BPC 0007

ENQUIRY

TWO PART BID

E-TENDER

भारत हैवी इलेक्ट्रिकल्स लिमिटेड, पिपलानी, भोपाल– ४६२०२२ (भारत)
सामग्री प्रबंधन विभाग
BHARAT HEAVY ELECTRICALS LIMITED, PIPLANI, BHOPAL–462022 (INDIA)
MATERIALS MANAGEMENT DIVISION
TIN NO- 23573000001 | ECC NO- AAACB4146PXM009 | MPCT NO- HEL/05/01/0001/S15/11/79
PHONE NO : 91-755-2500100 FAX : 91-755-2500023 www.bhel.com

ENQUIRY NO E1643089
ENQUIRY DATE 30/10/24
ENQUIRY DUE DATE 28/11/24

ENQUIRY

SUPP NAME AND ADDRESS	SUPP CODE	REV CD	REV NO	REV DATE	NO OF CATY2	NO OF CATY3	ENQ NO OF ITEMS	INDENT NO
	0	1	0	NA	3	4	3	340148171

GUARANTEE CERTIFICATE	Y	SUPPLY CONDITION	AS PER DESCRIPTION
TEST CERTIFICATE	Y		
INSTRUCTION BOOKLET	N	TECHNICAL CONDITION	AS PER DESCRIPTION
SAMPLE	N		
GATE PASS	Y	INSPECTION CONDITION	BHEL QC / BHEL APPOINTED TPI AND NPCIL

NOTE: QUOTE PRICE BOTH IN FIGURES & WORDS.IN CASE OF MISMATCH PRICE IN WORDS WILL BE VALID,QUOTATIONS NOT BEARING ENQUIRY NO AND DUE DATE LIABLE TO BE REJECTED.

SL NO	MATERIAL CODE	DESC	UNIT	ITEM QTY	QTY VR%	LOT NO	LOT QTY	DEST	DELIVERY DATE
1	ST4120856070	ATMOSPHERIC STEAM DISCHARGE VALVE (ASDV) ALONG WITH ITS PNEUMATIC ACTUATOR AS PER TECHNICAL SPEC NO. KAIGA-5&6/PC/E/08003 AND ANNEXURE-T	NO	16.000	0	1	8.000	201	15/09/25
						2	8.000	201	15/09/25
2	ST4120856070	ATMOSPHERIC STEAM DISCHARGE VALVE (ASDV) ALONG WITH ITS PNEUMATIC ACTUATOR AS PER TECHNICAL SPEC NO. KAIGA-5&6/PC/E/08003 AND ANNEXURE-T FOR SPARES	NO	4.000	0	1	4.000	201	15/09/25
3	ST4120856070	MANDATORY SPARES (1 SET CONSIST OF REMOVABLE SEAT RINGS -04 NOS. & GLAND PACKINGS -04 SETS) AS PER TECHNICAL SPEC NO. KAIGA-5&6/PC/E/08003 AND ANNEXURE-T	ST	1.000	0	1	1.000	201	15/09/25

REMARK 1. OFFER TO BE SUBMITTED IN TWO PART BID I.E, `TECHNICAL BID' & `PRICE BID'. 2. REFER GCC & `ANNEX' FOR COMMERCIAL TERMS AND TECHNICAL TERMS. 3. PLEASE FURNISH DULY FILLED AND ENDORSED COPY OF BHEL GTC (BP 200102), ANNEXURE B, ANNEXURE C, ANNEXURE D, IP & EPBG ALONG WITH OFFER. 4. PLEASE ACCEPT OUR TECHNO COMMERCIAL OFFER IN TOTO. ANY DEVIATION FROM OUR COMMERCIAL CONDITION SHALL BE SUITABLY LOADED IN THE OFFERED PRICE.5. ENQUIRY TECHNICAL TERM : AS PER DESCRIPTION6. SUPPLIER TECHNICAL TERM : AS PER DESCRIPTION7. INSPECTION TERMS : BHEL QC / BHEL APPOINTED TPI AND NPCIL8. PLEASE SUBMIT DULY SEAL & SIGNED PQR WITH SUPPORTING DOCUMENTS.9. ALL THE ITEMS SHALL BE PROCURED FROM THE SAME VENDOR. HENCE, EVALUATION TO BE DONE ON OVERALL BASIS. 10. DELIVERY PERIOD SHALL START FROM THE DATE OF MANUFACTURING CLEARANCE FROM BHEL BHOPAL. 11. INSPECTION SHALL BE DONE BY BHEL/ BHEL APPOINTED THIRD PARTY AND NPCIL.12. ITEM IS DIRECTLY DISPATCHED TO THE SITE. TO CONSIGNEE ADDRESS: CHIEF CONSTRUCTIONENGINEER, KAIGA ATOMIC POWER PROJECT-5&6 (KAIGA-5&6) KAIGA SITE, VIA - KARWAR, DIST-UTTAR KANNADA, KARNATAKA- 581400.

DRAWING N **PURCH SPEC** Y **CATALOUGE** N **Quality Surveillance Pla** Y **TWO PART BID** Y

NOTE:BHEL,BHOPAL'S Standard Terms & Conditions BP200102 (Latest Revision) form a part of this Enquiry. Bidders may obtain from us copies of these terms and conditions if not already available.

Note: During Bid Evaluation, No loading of price with regard to preferential payment of within 45 days will be made on vendore falling under MSMED ACT - OCT 06

Please submit your lowest quotation in sealed envelop essentially superscribed with ENQUIRY NO, DUE DATE AND PARTY'S NAME so as to reach at TENDER ROOM, GROUND FLOOR, ADM BUILDING, BHEL, PIPLANI BHOPAL-462022 by 11.00 am of due date.

SPECIAL REMARK: Bid to be submitted through e-procurement. Refer eproc link on BHEL Bhopal B2B site.

1.This is only a request for Quotation & not an order.
2.Small Scale industries should indicate SSI Regn. No. in Quotation/invoice.
3.In case you are not making an offer against this Enquiry, we request you to post a regret letter.
4.Indian vendors to please indicate GSTIN on their quotation.

Documents Enclosed
1.Drawing. 3.Purchase specification.
2.Catalogue. 4.Quality Surveillance Plan.

NAME : RASHMI PRATIMA KUJUR
DESG : MANAGER
0755-2502401
rashmiminz@bhel.in

SIGN & SEAL

BPC 0007

ENQUIRY

TWO PART BID

E-TENDER

भारत हैवी इलेक्ट्रिकल्स लिमिटेड, पिपलानी, भोपाल– ४६२०२२ (भारत)
सामग्री प्रबंधन विभाग
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SUPP NAME AND ADDRESS	SUPP CODE	REV CD	REV NO	REV DATE	NO OF CATY2	NO OF CATY3	ENQ NO OF ITEMS	INDENT NO
OFFICE COPY		1	0	NA	3	4	3	340148171

GUARANTEE CERTIFICATE	Y	**SUPPLY CONDITION**	AS PER DESCRIPTION
TEST CERTIFICATE	Y		
INSTRUCTION BOOKLET	N	**TECHNICAL CONDITION**	AS PER DESCRIPTION
SAMPLE	N		
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DRAWING N **PURCH SPEC** Y **CATALOUGE** N **PLAN** Y **TWO PART BID** Y

SUPP CD.	SUPP NAME	MSME	STATUS	PMD	Cust Appr

S.NO	INDENT NO	ITEM NO	CATEGORY	ENQUIRY QTY.
1	340148171	1	750060	16.000
2	340148171	2	750060	4.000

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NAME : RASHMI PRATIMA KUJUR
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BPC 0007

