	8.15
10.70	2.56	7.15	3.60	1.88	1.88	2.72	3.11	1.99	2.05	2.17	2.05	3.22	4.81	6.23	8.15
10.80	2.56	7.15	3.60	1.87	1.87	2.72	3.11	1.99	2.05	2.17	2.05	3.22	4.81	6.23	8.15
10.90	2.56	7.15	3.60	1.86	1.86	2.72	3.11	1.99	2.05	2.17	2.05	3.22	4.81	6.23	8.15

Frequency (HZ)	Acceleration in X -Direction Z/2*Sa (m/s2)					Acceleration in Y -Direction Z/2*Sa(m/s2)					Acceleration in Z -Direction Z/2*Sa (m/s2)				
	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M
11.00	2.56	7.15	3.60	1.85	1.85	2.72	3.11	1.99	2.05	2.17	2.05	3.22	4.81	6.23	8.15
11.10	2.56	7.15	3.60	1.85	1.85	2.72	3.11	1.99	2.05	2.17	2.05	3.22	4.81	6.23	8.15
11.20	2.56	7.15	3.60	1.84	1.84	2.72	3.11	1.99	2.05	2.17	2.05	3.22	4.81	5.03	8.15
11.30	2.56	7.15	1.86	1.83	1.83	2.72	3.11	1.99	2.05	2.17	2.05	3.22	3.30	5.03	8.15
11.40	2.56	7.15	1.83	1.82	1.82	2.72	3.11	1.99	2.05	2.17	2.05	3.22	3.30	5.03	8.15
11.50	2.56	7.15	1.81	1.81	1.81	2.72	3.11	1.99	2.05	2.17	2.05	3.22	3.30	5.03	8.15
11.60	2.46	7.15	1.80	1.80	1.80	2.72	3.11	1.99	2.05	2.04	2.05	3.22	3.30	5.03	8.15
11.70	2.46	7.15	1.79	1.79	1.79	2.72	3.11	1.99	1.79	2.04	1.79	3.22	3.30	5.03	8.15
11.80	2.46	7.15	1.78	1.78	1.78	2.72	3.11	1.99	1.78	2.04	1.78	3.22	3.30	5.03	8.15
11.90	2.46	7.15	1.77	1.77	1.77	2.72	3.11	1.99	1.77	2.04	1.77	3.22	3.30	5.03	8.15
12.00	2.46	7.15	1.77	1.77	1.77	2.72	3.11	1.99	1.77	2.04	1.77	3.22	3.30	5.03	8.15
12.10	2.46	4.95	1.76	1.76	1.76	2.72	3.11	1.99	1.76	2.04	1.76	3.22	3.30	5.03	8.15
12.20	2.46	4.81	1.75	1.75	1.75	2.72	3.11	1.99	1.76	2.04	1.75	3.22	3.30	5.03	8.15
12.30	2.46	4.62	1.74	1.74	1.74	2.72	3.11	1.99	1.76	2.04	1.74	3.22	3.30	5.03	8.15
12.40	2.46	4.45	1.73	1.73	1.73	2.72	3.11	1.99	1.76	2.04	1.73	3.22	3.30	5.03	8.15
12.50	2.46	4.42	1.73	1.73	1.73	2.72	3.11	1.99	1.76	2.04	1.73	3.22	3.30	5.03	8.15
12.60	2.46	4.32	1.72	1.72	1.72	2.72	3.11	1.99	1.76	2.04	1.72	3.22	3.30	5.03	8.15
12.70	2.46	4.14	1.71	1.71	1.71	2.72	3.11	1.99	1.76	2.04	1.71	3.22	3.30	5.03	8.15
12.80	2.46	3.93	1.70	1.70	1.70	2.72	3.11	1.99	1.76	2.04	1.70	3.22	3.30	5.03	8.15
12.90	2.46	3.83	1.70	1.70	1.70	2.72	3.11	1.99	1.76	2.04	1.70	3.22	3.30	5.03	8.15
13.00	2.46	3.72	1.69	1.69	1.69	2.72	3.11	1.99	1.76	2.04	1.69	3.22	3.30	5.03	8.15
13.10	2.46	3.61	1.68	1.68	1.68	2.72	3.11	1.99	1.76	2.04	1.68	3.22	3.30	5.03	8.15
13.20	2.46	3.51	1.68	1.68	1.68	2.72	3.11	1.99	1.76	2.04	1.68	3.22	3.30	5.03	8.15
13.30	2.46	3.42	1.67	1.67	1.67	2.72	3.11	1.99	1.76	2.04	1.67	3.22	3.30	5.03	8.15
13.40	2.46	3.34	1.66	1.66	1.66	2.72	3.11	1.99	1.76	2.04	1.66	3.22	3.30	5.03	8.15