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TWO PART BID

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भारत हैवी इलेक्ट्रिकल्स लिमिटेड, पिपलानी, भोपाल– ४६२०२२ (भारत)

सामग्री प्रबंधन विभाग

BHARAT HEAVY ELECTRICALS LIMITED, PIPLANI, BHOPAL–462022 (INDIA)

MATERIALS MANAGEMENT DIVISION

TIN NO- 23573000001 | ECC NO- AAACB4146PXM009 | MPCT NO- HEL/05/01/0001/515/11/79

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NAME : RASHMI PRATIMA KUJUR
DESG : MANAGER
0755-2502401
rashmiminz@bhel.in

SIGN & SEAL

ANNEXURE-T

1. Following documents shall be submitted to BHEL Bhopal within 1 month from the placement of purchase order for NPCIL approval:
   a. Quality Assurance Plan, Data sheet, Arrangement drawings,
   b. Welding Procedure Specification (WPS), Procedure Qualification Record (PQR) and Welders' Qualification.
   c. NDT (MP,LP,UT) procedures,
   d. Hydro-Test Leak tightness of Stem Packing,
   e. Burst Pr. Test of Diaphragm of the actuator
   f. Air Leak tightness Procedure for Actuator assembly,
   g. Performance Accuracy of Positioning
   h. Performance Test Procedure (Positioning Accuracy, Repeatability, Hysteresis, Linearity, Dead Band, Valve Travel etc.)
   i. Flow Characteristic.
   j. Seat Leakage Procedure,
   k. Seismic Qualification Procedure,
   l. Functional Qualification Procedure,
   m. Dynamic Response Test Procedure
   n. Cleaning & Painting Procedure of Valves
   o. Packing procedure of Complete Assembly.

   If any additional documents are required from the customer, vendor shall furnish the same.
2. Vendor registration form with credentials shall be filled and submitted to BHEL along with techno-commercial offer for NPCIL approval.
3. All the documents (QAP, Data sheet, arrangement drawings, seismic analysis, QME qualification etc.) shall be submitted in line with technical specification no. Kaiga-5&6/PC/E/08003.

Prepared by	Checked by	Approved by
S.A. Ahmad STE-SY	KUMAR (Design) S.T.E. Division BHEL Bhopal	संजीव कुमार/SANJEEV KUMAR /Sr.Dy.General Manager एस.टी. ई. विभाग/S.T.E. Division बी.एच.ई.एल.,भोपाल/BHEL Bhopal

4. Tentative Floor response spectra is enclosed in the technical specification. If any changes required from customer, same shall be intimated to vendor after PO placement.
5. Delivery period shall start from the date of manufacturing clearance from BHEL Bhopal.
6. Vendor shall supply valve with counter flanges.
7. All the Technical data shall be filled in the Annexure-1 of technical specification and submitted to BHEL along techno-commercial.
8. Inspection shall be carried out by NPCIL and BHEL/ BHEL appointed TPI as per NPCIL approved QAP.
9. Item shall be directly sent to kaiga site.

   Consignee address is as follows:

   Consignee Address:

   Chief Construction

   Engineer,Kaiga Atomic Power

   Project-5&6 (KAIGA-5&6)

   Kaiga Site, Via - Karwar, Dist-

   Uttar Kannada, Karnataka-581400

Prepared by	Checked by	Approved by
S.A. Ahmad STE-54	AMIT KUMAR Manager(Design) S.T.E. Division BHEL Bhopal	SANJEEV KUMAR Sr.Dy.General Manager S.T.E. Division

561683/2024/HEP-STE40100

Technical Pre-qualification requirements (PQR) for Atmospheric Steam Discharge Valve (ASDV) -2X700 MW Kaiga 5 & 6

Purchase indent no. 340148171 **Date:** 07.09.2024

Vendor must fulfill the following pre-qualification requirements (PQR):

Sr. No.	Description	Vendor Complied	Supporting Documents needed from vendor to accept the compliance
1	Offered valves should be qualified as per ASME QME-1.	YES /NO	If offered valve is ASME QME-1 qualified, Bidder shall submit the ASME QME-1 qualification report and procedure of offered valve. OR If offered valve is not ASME QME-1 qualified, then 1) Bidder to submit the ASME QME-1 qualification report of any identical type valve (to be considered as a Parent) along with the procedure and also submit the letter of confirmation to carry out the qualification of offered valve as per ASME QME-1 after PO placement. OR 2) If there are no QME-1 qualified valves available with bidder, then the bidder must submit ASME QME-1 qualification procedure along with the Lab details, where QME-1 testing to be performed. Bidder must also submit the Lab confirmation for QME -1 testing.

STE PQR TECHNICAL REVIEW COMMITTEE

Member -1	Member -2	Member -3
दिनेश चन्द्र निर्मल/Dinesh Chandra Nirmal वरि.उप महाप्रबंधक/Sr. DGM एस.टी.ई.विभाग/S.T.E. Division बी.एच.ई.एल.,भोपाल/B.H.E.L.,BHOPAL	SANJEEV KUMAR/Sr.Dy.General Manager एस.टी.ई.विभाग/S.T.E. Division बी.एच.ई.एल.,भोपाल/BHEL Bhopal	DHIVAKAR KUMAR/Dy. General Manager एस.टी.ई.विभाग/STE Division बी.एच.ई.एल.,भोपाल/B.H.E.L.,BHOPAL

Prepared by: Syed Adnan Ahmad, STE-S4

Checked by: Amit Kumar, Mgr/STE

Approved by: SANJEEV KUMAR/Sr.Dy.General Manager, एस.टी.ई.विभाग/S.T.E. Division, बी.एच.ई.एल.,भोपाल/BHEL Bhopal

561683/2024/HEP-STE40100

Technical Pre-qualification requirements (PQR) for Atmospheric Steam Discharge Valve (ASDV) -2X700 MW Kaiga 5 & 6

Purchase indent no. 340148171 **Date: 07.09.2024**

2	The valves shall be seismically qualified for Operating Basis Earthquake (OBE) & Safe Shut down Earthquake (SSE).	YES /NO	If Yes, Bidder to submit the report. If No, Bidder must submit the procedure along with confirmation to carry out OBE & SSE qualification.
3	Past experience	YES /NO	Bidder must submit the sketch with explanation of control scheme and type of Atmospheric Discharge Valve supplied to any Nuclear Power Station and is operating successfully. As an evidence of successful execution, vendor must submit PO copy and LR copy / SRV copy / customer completion certificate.

NOTE: All the credentials submitted by the vendors shall be reviewed & approved by BHEL & NPCIL and if any additional document required by NPCIL/BHEL, BIDDER shall furnish the same.

Final price bid shall be opened only for those vendors who will be approved by the end customer (NPCIL) on the basis of credentials.

STE PQR TECHNICAL REVIEW COMMITTEE

Member -1	Member -2	Member -3
दिनेश चन्द्र निमेर/Dinesh Chandra Nimsl वरि.उप महाप्रबंधक/Sr. DGM एस.टी.ई.विभाग/S.T.E. Division बी.एच.ई.एल.,भोपाल/B.H.E.L.,BHOPAL	SANJEEV KUMAR Sr. Dy General Manager S.T.E. Division BHEL Bhopal	SHANKAR KUMAR Dy General Manager STE Division BHEL, BHOPAL

Prepared by
Syed Adnan Ahmad
STE-54

Checked by
Amit Kumar
Mgr IS TE

Approved by
SANJEEV KUMAR
Sr. Dy General Manager
S.T.E. Division
BHEL Bhopal

MAIN CONTRACTOR'S PROPOSAL CUM EVALUATION REPORT
(FOR GHAVP- 1 & 2, KAIGA- 5 & 6 AND GHAVP- 3 & 4)
मुख्य संविदाकार प्रस्ताव सह मुल्यांकन रिपोर्ट
(GHAVP- 1 & 2, KAIGA- 5 & 6 AND GHAVP- 3 & 4 के लिये)

Ref No: संदर्भ सं.:	BHEL/VER /CCI/POMSSV, Rev 00	***Date:*** तिथि:	09.09.2024

i.	**Main *Contractor*** मुख्य संविदाकार	BHEL, Bhopal
ii.	**Project /** परियोजना	KAIGA- 5 & 6 (NPCIL)
iii.	**Package Name** पैकेज का नाम	TURBINE ISLAND PACKAGE
iv.	**Proposed Item /** प्रस्तावित मद	Atmospheric Steam Discharge Valve (ASDV) along with spares & mandatory spares
v.	**Name and Address of the proposed Sub-vendor's works** /प्रस्तावित सब-वेंडर का नाम तथा पता: Filled by Vendor	
vi.	**Brief description of the Sub-contractor, their products and capabilities in terms of manpower, machines, testing facilities etc.:** - Details are mentioned below; **Products: -** Filled by Vendor along with credentials **Capabilities:** - Filled by Vendor along with credentials **Manpower:** - Filled by Vendor along with credentials **Testing Facilities**:- Filled by Vendor along with credentials Vendor to furnish any additional details in Annexure	
vii.	**Supplier Performance Rating out of 100 (If applicable)**	NA.
viii.	**BHEL PO Numbers already Placed on Vendor**	Filled by vendor
ix.	Details of and financial capability of Sub-contractor: - Details are mentioned below Filled by Vendor along with credentials *# Negative PBT of any company do not imply that vendor lacks resources to execute orders. It means margins are low in the present business scenario. Vendor has already successfully executed BHEL POs in year 2021 & 2020, in spite of negative PBTs in previous years.*	

MAIN CONTRACTOR'S PROPOSAL CUM EVALUATION REPORT
(FOR GHAVP- 1 & 2, KAIGA- 5 & 6 AND GHAVP- 3 & 4)
मुख्य संविदाकार प्रस्ताव सह मुल्यांकन रिपोर्ट
(GHAVP- 1 & 2, KAIGA- 5 & 6 AND GHAVP- 3 & 4 के लिये)

x.	Whether the Sub-contractor supplied the Equipment/item/component to BHEL/NPCIL earlier. If supplied, please mention the project name and year; - Details are mentioned below Filled by Vendor along with credentials
xi.	Details of the other customers of the Sub-contractors: - Details are mentioned below. Filled by Vendor along with credentials
xii.	Details of their ISO and other certifications: - Details are mentioned below Filled by Vendor along with credentials

We confirm that as per BHEL assessment, the proposed sub-vendor is fully capable for supplying the item in the project.
BHEL के आकलन के अनुसार इस बात की पुष्टि करते हैं कि, प्रस्तावित उप-विक्रेता प्रस्तावित मद की आपूर्ति के लिए इस परियोजना में उपयुक्त है।
Additional Remarks: -

To be filled by BHEL

Name / नाम	Design./ पद	Sign & Date / हस्ताक्षर व तिथि
BHEL Employee	**BHEL Employee**	**BHEL Employee**
BHEL Employee	**BHEL Employee**	**BHEL Employee**
BHEL Employee	**BHEL Employee**	**BHEL Employee**

561683/2024/HEP-STE40100

NUCLEAR POWER CORPORATION OF INDIA LIMITED

(A Govt. of India Enterprise)

PROJECT : KAIGA ATOMIC POWER PROJECT UNIT 5&6

TECHNICAL SPEC. NO.: Kaiga-5&6/PC/E/08003

BHEL REF NO : BHEL/STE-Z16-508-01_R01

REVISION NO. :	R0			
DATE OF ISSUE : (dd / mm/yy)	15.05.2024			
TOTAL NO. OF PAGES (Including Cover Sheet) :	141			

TECHNICAL SPECIFICATION FOR ATMOSPHERIC STEAM DISCHARGE VALVE (ASDV)

BHARAT HEAVY ELECTRICALS LTD.				NPCIL'S ACCEPTANCE			
	NAME	SIGN	DATE		NAME	SIGN	DATE
PREPARED BY	ADNAN		15/05/2024	CHECKED BY	Nitin Kr. Singh, Sr. EE, TG&SS		24.05.2024
CHECKED BY	AMIT KUMAR		15/05/2024	REVIEWED BY			24.05.2024
REVIEWED BY			15/05/2024	APPROVED BY			27.05.2024
APPROVED BY	SANJEEV KUMAR		15/05/2024				

(For Revisions See Revision Control Sheet)

FILE NAME: KAIGA-5 &6 _PC_E_08003_ R0

REVISION CONTROL SHEET

DOCUMENT TYPE: TECHNICAL SPECIFICATION

NO.: Kaiga-5&6/PC/E/08003

TITLE: TECHNICAL SPECIFICATION FOR ATMOSPHERIC STEAM DISCHARGE VALVE (ASDV)

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

BHEL - REVISION RECORD SHEET

BHEL/ BHEL/STE-Z15-497-01_R01

REV. NO. DATE	DESCRIPTION OF REVISION	BHEL			REMARK
		REVISED BY	REVWD BY	APPD BY	
01 15/05/2024	Incorporated NPCIL comments received via mail dated 05.04.2024				

TABLE OF CONTENT

1.0 GENERAL & SCOPE OF SUPPLY

1.0 General

This specification is intended to cover the requirements of design, manufacture, assembly, testing and delivery, properly packed for transport, of the Atmospheric steam discharge valves (ASDV) complete with their operators and all other accessories as specified hereinafter, for 700 MWe PHWR plants.

2.0 Scope

2.1 The scope of work covered by the specification shall be as follows:

Twenty (20) (16+ 4 spares) nos. of ASDVs for two units as follows.

	UNIT-1	UNIT 2
SL NO.	**QUANTITY**	**QUANTITY**
1	8+2 (Spares)	8+2 (Spares)

Diaphragm actuator with hand wheel (wherever specified), pneumatic positioner for ASDVs with contactless Hall Effect based Electronic Position Transmitter, limit switches, air filter regulator, volume booster etc. as required for all the valves.

2.2 Spare Parts

2.2.1 The Supplier shall provide following components as mandatory spare parts

a. Removable seat rings- 4 nos.

b. Gland packing- 4 sets

2.2.2 The Supplier shall also recommend other maintenance spare parts as may be considered necessary for five year's operation.

2.2.3 The Bidder shall quote separately for the above spare parts.

2.3 Recommended Spares

2.3.1 Two (2) sets of unused spare parts for five years' trouble-free operation of valves shall be offered.

2.3.2 Two (2) complete set of unused maintenance tools.

2.4 Standards

The design, manufacture and testing of the equipment covered by this specification unless specifically stated otherwise shall conform to the latest edition as on the date of N.I.T. of the following standards and publications:

2.4.1 ASME Boiler and pressure Vessel Code Section-III, Subsection-NC.

2.4.2 IEEE Std. 600 Qualification testing of safety system equipment for use in Nuclear Power Generating station.

2.4.3 American society of mechanical engineers.

2.4.4 Instrument society of America.

2.4.5 Indian Standards Institute.

2.4.6 ANSI B 16.34 – Valves: flanged and butt welding ends.

2.4.7 IEEE standard 382 – Qualification of safety – related valve actuators.

2.4.8 FCI 70-2 – Control Valve seat leakage.

2.4.9 ISA S75.19 – Hydrostatic testing of control valves.

2.4.10 ISA –S75.02 Control valve capacity test procedure.

2.4.11 IEEE – 344 –Recommended practices for Seismic qualification of class 1E components for Nuclear Power Generating Plant.