13.50	2.46	3.27	1.66	1.66	1.66	2.72	3.11	1.99	1.76	2.04	1.66	3.22	3.30	5.03	8.15
13.60	2.46	3.21	1.65	1.65	1.65	2.72	3.11	1.99	1.76	2.04	1.65	3.22	3.30	3.82	5.14
13.70	2.46	3.15	1.64	1.64	1.64	2.72	3.11	1.99	1.76	2.04	1.64	3.22	3.30	3.82	5.14
13.80	2.46	3.07	1.64	1.64	1.64	2.72	3.11	1.99	1.76	2.04	1.64	3.22	3.30	3.82	5.14
13.90	2.46	2.98	1.64	1.63	1.63	2.72	3.11	1.99	1.76	2.04	1.63	3.22	3.30	3.82	5.14
14.00	2.46	2.94	1.64	1.63	1.63	2.72	3.11	1.99	1.76	2.04	1.63	3.22	3.30	3.82	5.14
14.10	2.46	2.92	1.64	1.62	1.62	2.72	3.11	1.99	1.76	2.04	1.62	3.22	3.30	3.82	5.14
14.20	2.46	2.88	1.64	1.61	1.61	2.72	3.11	1.99	1.76	2.04	1.61	3.22	3.30	3.82	5.14
14.30	2.46	2.82	1.64	1.61	1.61	2.72	3.11	1.99	1.76	2.04	1.61	3.22	3.30	3.82	5.14
14.40	2.46	2.75	1.60	1.60	1.60	2.72	3.11	1.99	1.76	2.04	1.61	3.22	3.30	3.82	5.14
14.50	2.46	2.72	1.60	1.60	1.60	2.72	3.11	1.99	1.76	2.04	1.61	3.22	3.30	3.82	5.14
14.60	2.46	2.68	1.59	1.59	1.59	2.72	3.11	1.99	1.76	2.04	1.61	3.22	3.30	3.82	5.14

Frequency (HZ)	Acceleration in X -Direction Z/2*Sa (m/s2)					Acceleration in Y -Direction Z/2*Sa(m/s2)					Acceleration in Z -Direction Z/2*Sa (m/s2)				
	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M
14.70	2.46	2.63	1.59	1.59	1.59	2.72	3.11	1.99	1.76	2.04	1.61	3.22	3.30	3.82	5.14
14.80	2.46	2.59	1.58	1.58	1.58	2.72	3.11	1.99	1.76	2.04	1.61	3.22	3.30	3.82	5.14
14.90	2.46	2.55	1.57	1.57	1.57	2.72	3.11	1.99	1.76	2.04	1.61	3.22	3.30	3.82	5.14
15.00	2.46	2.52	1.57	1.57	1.57	2.72	3.11	1.99	1.76	2.04	1.61	3.22	3.30	3.82	5.14
15.10	2.46	2.51	1.56	1.56	1.56	2.72	3.11	1.99	1.76	2.04	1.61	3.22	3.30	3.82	5.14
15.20	2.46	2.51	1.56	1.56	1.56	2.72	3.11	1.68	1.76	2.04	1.61	3.22	3.30	3.82	5.14
15.30	2.46	2.51	1.55	1.55	1.55	2.72	3.11	1.68	1.76	2.04	1.61	3.22	3.30	3.82	5.14
15.40	2.46	2.51	1.55	1.55	1.55	2.72	3.11	1.68	1.76	2.04	1.61	3.22	3.30	3.82	5.14
15.50	1.92	2.51	1.54	1.54	1.54	2.72	3.11	1.68	1.76	2.04	1.61	3.22	3.30	3.82	5.14
15.60	1.92	2.51	1.54	1.54	1.54	2.72	3.11	1.68	1.76	2.04	1.61	3.22	3.30	3.82	5.14
15.70	1.92	2.51	1.53	1.53	1.53	2.72	3.11	1.68	1.76	2.04	1.61	3.22	3.30	3.82	5.14
15.80	1.92	2.51	1.53	1.53	1.53	2.72	3.11	1.68	1.76	2.04	1.53	3.22	3.30	3.82	5.14
15.90	1.92	2.51	1.53	1.53	1.53	2.72	3.11	1.68	1.76	2.04	1.53	3.22	3.30	3.82	5.14
16.00	1.92	2.51	1.52	1.52	1.52	2.72	3.11	1.68	1.76	2.04	1.52	3.22	3.30	3.82	5.14
16.10	1.92	2.51	1.52	1.52	1.52	2.72	3.11	1.68	1.76	2.04	1.52	3.22	3.30	3.82	5.14
16.20	1.92	2.51	1.51	1.51	1.51	2.72	3.11	1.68	1.76	2.04	1.51	3.22	3.30	3.82	5.14
16.30	1.92	2.51	1.51	1.51	1.51	2.72	3.11	1.68	1.76	2.04	1.51	3.22	3.30	3.82	5.14