2.4.12 ASME-QME-1- Qualification of active mechanical equipment used in Nuclear Power Plants

2.4.13 PP-P-1819: Technical specification on methods and procedures for seismic qualification of valves, panels, devices rotating and reciprocating equipment, tanks, vessels & supports.

2.5 General Description

The Power Station is rated at 700 MWe. Total steam flow at 700 MWe is 3874Tonnes/hours (subject to variation based on secondary cycle optimization). Constant Steam Generator pressure program is selected for this reactor design. This means that pressure in the steam generator will be maintained as 44 kg/cm$_2$(g) at any load condition. The boiler pressure controller automatically tries to maintain the proper balance between the steam output and turbine steam consumption

in order to maintain the steam pressure at its programmed set point. But in case of sudden fluctuations in the grid power requirement or an increase in the thermal power output which cannot be transferred to the grid due to grid limitation etc., the amount of steam generated in the plant may be in excess of what can be admitted to the turbine. If the steam pressure rises above the programmed set point, then the boiler pressure controller sends a signal to the atmospheric steam discharge and the condenser dump valves for discharging this excess steam from the steam system.

The opening of the steam dump and discharge valves are programmed in different stages. Opening of the CSDVs is programmed based on the Boiler Pressure Controller (BPC). As the steam pressure goes on rising, depending on the BPC signal, CSDVs will be opened and steam will be dumped in the condenser. This steam dumping action will be prevented in case of high backpressure in the condenser or loss of normal power supply, which drives the circulating water pumps. Travel of those steam dump valves will be proportional to the control signal received from boiler pressure controllers. If the pressure still continues to rise even after opening of CSDVs, the increased signal level from the boiler pressure controller will next open simultaneously the eight atmospheric steam discharge valves to relieve the excess steam to atmosphere. Opening of these steam discharge valves will send a signal to the plant to reduce its thermal power output, thus hoping to match the thermal output with turbine demand.

In case however the regulating system fails, the boiler and its associated steam distribution piping is protected from over pressure by a set of full capacity safety valves which operate independently of the boiler pressure controller, and its associated steam discharge and dump valves.

BIDDER shall note that atmospheric steam discharge valve are located out door and shall be suitable for service in outdoor environment. ASDVs shall be able to perform its intended function in the environment of steam with temperature 170 ^{0}C which can be released due to any pipe rupture around the valves. Such operation at elevated temperature (170 ^{0}C) is expected only for half an hour. BIDDER shall confirm this requirement is met.

BIDDER to ensure that space for ASDV actuators' withdrawal shall be suitable to the layout of main steam piping. Refer piping layout and 3D model screen shots of ASDV (page no. 67 to 69).

2.6 Operating Conditions

2.6.1 The control signal coming from all the three channels of the boiler pressure controller will Range from 4 to 20 mili amperes for ASDVs. All these electrical signals will be converted to 0.21 to 1.06 Kg/cm^2 (g) pneumatic signals by the Purchaser before feeding them to the valve positioners. Quality of air will be dry (- 40 °C dew point) and oil free.

2.6.2 **Valve Sizing**

2.6.2.1 Each of the atmospheric steam discharge valves shall be designed to discharge around 388 T/hr. subject to variation based on secondary cycle optimization of steam at an inlet pressure of 44 Kg/cm^2 (g) and outlet pressure of 3 Kg/cm^2 (g) (at the outlet of LNP set to facilitate discharge of steam to atmosphere through discharge piping, as shown in the layout piping drawing (page no. 67 to 69). with the valve in 100% open condition.

2.6.2.2 All the discharge valves shall be modulating type. The discharge capacities referred are corresponding to full open condition of the valves.

2.6.3 Average total time per year during which the valves will not be fully closed will be approximately as follows:

Atmospheric Steam Discharge Valves : 50 hrs.

2.6.4 The Atmospheric discharge valves are mounted on main steam pipe line at a floor elevation of 116 M. The discharge valves shall be mounted on horizontal pipelines. Bidder shall provide any additional supporting arrangement if required for pneumatic operator and suggest if any such arrangement is needed.

2.6.5 Apart from the operating conditions mentioned above it is foreseen that the valves shall operate without giving in, in seismic condition that would be furnished to successful bidder. The valve body and specially the extended structure, holding the actuator positioner assembly shall be capable of withstanding the resulting forces.

2.6.6 All the atmospheric discharge valves should be air fail to close type.

2.7 General Design Requirements

2.7.1 Design criteria and material

2.7.1.1 Atmospheric Steam Discharge Valves (ASDVs) design shall conform to ASME Section III clause NC 3500, with service limit of level B for OBE & upset condition and Level C limit for SSE & emergency condition: – class 2 components.

The valve design shall be in accordance with high degree of engineering practice to ensure satisfactory operation over an expected life of 40 years

2.7.1.2 The valve shall be of 600 lb class in accordance with the classification of ANSI B 16.34.

The valves shall be designed for a pressure of 55 Kg/cm^2 (g) and a temperature of 270 ^0C.

2.7.1.3 Analysis for occasional forces

The steam pipe on which these valves are mounted may occasionally be subjected to steam/water hammer force of as an impact force on the pipe center line. The bonnet flanges, yoke operator and the valve as a whole shall be designed to withstand such force without causing failure/ permanent damage to any part. For this purpose, the forces resulting out of steam / water hammer shall be estimated by BIDDER.

2.7.1.4 Valve construction shall be as follows:

Cast carbon steel ASME SA 352 LCB body & bonnet for ASDVs, 12% chrome steel stem of BHN 200 minimum, type 316 stainless steel trim with stellited seats and renewable body seat ring.

2.7.1.5 The valves shall have a guided single seat cage design and seat leakage when fully closed shall be as per FCI 70-2 Class V.

2.7.1.6 The valve flow paths shall be accepted in as cast condition provided they are free of surface dents, protrusions and porosity.

2.7.1.7 Parts subject to wear, corrosion or other deterioration, requiring adjustment, inspection or repair, shall be accessible and capable of reasonably convenient removal for repair / replacement when required, and where applicable, wearable

parts shall have means of adjustment. The bidder shall indicate the life of all the components that would require replacement and replacement schedule. The bidder shall also indicate the inspection required and its schedule for all the components of valve.

2.7.1.8 The castings and forgings shall be free from blow holes, porosity, shrinkage defects, cracks or other defects. They shall be smooth and well cleaned.

2.7.1.9 Detailed specifications and descriptions of all the processing and manufacturing techniques employed, welding (if employed for fabrication or repair), heat treating methods, testing and cleaning procedures to be followed shall be subject to approval by the Purchaser's Engineer prior to carrying out manufacture or repairs.

2.7.2 Under the specified service conditions, there shall be no leakage to atmosphere across the valve stem packing and neither air should enter the system when the packing is properly tightened for normal operation.

2.7.3 All nuts shall be provided with locking devices. Positive locking devices are preferred to others.

2.7.4 The counter-flanges shall be of weld neck type of proper pressure rating. Edge preparation for the weld ends shall be according to ANSI B 16.25.

2.7.5 As already indicated, the discharge valves are to be sized for the capacity indicated, with the valve wide open (i.e. lift 100%).

2.7.6 The BIDDER shall indicate the reliability/availability figures of the valve and basis for arriving at the same.

2.7.7 It may be noted that the ASDVs shall be air fail to close, i.e. on failure of air supply the actuator shall close ASDVs. The design of the valve stem, however should be such that the air fails to open type of actuators also can be mounted on the valve. With this, purchaser will be able to change over the actuator from fail close type to air fail to open type, if need arises.

2.8 Seismic Requirements (For ASDVs)

The piping system on which Atmospheric Steam Discharge valves are mounted shall be designed for SSE (Safe Shutdown Earthquake) & OBE (Operating Basis Earthquake). These valves are therefore required to be seismically qualified.

2.8.1 The valves (ASDVs) shall be qualified for Operating Basis Earthquake (OBE) and Safe Shutdown Earthquake (SSE). It shall be demonstrated that the integrity and operability of the valve is not impaired during and after the occurrence of either OBE or SSE. All instrumentation accessories of ASDVs shall be seismically qualified for OBE & SSE by shake table test.

2.8.2 The BIDDER shall demonstrate that the valve with actuator assembly is either rigid or flexible with the fundamental natural frequency of the valve being greater than the cut off frequency or less than the cut off frequency (100 Hz) respectively.

2.8.3 Subsequently, functional qualification shall be carried out as per ASME QME-1. Bidder may note that if the offered valve has already been qualified as per ASME QME-1, then such valves need not be qualified again. However the qualification report (based on analysis and supplemental tests) justifying the identically of the offered valve and the already qualified valve shall be submitted for purchaser's approval.

2.8.4 Following seismic acceleration shall be considered.

Refer the floor response spectra enclosed with the specification, of EL.116 m of control building in Attachment-16 at page no. 63 to 92.

2.8.5 The valves shall withstand the stresses due to normal operating condition together with upset (OBE)/Emergency (SSE) loading. Simultaneous application of seismic acceleration in three orthogonal directions (two horizontal and one vertical) need be considered for analysis and testing. For checking the stresses due to higher loading in upset/emergency condition, ASME section-III NC shall be referred.

2.8.6 All the analysis procedure and the report shall be submitted to the purchaser's Engineer for his approval.

2.9 Additional Requirements

2.9.1 When operating at full flow, both the dump and discharge valves noise level shall be kept to a minimum. The bidder shall indicate the noise level in his offer. If required, bidder will offer noise reduction device to limit the noise to 85 decibels.

2.9.2 In the offer bidder is required to furnish the sketch with explanation of control scheme and type of Atmospheric discharge supplied by them to any Nuclear Power Station and operating successfully.

2.9.3 The opening time required by these valves are specified in data sheet. These times are required during actual service hence shop floor test timing shall be less than that specified in the tender. Bidder shall also give explanation as to how trim / plug material and shape is decided to avoid damage to the component due to fast opening. A closing time of 2 sec. is permissible for the valve.

2.10 Pneumatic Operator and Accessories

2.10.1 General

The operators and positioners shall be suitable for service under the conditions specified.

The operators shall be spring and diaphragm units. The main air supply is clean, oil free, dry air (-40^{0}C dew point) at maximum 6.5 kg/cm2 (g).

Normal air supply for the operation of discharge valves is from a compressed air/air drying plant network with 6.5 kg/cm^2 (g) pressure. For operation of discharge valves additionally provision shall be made by BIDDER for one dry air receiver for each ASDV (8 receivers for 8 ASDVs) to be located in the vicinity of valves. In case the main compressor fails, air receivers local to the discharge valve will cater for the operation of the discharge valve. The air receivers shall also be supplied by BIDDER. The bidder shall indicate up to which minimum pressure in the receiver, the discharge valve can remain functional.

Dimensions and locations of air receivers given as an attachment-23.

Air receiver shall be capable of supplying motive air for ASDV operation for 150 full strokes with no inflow of air into the receiver.

The bidder to include necessary filter regulator unit, as needed.

2.10.2 **Pneumatic operators**

2.10.2.1 The material and design of the operators shall be such as to ensure long, trouble free life.

2.10.2.2 The operator shall consist of a spring and diaphragm unit.

2.10.2.3 The design and selection of individual operators shall be such as to ensure that the valve will fully stroke in both directions under the condition of combined maximum flow induced and stem friction loads. Operation under these conditions shall be possible when the differential pressure across the diaphragm of the operator is equal to the lesser of:

a. 65% of the air supply pressure.

b. 65% of the maximum pressure handling capability of the valve positioner.

2.10.2.4 The intent is to provide operators as small and compact as possible and hence, preference will be given to operators that utilize the highest air pressure.

2.10.2.5 All pneumatic operators shall be adequate to withstand the full supply air pressure.

2.10.2.6 The design of the operator, valve body and/or the main seat shall be adequate to withstand the impact load which may occur under the maximum velocity of the valve stem resulting from the maximum accelerating force available.

2.10.2.7 A stem travel indicator with open and closed indication shall be provided on each pneumatic operator. In addition, the valve stem extension and/or the push rod from the operator shall be guided or otherwise fixed to prevent rotation.

2.10.2.8 For air to open type valves, the diaphragm actuators shall incorporate a spring to generate adequate stem force for closing of the valves in case of loss of supply air pressure. The valves will be opened by the diaphragm operators against this spring force, but will be forced closed by the spring as soon as the supply air pressure is lost.

2.10.2.9 All the operators shall be provided with suitable hand wheel for manual operation.

2.10.3 Positioner

Positioner shall be direct acting type for all discharge valves.

2.10.4 Valve position indicator and limit switches

2.10.4.1 Each of the atmospheric steam discharge valves shall be furnished with valve stem position transmitters.

2.10.4.2 Each of the Atmospheric steam discharge valves shall have seven limit switches (SPDT type) which are independently adjustable to actuate at any position of stem travel. The supplier shall adjust five switches for the fully closed position and two numbers at fully open position of the valves. Contacts shall be suitable for 1 ampere (resistive) at 240 volts AC. and 48 volts DC. These switches shall be enclosed in weatherproof enclosures (IP-65 class).

2.10.5 For details of individual valves. Please refer Data Sheet (refer page no.25 to 29).

2.11 Performance

2.11.1 General

The valves and operators along with positioners and any other necessary ancillary equipment shall be suitable for modulating control and shall have fast response, in both the opening and closing directions. All discharge valves shall be designed to meet the performance requirement with the air supply pressure of max. 6.5 kg/cm2 (g) or the maximum pressure handling capability of the positioner, whichever is less.

2.11.2 Characteristics

The characteristic of each valve shall be such that for a given upstream pressure, the flow shall vary linearly with stem position.

2.11.3 Static performance

The following requirements shall refer to the relation between the position of the valve plug and input signal to the positioner. The dead band shall be not more than 0.25% of input Span. (Input span is that range of input signal to the positioner over which the valve moves from fully open to fully closed position).

2.11.4 Dynamic performance

The valves shall meet the following minimum requirements:

For step change in input signal equal to that, which corresponds to full stroke in either direction, a large valve shall have moved more than 63.2% of the full stroke within 1.0 second.

The valve opening time is critical to user. (Refer individual data sheet). For input, a sine waves with a peak-to-peak magnitude of 10% of the input signal span, centered about 50% of the input span the magnitude and phase response shall be not poorer than the following:

Magnitude Response	Phase Response
- 3 db 1 cps	- 45^0 0.5 cps
- 10 db 3 cps	- 90^0 1.5 cps

In addition, the response curves shall not indicate any response which results in the magnitude response increasing within –3 db of unity gain (0 db) at any frequency greater than that which the response first drops below 3 db. The response at any frequency shall not exceed + 3 db and the phase margin shall be not less than 30 degrees when the magnitude response is 0 db.

A high capacity volume booster should be used, if required, to satisfy the above requirement provided stable operation can be achieved.