16.40	1.92	2.51	1.50	1.50	1.50	2.72	2.45	1.68	1.76	2.04	1.50	3.22	3.30	3.82	5.14
16.50	1.92	2.51	1.50	1.50	1.50	2.72	2.40	1.68	1.76	2.04	1.50	3.22	3.30	3.82	5.14
16.60	1.92	2.51	1.49	1.49	1.49	2.72	2.36	1.68	1.76	2.04	1.49	3.22	3.30	3.82	5.14
16.70	1.92	2.51	1.49	1.49	1.49	2.72	2.34	1.68	1.76	2.04	1.49	2.17	3.30	3.82	5.14
16.80	1.92	2.51	1.49	1.49	1.49	1.93	2.32	1.68	1.56	2.04	1.49	2.14	3.30	3.82	5.14
16.90	1.92	2.51	1.48	1.48	1.48	1.93	2.31	1.68	1.56	2.04	1.48	2.14	3.30	3.82	5.14
17.00	1.92	2.51	1.48	1.48	1.48	1.93	2.31	1.68	1.56	1.65	1.48	2.14	3.30	3.82	5.14
17.10	1.92	2.51	1.47	1.47	1.47	1.93	2.30	1.68	1.56	1.65	1.47	2.14	3.30	3.82	5.14
17.20	1.92	2.51	1.47	1.47	1.47	1.93	2.30	1.68	1.56	1.65	1.47	2.14	3.30	3.82	5.14
17.30	1.92	2.51	1.47	1.47	1.47	1.93	2.29	1.68	1.56	1.65	1.47	2.14	3.30	3.82	5.14
17.40	1.92	2.51	1.46	1.46	1.46	1.93	2.28	1.68	1.56	1.65	1.46	2.14	3.30	3.82	5.14
17.50	1.92	2.51	1.46	1.46	1.46	1.93	2.26	1.68	1.56	1.65	1.46	2.14	3.30	3.82	5.14
17.60	1.92	2.51	1.45	1.45	1.45	1.93	2.24	1.68	1.56	1.65	1.45	2.14	3.30	3.82	5.14
17.70	1.92	2.51	1.45	1.45	1.45	1.93	2.22	1.68	1.56	1.65	1.45	2.14	3.30	3.82	5.14
17.80	1.92	2.51	1.45	1.45	1.45	1.93	2.18	1.68	1.56	1.65	1.45	2.14	3.30	3.82	5.14
17.90	1.92	2.51	1.44	1.44	1.44	1.93	2.14	1.68	1.56	1.65	1.44	2.14	2.35	2.18	5.14
18.00	1.92	2.51	1.44	1.44	1.44	1.93	2.09	1.68	1.56	1.65	1.44	2.14	2.35	2.11	3.42
18.10	1.92	2.51	1.44	1.44	1.44	1.93	2.04	1.57	1.56	1.65	1.44	2.14	2.35	2.03	3.28
18.20	1.92	2.51	1.43	1.43	1.43	1.93	1.99	1.57	1.56	1.65	1.43	2.14	2.35	1.95	3.14
18.30	1.92	2.51	1.43	1.43	1.43	1.93	1.93	1.57	1.56	1.65	1.43	2.14	2.35	1.87	3.01

Frequency (HZ)	Acceleration in X -Direction Z/2*Sa (m/s2)					Acceleration in Y -Direction Z/2*Sa(m/s2)					Acceleration in Z -Direction Z/2*Sa (m/s2)				
	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M
18.40	1.92	2.51	1.42	1.42	1.42	1.93	1.93	1.56	1.56	1.65	1.42	2.14	2.35	1.80	2.89
18.50	1.83	2.51	1.42	1.42	1.42	1.93	1.93	1.55	1.56	1.65	1.42	2.14	2.35	1.78	2.78
18.60	1.83	2.51	1.42	1.42	1.42	1.93	1.93	1.54	1.56	1.65	1.42	2.14	2.35	1.78	2.69
18.70	1.83	2.51	1.41	1.41	1.41	1.93	1.93	1.53	1.56	1.65	1.41	2.14	2.35	1.78	2.61
18.80	1.83	2.51	1.41	1.41	1.41	1.93	1.93	1.52	1.56	1.65	1.41	2.14	2.35	1.78	2.54
18.90	1.83	2.51	1.41	1.41	1.41	1.93	1.93	1.51	1.56	1.65	1.41	2.14	2.35	1.78	2.48
19.00	1.83	2.51	1.40	1.40	1.40	1.93	1.93	1.49	1.56	1.65	1.40	2.14	2.35	1.78	2.43
19.10	1.83	2.51	1.40	1.40	1.40	1.93	1.93	1.48	1.56	1.65	1.40	2.14	2.35	1.78	2.43