2.12 Welding

2.12.1 All the welding and weld repair shall conform to the requirement of ASME code for pressure vessels – Section-III, sub section NC for ASDVs. For examination and repair, NC 2500 shall be followed for ASDVs.

2.12.2 The Supplier shall be responsible for the quality of welding. He shall conduct tests of the welding procedure to determine its suitability. He shall also carry out tests of the welders to determine their ability to apply the procedure properly. The qualification tests shall be in accordance with the code mentioned below:

2.12.3 All weldments manufactured as parts of the equipment shall be fabricated with materials which shall meet the requirement of ASME Section-III, Subsection NC for ASDVs.

2.12.4 The supplier shall have all welding procedures, welding equipment, and operators qualified in accordance with ASME Boiler and Pressure vessel code Section IX. Each operator's certificate of qualification shall be on file with the supplier and shall be made available to the purchaser or his representative on request.

2.12.5 Each weld shall be stamped with the supplier's welder or welding operator's number or symbol. Stamping shall be done lightly on the crown of the weld or on the pipe adjacent to the weld using low stress type die stamps with round nose interrupted dots.

2.12.6 A procedure of the repair of defects shall be submitted for approval of the Engineer prior to carrying out such repairs.

2.13 Special Tools and Tackles

The Bidder shall supply complete unused set of all special tools, wrenches etc. including toolboxes as required for erection, maintenance, overhaul or complete replacement of the equipment under this specification. The bidder shall enclose with this proposal a list of those tools.

2.14 SPARE PARTS

2.14.1 The Supplier shall provide following components as spare parts

a. Removable seat rings.

b. Gland packing.

2.14.2 The Supplier shall also recommend other maintenance spare parts as may be considered necessary for five year's operation.

2.15 Testing and Inspection at Manufacturer's Works

2.15.1 The manufacturer shall provide inspection to establish and maintain the quality of workmanship in his works and that of his sub-contractors to ensure the mechanical accuracy of each component, identity and acceptability of all materials, parts and equipment. He shall conduct all tests required to ensure that the equipment furnished shall conform to the requirements of the applicable codes. All tests and test procedures proposed by the manufacturer shall be submitted to the Engineer for his approval.

All material used for the manufacture of the equipment covered under this specification shall be of tested quality. Relevant test certificates shall be made available to the Engineer before the final shop inspection. If such correlating test certificates are not available, supplier shall carry out the tests at his own cost. The Engineer shall be notified well in advance of major shop tests for the purpose of making general inspections and for the progress report. The Engineer's representative shall be given full access to the shop in which the equipment is manufactured or tested and all test records shall be made available to him.

A final inspection will be made by the Engineer's representative before the dispatch of the equipment.

Four (4) sets of certified physical and chemical analysis of all the components and certificates of the hydrostatic tests shall be submitted to the Engineer.

2.15.2 **Steel Castings**

Material for steel casting of pressure containing parts shall be as per ASME SA 352 LCB conforming to all the requirements specified in the above standard. A copy of the check analysis shall be sent to the engineer.

2.15.3 **Steel Forgings**

2.15.3.1 Material for steel forgings of pressure containing parts shall be as per ASME SA 350 GLF2 (for ASDVs), conforming to all the requirements specified in the above standard. A copy of the check analysis of the steel shall be sent to the engineer.

Material for fasteners shall be;

Bolts – ASTM A-193 Gr. B7

Nuts - ASTM A-194 Gr. 7

2.15.3.2 All forgings shall be tested by Magnetic particle test following the relevant ASTM E109/E138 standards, however, the non-ferrous forgings shall be inspected by liquid penetration tests following the relevant ASTM E165 standard. The testing shall be carried out after rough machining operation.

2.15.4 **Repairs to Casting / Forgings**

Any defect which will not machine out during the final machining of casting/forging, will be gouged out and repaired using an approved repair procedure and inspected to see that the defect is fully removed. All repair work shall comply with the requirements of NC 2500 for ASDVs.

Any indication which proves to penetrate deeper than 2.5% of the finished thickness of the forging/casting shall be reported to engineer giving location, length, width and depth.

2.15.5 **Radiographic Inspection**

Pressure containing parts of the valves shall be fully radiographed. The radiography shall be in accordance with ASTM E94 and ASTM E142. The valves shall meet the class-2 requirements of ASTM E71.

All fabrication welds joining pressure containing parts of valves, or welds of any extension thereto, shall be fully radiographed. Radiography shall be in accordance with ASTM E94 and ASME Section-III, Sub Section NC (Section NC requirement for ASDVs). Weld quality shall meet the requirements of NC 4400.

2.15.6 **Hydrostatic test**

The valves shall be subjected to hydrostatic tests at manufacturer's shop to check the adequacy of its construction. Test pressure shall be as follows:

2.15.6.1 **Shell Test**

Valve bodies shall be tested at pressure and duration as per ISA S 75.19 and ASME Sec III subsection NC (NC for ASDVs).

2.15.6.2 **Seat Test**

Valve seats shall be tested in accordance with FCI 70-2. They shall meet the leakage requirements of specified class of leakage in data sheet as per FCI 70-2.

2.15.6.3 **Air Test**

An air leak seat test shall be carried out for all the valves under water, with a pressure of 8 kg/cm^2 (g).

2.15.6.4 **Stem packing test**

During the Hydrostatic test of the shell, stem packing shall be tested as follows and shall meet the requirements stated herein:

a. The pressure on the valve shall first be raised to the maximum service pressure of 44 kg/cm^2 (g). The packing gland shall be adjusted so that there is no visible leakage past the packing.

B. The pressure on the valve shall then be raised to full hydrostatic test pressure to complete the shell and seat test. Minor leakage at the packing gland is acceptable.

c. The packing glands of the valves shall be retested at the maximum service pressure referred to in (a) above. No visible leakage at the packing gland shall be permitted.

D. Tests (a) and (b) and (c) above shall be repeated after stroking the valve 10 times.

2.15.7 **Static Performance Test**

The fully assembled valves shall be tested to demonstrate conformity with the requirements of Para 2.10.2.3 with the stem packing adjusted to satisfy simultaneously Para 2.11.3 and 2.15.6.4.

The test procedure shall be submitted by the supplier and shall be subject to prior approval by the engineer.

2.15.8 **Dynamic Performance Test**

The fully assembled valves shall be tested in accordance with the recommendations of I.S.A. RP 26.1 and RP 26.4 to demonstrate conformity with para 2.11.4. The stem packing adjustments shall not have been altered from those used under para 2.15.7.

The test procedure shall be submitted by the Supplier and shall be subjected to prior approval by the Engineer.

2.15.9 Functional qualification test should be as per ASME QME-1.

2.15.10 Capacity test of control valve as per ISA S75.02.

2.15.11 Reports

Five copies of reports of all tests/analysis called for above and five copies of routine shop inspection and test reports shall be submitted to the engineer. All test reports shall be signed by an authorized representative of the Supplier.

3.0 Reliability Requirement

BIDDER shall furnish following information on reliability parameters for ASDV–

- Mean Time Between Failures (MTBF).
- Test interval for all the above safety related equipment if it is used as standby or not in operation during normal plant operation for achieving desired performance as per design intent.
- Mean Time Between Inspections.
- Apart from the normal functional requirement for operation, following safety related valves will be operated for following number of operation during the life of plant for surveillance testing apart from normal operation requirement.

Sr. No.	Equipment	No. of Operations
1	ASDV	3900

BIDDER shall note this and take care of this requirement during design of the valves. Any limitation for meeting these requirements shall be clearly brought out.