19.20	1.83	2.51	1.40	1.40	1.40	1.93	1.93	1.46	1.56	1.65	1.40	2.14	2.35	1.78	2.43
19.30	1.83	2.51	1.39	1.39	1.39	1.93	1.93	1.44	1.56	1.65	1.39	2.14	2.35	1.78	2.43
19.40	1.83	2.51	1.39	1.39	1.39	1.93	1.93	1.43	1.56	1.65	1.39	2.14	2.35	1.78	2.43
19.50	1.83	2.51	1.39	1.39	1.39	1.70	1.93	1.41	1.56	1.65	1.39	2.14	2.35	1.78	2.43
19.60	1.83	2.51	1.39	1.39	1.39	1.70	1.93	1.41	1.55	1.65	1.39	2.14	2.35	1.78	2.43
19.70	1.83	2.51	1.38	1.38	1.38	1.70	1.93	1.41	1.55	1.65	1.38	2.14	2.35	1.78	2.43
19.80	1.83	2.51	1.38	1.38	1.38	1.70	1.93	1.41	1.55	1.65	1.38	2.14	2.35	1.78	2.43
19.90	1.83	2.51	1.38	1.38	1.38	1.70	1.93	1.41	1.55	1.65	1.38	2.14	2.35	1.78	2.43
20.00	1.83	2.51	1.37	1.37	1.37	1.70	1.93	1.41	1.55	1.65	1.37	2.14	2.35	1.78	2.43
20.10	1.83	2.51	1.37	1.37	1.37	1.70	1.93	1.41	1.55	1.65	1.37	2.14	2.35	1.78	2.43
20.20	1.83	2.51	1.37	1.37	1.37	1.70	1.93	1.41	1.55	1.65	1.37	2.14	2.35	1.78	2.43
20.30	1.83	2.51	1.36	1.36	1.36	1.70	1.93	1.41	1.55	1.65	1.36	2.14	2.35	1.78	2.43
20.40	1.83	2.51	1.36	1.36	1.36	1.70	1.93	1.41	1.55	1.65	1.36	2.14	2.35	1.78	2.43
20.50	1.83	2.51	1.36	1.36	1.36	1.70	1.93	1.41	1.55	1.65	1.36	2.14	2.35	1.78	2.43
20.60	1.83	2.51	1.36	1.36	1.36	1.70	1.93	1.41	1.55	1.65	1.36	2.14	2.35	1.78	2.43
20.70	1.83	2.51	1.35	1.35	1.35	1.70	1.93	1.41	1.55	1.65	1.35	2.14	2.35	1.78	2.43
20.80	1.83	2.51	1.35	1.35	1.35	1.70	1.93	1.41	1.55	1.65	1.35	2.14	2.35	1.78	2.43
20.90	1.83	2.51	1.35	1.35	1.35	1.70	1.93	1.41	1.55	1.65	1.35	2.14	2.35	1.78	2.43
21.00	1.83	2.51	1.35	1.35	1.35	1.70	1.93	1.41	1.55	1.65	1.35	2.14	2.35	1.78	2.43
21.10	1.83	2.51	1.34	1.34	1.34	1.70	1.93	1.41	1.55	1.65	1.34	2.14	2.35	1.78	2.43
21.20	1.83	2.51	1.34	1.34	1.34	1.70	1.93	1.41	1.55	1.65	1.34	2.14	2.35	1.78	2.43
21.30	1.83	2.51	1.34	1.34	1.34	1.70	1.93	1.41	1.55	1.65	1.34	2.14	2.35	1.78	2.43
21.40	1.83	2.51	1.33	1.33	1.33	1.70	1.93	1.41	1.55	1.65	1.33	2.14	2.35	1.78	2.43
21.50	1.83	2.51	1.33	1.33	1.33	1.70	1.93	1.41	1.55	1.65	1.33	2.14	2.35	1.78	2.43
21.60	1.67	2.51	1.33	1.33	1.33	1.70	1.93	1.41	1.55	1.65	1.33	2.14	2.35	1.78	2.43
21.70	1.67	2.51	1.33	1.33	1.33	1.70	1.93	1.41	1.55	1.65	1.33	2.14	2.35	1.78	2.43
21.80	1.67	2.51	1.32	1.32	1.32	1.70	1.93	1.41	1.55	1.65	1.32	2.14	2.35	1.78	2.43
21.90	1.67	2.51	1.32	1.32	1.32	1.70	1.93	1.41	1.55	1.65	1.32	2.14	2.35	1.78	2.43
22.00	1.67	2.51	1.32	1.32	1.32	1.70	1.93	1.41	1.55	1.65	1.32	2.14	2.35	1.78	2.43

Frequency (HZ)	Acceleration in X -Direction Z/2*Sa (m/s2)					Acceleration in Y -Direction Z/2*Sa(m/s2)					Acceleration in Z -Direction Z/2*Sa (m/s2)				
	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M