4.0 Valve Testing At Site

Valves to be retested for their leak tightness, gland leakage & operability in the field. Any defect found shall be rectified by the SUPPLIER, including replacement of defective part or the complete valve at no extra cost. Lapping of the seat and wedge if called for shall be the responsibility of the SUPPLIER and carried out at no extra cost.

5.0 Special Cleaning, Protection and Painting

5.1 All valves shall be free of mill scale. The inside of all the valves shall be free of sand, dirt and other foreign matter.

5.2 All flange faces and exterior finished or machined carbon steel surfaces shall be protected against corrosion by a rust preventive compound (other than grease). All openings shall be adequately sealed. Flanged openings shall be covered with 20mm thick plywood blank flanges held in place with four bolts and sealed with blank gasket of natural rubber. Internally threaded pipe connections shall be plugged with threaded metal plugs, sealed with thread tap.

5.3 A sack containing active silica gel desiccants shall be firmly attached to the inner surfaceof the cover on one end of each valve.

5.4 Actuators and positioners shall be painted with one coat of paint to protect them against corrosion. The outside surface of the valves shall be given two coats of red lead primer or approved equivalent primer.

6.0 Identification and Marking

The valve body and attached plate shall be marked with the information called for in M.S.S. – SPECIFICATION – 25 for steel valves meeting UASASB 16.5 standards. In addition, each valve shall have a metallic tag fixed to the valve by means of a rust resistant wire. The tag numbers shall be as shown in the individual specification sheets or will be given to the tenderer at a later date.

7.0 References

S.NO.	Descripition	Reference No.
1	Technical specification for requirement of ASDV	PC-E-625/Rev no.1
2	Valve specification sheet	Kaiga-5&6/36113/8003/VSS
3	Floor response spectra data at EL 116 m of control building	KAIGA-5&6/DC/24200/00002/R2
4	Piping layout at EL 116 m	GHAVP-1/36110/2002/GA and GHAVP-2/36110/2002/GA

8.0 VALVE SPECIFICATION SHEET

NUCLEAR POWER CORPORATION OF INDIA LTD.

VALVE TYPE : GLOBE CONTROL					**VALVE SPECIFICATION SHEET NO.**	**Kaiga-5&6/36113/8003/VSS REV NO. 0 PAGE : 1 OF 5**	
GENERAL	**INLET/OUTLET LINE SIZE**	:	300NB/600 NB		ENVIRONMENT QUALIFICATION REQUIREMENT		
	SCHEDULE	:	14.27 mm INLET /9.53 OUTLET		TEST: THERMAL — REQUIREMENT: YES; RADIATION — N.A.; LOCA — N.A.; MSLB — N.A.		
	APPLICABLE TECHNICAL SPECIFICATION	:					
	APPLICABLE DESIGN CODES/ STANDARDS:				**SEISMIC REQUIREMENT (COMPLETE VALVE ASSEMBLY)**		
	DESIGN		ASME SEC III NC/ ANSI B 16.34		**CONDITION**	**STRUCTURAL INTEGRITY**	**OPERABILITY**
	RANGEABILITY		BIDDER TO SPECIFY				
	BUTT WELD ENDS		-		**OBE**	YES	YES
					SSE	YES	YES
BODY	PRESSURE RATING	:	PN-100 (600 LBS)				
	END CONNECTIONS	:	FLANGED & ASME 600 # RF				
	MATERIAL	:	BODY	AME SA 352 GR. LCB	LINING	NOT REQUIRED	
		:	BOLTS	ASME SA193 Gr B7	NUTS	ASME SA194 GR 7	
	BORE SIZE	:	BIDDER TO SPECIFY	VALVE SIZE	:	BIDDER TO SPECIFY	
BONNET	TYPE	:	STANDARD				
	MATERIAL	:	ASME SA 352 Gr LCB				
	BONNET GASKET	:	GRAPHITE				
	HAND WHEEL	:	REQUIRED	MATERIAL	:	ASME SA216 Gr. WCC	
	STEM PACKING	:	REQUIRED	MATERIAL	:	GRAPHITE NUCLEAR GRADE	
TRIM	SEAT	:	CAGE	SEAT MATERIAL	:	ASME SA 182 Gr. F316 + Stellite No.6 362 BHN HARDNESS	
	STEM SIZE	:	VENDOR TO SPECIFY				
	STEM MATERIAL	:	17-4 PH (ASME SA 564 GR.630	PLUG MATERIAL	:	17-4 PH (ASME SA 747 GR. CB7 CU-1) 375 BHN HARDNESS	
	BACK SEATING	:	`REQUIRED				
	GUIDING	:	CAGE GUIDED				
	CAGE MATERIAL	:	ASME SA 487 GR. CA6NM CHROME PLATING				

NUCLEAR POWER CORPORATION OF INDIA LTD.								
VSS NOS. Kaiga-5&6/36113/8003/VSS				REV NO. : 0		PAGE : 2 OF 5		
SERVICE CONDITIONS	FLUID	:	STEAM					
	DESIGN PRESSURE KG/CM^2 (g)	:	55					
	TEMPERATURE(^{0} C)	:	270 (SATURATION TEMPERATURE CORRESPONDING TO ABOVE PRESSURE)					
	SHUT-OFF ΔP (KG/CM^2)	:	BIDDER TO SPECIFY					
	SHUT-OFF CLASS (LEAKAGE)	:	BIDDER TO SPECIFY					
	FLOW (TPH)	:	388					
	UPSTREAM PR. KG/CM^2 (g)	:	45					
	DOWNSTREAM PR. KG/CM^2 (g) (AT THE OUTLET OF LNP)	:	3					
	ΔP KG/CM^2 (ACROSS ASDV & LNP ASSEMBLY)	:	42					
	ΔP KG/CM^2 (ACROSS THE VALVE)		BIDDER TO SPECIFY					
	SP. GR.	:	BIDDER TO SPECIFY					
	VALVE OUTLET VELOCITY	:	BIDDER TO SPECIFY					
	C_v AT MAX FLOW CALCULATED/C_v SELECTED	:	BIDDER TO SPECIFY					
	VALVE CHARACTERISTIC	:	LINEAR					
	NOISE LEVEL @ 1.86 METERS	:	LESS THAN 85 dB					
	INHERENT VALVE CHARACTERISTIC	:	EQUAL PERCENTAGE					
OPERATION	ACTUATOR TYPE	:	PNEUMATIC	YES	ELECTRIC	-		
	ACTUATOR CONSTRUCTION TYPE	:	SPRING DIAPHRAM	YES	CYLINDER & PISTON	-		
			SINGLE ACTING	-	DOUBLE ACTING	-		
	ACTUATOR LIFTING ARRANGEMENT	:	REQUIRED					
	INSTRUMENT AIR (MOTIVE POWER) PRESSURE, kg/cm^2 (g)	:	MAXIMUM		7			
		:	MINIMUM		4			
		:	FOR SIZING ACTUATOR		3.5			
		:	FOR SIZING ACCUMULATOR TANK		REQUIREMENT 150 OPERATIONS			
	AIR SUPPLY PRESSURE KG/CM^2 (g)	:	6.5					
	OPERATOR ACTION	:	CLOSE AT	BIDDER TO SPECIFY	CLOSING TIME (SEC)	<=2 Secs		
		:	OPEN AT	BIDDER TO SPECIFY	OPENING TIME (SEC)	<=1.5 Secs		
	SUPPLY FAILURE POSITION	:	OPEN	-	CLOSE	YES	NO CHANGE	-
	POSITIONER REQUIRED	:	PNEUMATIC NON SMART TYPE WITH SEPARATE E TO A CONVERTORS					