22.10	1.67	2.51	1.32	1.32	1.32	1.70	1.93	1.41	1.55	1.65	1.32	2.14	2.35	1.78	2.43
22.20	1.67	2.51	1.32	1.32	1.32	1.70	1.93	1.41	1.55	1.65	1.32	2.14	2.35	1.78	2.43
22.30	1.67	2.51	1.31	1.31	1.31	1.70	1.93	1.41	1.55	1.65	1.31	2.14	2.35	1.78	2.43
22.40	1.67	2.51	1.31	1.31	1.31	1.70	1.93	1.41	1.55	1.65	1.31	2.14	2.35	1.78	2.43
22.50	1.67	2.51	1.31	1.31	1.31	1.70	1.93	1.41	1.55	1.65	1.31	2.14	2.35	1.78	2.43
22.60	1.67	2.51	1.31	1.31	1.31	1.70	1.93	1.41	1.55	1.65	1.31	2.14	2.35	1.78	2.43
22.70	1.67	2.51	1.30	1.30	1.30	1.70	1.72	1.41	1.55	1.62	1.30	2.14	2.35	1.78	2.43
22.80	1.67	2.51	1.30	1.30	1.30	1.70	1.72	1.41	1.55	1.62	1.30	2.14	2.35	1.78	2.43
22.90	1.67	2.51	1.30	1.30	1.30	1.70	1.72	1.41	1.55	1.62	1.30	2.14	2.35	1.78	2.43
23.00	1.67	2.51	1.30	1.30	1.30	1.70	1.72	1.41	1.55	1.61	1.30	2.14	2.35	1.78	2.43
23.10	1.67	2.51	1.29	1.29	1.29	1.70	1.72	1.41	1.55	1.61	1.29	2.14	2.35	1.78	2.43
23.20	1.67	2.51	1.29	1.29	1.29	1.70	1.72	1.41	1.55	1.61	1.29	2.14	2.35	1.78	2.43
23.30	1.67	2.51	1.29	1.29	1.29	1.70	1.72	1.41	1.55	1.61	1.29	2.14	2.35	1.78	2.43
23.40	1.67	2.51	1.29	1.29	1.29	1.70	1.72	1.41	1.55	1.61	1.29	2.14	2.35	1.78	2.15
23.50	1.67	2.51	1.29	1.29	1.29	1.70	1.72	1.41	1.55	1.61	1.29	2.14	2.35	1.78	2.15
23.60	1.67	2.51	1.28	1.28	1.28	1.70	1.72	1.41	1.55	1.61	1.28	2.14	2.35	1.78	2.15
23.70	1.67	2.51	1.28	1.28	1.28	1.70	1.72	1.41	1.55	1.61	1.28	2.14	2.35	1.78	2.15
23.80	1.67	2.51	1.28	1.28	1.28	1.70	1.72	1.41	1.55	1.60	1.28	2.14	2.35	1.78	2.15
23.90	1.67	2.51	1.28	1.28	1.28	1.70	1.72	1.41	1.55	1.60	1.28	2.14	2.35	1.78	2.15
24.00	1.67	2.51	1.28	1.28	1.28	1.70	1.72	1.41	1.55	1.60	1.28	2.14	2.07	1.78	2.15
24.10	1.67	2.51	1.27	1.27	1.27	1.70	1.72	1.41	1.55	1.60	1.27	2.14	2.07	1.78	2.15
24.20	1.67	2.51	1.27	1.27	1.27	1.70	1.72	1.41	1.55	1.60	1.27	2.14	2.07	1.78	2.15
24.30	1.67	2.16	1.27	1.27	1.27	1.70	1.72	1.41	1.55	1.60	1.27	2.14	2.07	1.78	2.15
24.40	1.67	2.14	1.27	1.27	1.27	1.70	1.72	1.41	1.55	1.60	1.27	2.14	2.07	1.78	2.15
24.50	1.67	2.13	1.27	1.27	1.27	1.70	1.72	1.41	1.55	1.60	1.27	2.14	2.07	1.78	2.15
24.60	1.67	2.12	1.26	1.26	1.26	1.70	1.72	1.41	1.55	1.60	1.26	2.14	2.07	1.78	2.15
24.70	1.67	2.11	1.26	1.26	1.26	1.70	1.72	1.41	1.55	1.60	1.26	2.14	2.07	1.78	2.15
24.80	1.67	2.11	1.26	1.26	1.26	1.70	1.72	1.41	1.55	1.60	1.26	2.14	2.07	1.78	2.15
24.90	1.67	2.11	1.26	1.26	1.26	1.70	1.72	1.41	1.55	1.60	1.26	2.14	2.07	1.78	2.15
25.00	1.67	2.11	1.26	1.26	1.26	1.70	1.72	1.41	1.55	1.60	1.26	2.14	2.07	1.78	2.15
25.10	1.67	2.11	1.25	1.25	1.25	1.70	1.72	1.41	1.55	1.60	1.25	2.14	2.07	1.78	2.15
25.20	1.67	2.11	1.25	1.25	1.25	1.70	1.72	1.41	1.55	1.60	1.25	2.14	2.07	1.78	2.15
25.30	1.67	2.11	1.25	1.25	1.25	1.70	1.72	1.41	1.55	1.60	1.25	1.97	2.07	1.78	2.15
25.40	1.67	2.11	1.25	1.25	1.25	1.70	1.72	1.41	1.55	1.60	1.25	1.97	2.07	1.78	2.15
25.50	1.67	2.11	1.25	1.25	1.25	1.70	1.72	1.41	1.55	1.60	1.25	1.97	2.07	1.78	2.15
25.60	1.67	2.11	1.24	1.25	1.24	1.24	1.72	1.41	1.55	1.60	1.24	1.97	2.07	1.78	2.15
25.70	1.25	2.11	1.24	1.25	1.24	1.24	1.72	1.41	1.55	1.60	1.24	1.97	2.07	1.78	2.15

Frequency (HZ)	Acceleration in X -Direction Z/2*Sa (m/s2)					Acceleration in Y -Direction Z/2*Sa(m/s2)					Acceleration in Z -Direction Z/2*Sa (m/s2)				
	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M
25.80	1.25	2.11	1.24	1.25	1.24	1.24	1.72	1.41	1.55	1.60	1.24	1.97	2.07	1.78	2.15
25.90	1.25	2.11	1.24	1.25	1.24	1.24	1.72	1.41	1.55	1.60	1.24	1.97	2.07	1.78	2.15
26.00	1.25	2.11	1.24	1.25	1.24	1.24	1.72	1.41	1.55	1.60	1.24	1.97	2.07	1.78	2.15
26.10	1.25	2.11	1.24	1.25	1.24	1.24	1.72	1.41	1.55	1.60	1.24	1.97	2.07	1.78	2.15
26.20	1.25	2.11	1.23	1.25	1.23	1.24	1.72	1.37	1.55	1.60	1.23	1.97	2.07	1.66	2.15
26.30	1.25	2.11	1.23	1.23	1.23	1.24	1.72	1.37	1.55	1.60	1.23	1.97	2.07	1.66	2.15
26.40	1.25	2.11	1.23	1.23	1.23	1.24	1.72	1.37	1.55	1.60	1.23	1.97	2.07	1.66	2.15
26.50	1.25	2.11	1.23	1.23	1.23	1.24	1.72	1.37	1.55	1.60	1.23	1.97	2.07	1.66	2.15
26.60	1.25	2.11	1.23	1.23	1.23	1.24	1.72	1.37	1.55	1.60	1.23	1.97	2.07	1.66	2.15
26.70	1.25	2.11	1.23	1.23	1.23	1.24	1.72	1.37	1.55	1.60	1.23	1.97	2.07	1.66	2.15
26.80	1.25	2.11	1.22	1.22	1.22	1.24	1.72	1.37	1.55	1.60	1.22	1.97	2.07	1.66	2.15
26.90	1.25	2.11	1.22	1.22	1.22	1.24	1.72	1.37	1.55	1.60	1.22	1.97	2.07	1.66	2.15
27.00	1.25	2.11	1.22	1.22	1.22	1.24	1.72	1.37	1.55	1.60	1.22	1.97	2.07	1.66	2.15
27.10	1.25	2.11	1.22	1.22	1.22	1.24	1.72	1.37	1.55	1.60	1.22	1.97	2.07	1.66	2.15
27.20	1.25	2.11	1.22	1.22	1.22	1.24	1.72	1.37	1.55	1.60	1.22	1.97	2.07	1.66	2.15
27.30	1.25	2.11	1.22	1.22	1.22	1.24	1.72	1.37	1.55	1.60	1.22	1.97	2.07	1.66	2.15
27.40	1.25	2.11	1.21	1.22	1.21	1.24	1.72	1.37	1.55	1.60	1.21	1.97	2.07	1.66	2.15
27.50	1.25	2.11	1.21	1.22	1.21	1.24	1.72	1.37	1.55	1.60	1.21	1.97	2.07	1.66	2.15
27.60	1.25	2.11	1.21	1.22	1.21	1.24	1.72	1.37	1.55	1.60	1.21	1.97	2.07	1.66	2.15
27.70	1.25	2.11	1.21	1.22	1.21	1.24	1.72	1.37	1.55	1.60	1.21	1.97	2.07	1.66	2.15
27.80	1.25	2.11	1.21	1.22	1.21	1.24	1.72	1.37	1.55	1.60	1.21	1.97	2.07	1.66	2.15
27.90	1.25	2.11	1.21	1.22	1.21	1.24	1.72	1.37	1.55	1.60	1.21	1.97	2.07	1.66	2.15
28.00	1.25	2.11	1.21	1.22	1.21	1.24	1.72	1.37	1.55	1.60	1.21	1.97	2.07	1.66	2.15
28.10	1.25	2.11	1.20	1.22	1.20	1.24	1.72	1.37	1.55	1.60	1.20	1.97	2.07	1.66	2.15
28.20	1.25	2.11	1.20	1.22	1.20	1.24	1.72	1.37	1.55	1.60	1.20	1.97	2.07	1.66	2.15
28.30	1.25	2.11	1.20	1.22	1.20	1.24	1.72	1.37	1.55	1.60	1.20	1.97	2.07	1.66	2.15
28.40	1.25	2.11	1.20	1.22	1.20	1.24	1.72	1.37	1.55	1.60	1.20	1.97	2.07	1.66	2.15
28.50	1.25	2.11	1.20	1.22	1.20	1.24	1.72	1.37	1.55	1.60	1.20	1.97	2.07	1.66	2.15
28.60	1.25	2.11	1.20	1.22	1.20	1.24	1.72	1.37	1.55	1.60	1.20	1.97	2.07	1.66	2.15
28.70	1.25	2.11	1.19	1.22	1.19	1.24	1.72	1.37	1.55	1.60	1.19	1.97	2.07	1.66	2.15
28.80	1.25	2.11	1.19	1.22	1.19	1.24	1.72	1.37	1.55	1.60	1.19	1.97	2.07	1.66	2.15
28.90	1.25	2.11	1.19	1.22	1.19	1.24	1.72	1.37	1.55	1.60	1.19	1.97	2.07	1.66	2.15
29.00	1.25	2.11	1.19	1.22	1.19	1.24	1.72	1.37	1.55	1.60	1.19	1.97	2.07	1.66	2.15
29.10	1.25	2.11	1.19	1.22	1.19	1.24	1.72	1.37	1.55	1.60	1.19	1.97	2.07	1.66	2.15
29.20	1.25	2.11	1.19	1.22	1.19	1.24	1.72	1.37	1.55	1.60	1.19	1.97	2.07	1.66	2.15
29.30	1.25	2.11	1.19	1.22	1.19	1.24	1.72	1.37	1.55	1.60	1.19	1.97	2.07	1.66	2.15
29.40	1.25	2.11	1.19	1.22	1.19	1.24	1.72	1.37	1.55	1.60	1.19	1.97	2.07	1.66	2.15

Frequency (HZ)	Acceleration in X -Direction Z/2*Sa (m/s2)					Acceleration in Y -Direction Z/2*Sa(m/s2)					Acceleration in Z -Direction Z/2*Sa (m/s2)				
	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M	EL (+) 87 M	EL (+) 99.85 M	EL (+) 109.3 M	EL (+) 114.65 M	EL (+) 118 M
29.50	1.25	2.11	1.18	1.22	1.18	1.24	1.72	1.37	1.55	1.60	1.18	1.97	2.07	1.66	2.15
29.60	1.25	2.11	1.18	1.22	1.18	1.24	1.72	1.37	1.55	1.60	1.18	1.97	2.07	1.66	2.15
29.70	1.25	2.11	1.18	1.22	1.18	1.24	1.72	1.37	1.55	1.60	1.18	1.97	2.07	1.66	2.15
29.80	1.25	2.11	1.18	1.22	1.18	1.24	1.72	1.37	1.55	1.60	1.18	1.97	2.07	1.66	2.15
29.90	1.25	2.11	1.18	1.22	1.18	1.24	1.72	1.37	1.55	1.60	1.18	1.97	2.07	1.66	2.15
30.00	1.25	2.11	1.18	1.22	1.18	1.24	1.72	1.37	1.55	1.60	1.18	1.97	2.07	1.66	2.15



2x700 MWe PHWR – KAIGA-5&6 ATOMIC POWER PROJECT

BOQ CUM UNPRICED SCHEDULE FOR PLATE HEAT EXCHANGER PACKAGE (PHE)

GEM Bid number:

SL. No.	DESCRIPTIONS OF WORKS OR EQUIPMENT	HSN CODE	UOM	TOTAL QTY.	UNIT EX-WORKS PRICE (DULY PACKED) (INR)	TOTAL EX-WORKS PRICE (DULY PACKED) (INR)	FREIGHT CHARGES @ % OF TOTAL EX-WORKS	TOTAL PRICES (EX-WORKS + FREIGHT) (INR)	APPLICABLE GST RATE @ % ON (TOTAL EX-WORKS + FREIGHT) (INR)	TYPE OF GST (IGST/CGST + SGST/UTGST)	TOTAL F.O.R. SITE PRICE (INR)
1	2		3	4	5	6=4*5	7	8=6+7	9	10	11=8+9
A	Total Price for Design, manufacture, assembly, inspection and testing, at manufacturer's and / or his sub contractor's works, properly packed and painted for transportation and delivery of Plate Heat Exchangers along with mandatory spares complete with all accessories, special tools & tackles (if any), commissioning spares (if any), counter flanges with nuts, bolts, gaskets and coatings (wherever necessary), PG Testing as specified in the Technical specification No. PE-TS-488-179-W001 (Rev 00) .										
	Break up of 'A' above										
A.1	PHE		NOS.	8							
A.2	Lumpsum price for following Mandatory spares (also specified in Data Sheet-A) Break-up as under:										
A.2.1	Mandatory Spares for PHEs										
A.2.1.1	Heat transfer plates (This shall include four sets of end plates and sealing plates)		Nos.	10% of total no. supplied in all heat exchangers of one 700 Mwe unit.							
A.2.1.2	Gaskets (Plate joint of heat exchanger)		Sets	Two set for all plates joint of one heat exchanger							
A.2.1.3	Port Ring/Gasket		Nos.	50 % of total nos.							
	Total (A.1+A.2)										
B	Lumpsum Site Performance Testing of all PHE for TG Aux's. and PHE for SG Aux's	SAC CODE	UOM	TOTAL QTY.	UNIT PRICE FOR PG TEST (INR)	TOTAL PRICE FOR PG TEST (INR)	FREIGHT CHARGES @ % OF TOTAL EX-WORKS	TOTAL PRICES (EX-WORKS + FREIGHT) (INR)	APPLICABLE GST @ % (INR)	TYPE OF GST (IGST/CGST + SGST/UTGST)	TOTAL PRICE FOR PG TEST WITH GST (INR)
			SET	8							
C	Grand Total (A+B)										

NOTES :

- 1) Bidder to note that total price indicated above at C shall be considered complete in all respect for the full scope defined and considering all terms and conditions agreed.
- 2) Quantities indicated above shall be known as Order Quantities. The variation in Quantity shall be as per NIT.
- 3) Unit prices quoted by bidder, as above, shall be binding for any quantity variation.
- 4) Price of commissioning & erection spares, special tools & tackles and other accessories not listed above shall be included in the price of PHE & shall be supplied with the PHE.
- 5) Price break up for items not asked are deemed to be included in Sl.no 'A' of this price schedule.
- 6) Delivery shall be as per NIT
- 7) Wherever quantity has been specified as percentage (%), it shall mean percentage (%) of the total population of the PHE for the project, unless specified otherwise and the fraction will be rounded off to the next higher whole number.
- 8) Wherever the quantities have been indicated for each type, size etc., these shall cover all the items to be supplied and installed.