NUCLEAR POWER CORPORATION OF INDIA LTD

	VSS NOS.: Kaiga-5&6/36113/8003/VSS			**REV. NO. 0**			**PAGE : 3 OF 5**	
	POSITIONER INPUT SIGNAL	:	0.2-1 KG/CM^2					
	POSITIONER OUTPUT SIGNAL	:	BIDDER TO SPECIFY	VOLUME BOOSTER WITH ADJUST BYPASS	:	BIDDER TO SPECIFY		
	REQUIRED FAIL SAFE POSITION OF VALVE	:	AIR FAIL TO OPEN	----	AIR FAILURE CLOSE		YES	
	AIR CONSUMPTION PER STROKE	:	BIDDER TO SPECIFY	LOCAL ACCUMULATOR TANK	:	REQUIRED		

	DESCRIPTION	PRESSURE KG/CM^2 (g)	DURATION (MIN)	APPLICABLE CLAUSE	REMARKS
INSPECTION & TEST	HYDROSTATIC BODY TEST	154	10	ISA-S75.19	PURCHASER WITNESS SHALL BE AS PER NPCIL APPROVED QAP
	HYDROSTATIC SEAT/ DISC TEST	113 KG/CM2 (for integrity as per ASME B16.34)	3		
	AIR LEAK TEST	8 KG/CM2 (for leakage as per FCI 70-2)	3		
	OPENING/CLOSING TIME TEST	REQUIRED			
	C_V TEST	REQUIRED	-		
	BACK SEAT LEAK TEST	NA			
	VALVE & ACT. PERFORMANCE TEST	REQUIRED 15 TIMES OPEN/CLOSE OPERATION & SHALL BE TESTED FOR ACCURACY OF POSITIONING AND REPRODUCIBILITY OVER FULL RANGE			
	SEAT LEAKAGE TEST	AS PER ANSI FCI 70.2			
	FUNCTIONAL QUALIFICATION TEST	AS PER ASME QME-1			
	SEISMIC QUALIFICATION	REQUIRED			
	ALL RAW MATERIAL	PHYSICAL AND CHEMICAL T.C. FROM MANUFACTURER.			
	DIMENSIONAL CHECKS	MFG. CERTIFICATES & SAMPLE CHECK BY NPC			
	STEAM PACKING LEAK TIGHTNESS	AT MAXIMUM SERVICES PRESSURE, i.e., at 44 kg/cm^2			
	STATIC AND DYNAMIC RESPONSE TEST	REQUIRED			

	ACCESSORIES	APPLICABLE			
ACCESSORIES	LIMIT SWITCHES +MECHANICAL ATTACHMENT- REQUIRED (REFER NOTE-8)	OPEN	1 NO.	CLOSE	5 NOS.

ACCESSORIES	QUICK EXHAUST VALVE	:	NOT REQUIRED	FLOOR STAND	:	N.A
	SOLENOID VALVE	:	REQUIRED	SUPPORTING BRACKET	:	N.A
	FLANGES	:	COUNTER FLANGES WNRF, WITH STUDS, NUTS AND GASKETS	INTEGRAL CAST ADJUSTABLE TRAVEL STOP	:	N.A

NUCLEAR POWER CORPORATION OF INDIA LTD				
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	LIFTING LUGS	REQUIRED	AIR LOCK RELAYS	NA
	VALVE POSITION TRANSMITTER	REQUIRED	COOLING FINS	REQUIRED
	PRV FOR POSITIONER	REQUIRED	E/A CONVERTER	REQUIRED WITH INTEGRAL PRV
ACTUATOR CONSTRUCTION	**PNEUMATIC ACTUATOR**			
	BODY/CASING/SHELL	CARBON STEEL	SEALING OF ACTUATOR STEM	NA
	DIAPHRAGM	EPDM+NYLON INSERT	NUTS	ASME SA194 Gr. 7
	ACTUATOR STEM	ASME SA 564 Gr. 630	BOLTS	ASME SA 193 GR B7
	GUIDE BUSHING	BIDDER TO SPECIFY		
	SPRING	ASME SA 232		
	YOKE	ASME SA 216 Gr WCC		
MISC.	VENDOR SHALL FURNISH FOLLOWING INFORMATION ALONG WITH SUPPORTIVE DOCUMENTS			
	1. TEST INTERVAL FOR VALVE			
	2. MEAN TIME BETWEEN INSPECTIONS			
	3. THESE VALVES WILL BE OPERATED 150 TIMES DURING LIFE OF PLANT. VENDOR SHALL NOTE THAT AND TAKE CARE OF THIS REQUIREMENT DURING DESIGN OF VALVE			
	4. CALIBRATION FREQUENCY OF VALVES			

NOTE: 1. MANUFACTURER TO SUBMIT QAP & OBTAIN NPC'S APPROVAL BEFORE MANUFACTURING

2. TESTING SHALL BE AS PER ISA-S75.19.

3. TO OPERATE THE VALVE MANUALLY IN FIELDS UNDER AIR FAILURE CONDITIONS SPECIAL MECHANISM EITHER ON VALVE OR ON ACTUATOR SHALL BE PROVIDED. THIS MECHANISM SHOULD CONTAIN CHAIN PULLEY ARRANGEMENT ALSO.

4. VALVES SHOULD BE ABLE TO PERFORM IN VERTICAL AND HORIZONTAL ORIENTATION, UPSTREAM OR DOWNSTREAM OF ELBOWS AND PIPE REDUCER.

5. ACTUATOR SHALL BE DESIGNED CONSIDERING DIFFERENTIAL PRESSURE AS DESIGN PRESSURE.

6. DIFFERENCE IN HARDNESS OF MIN 50 BHN SHALL BE MAINTAINED BETWEEN DISC AND SEAT RING IF BASE MATERIAL HARDNESS IS LESS THAN 350 BHN.

7. VENDOR SHALL SUBMIT THE ACTUATOR SIZING CALCULATIONS FOR PURCHASERS APPROVAL.

8. "ACTUATOR CYLINDER SHALL BE INTERNALLY LINED WITH A MATERIAL HAVING SELF LUBRICATING PROPERTIES SO THAT IT CAN OPERATE SMOOTHLY WITH DRY AIR."

9. POSITIONERS, ACTUATORS AND ACCESSORIES REQUIRING TUBING SHALL BE MOUNTED, VALVED & TUBED.

10. SIZE OF INSTRUMENT AIR TUBING FROM E/A CONVERTER TO THE VALVE POSITIONER SHALL BE OF 6 MM OD COPPER TUBE AND ALL OTHER INSTRUMENT AIR TUBING SHALL BE OF 10 MM OD COPPER TUBE.

11. IF NOISE LEVEL EXCEEDS 85 dBA THEN VALVE SHALL BE PROVIDED WITH ACOUSTICAL TREATMENT SUBJECT TO PURCHASER REVIEW AND ACCEPTANCE.

NUCLEAR POWER CORPORATION OF INDIA LIMITED	
700 MWe KAIGA ATOMIC POWER PROJECT -UNIT 5&6 TECHNICAL SPECIFICATION FOR ASDV	PAGE NO.: PAGE 29 OF 141 REV NO.: 00 DATE: 15/05/2024

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12. BIDDER TO SUBMIT ALL THE TEST CERTIFICATES LISTED ABOVE FOR PURCHASER'S REVIEW & RECORDS.
13. BIDDER TO SUBMIT SIZING CALCULATIONS FOR ALL VALVES CONSIDERING ALL FLOW CONDITIONS, OUTLET VELOCITY, NOISE AND ACTUATORS SIZING FOR PURCHASER'S REVIEW AND APPROVAL.
14. COOLING FINS SHALL BE INCLUDED FOR DESIGN TEMPERATURE ABOVE 205 DEGC.
15. TRIM SHOULD BE DESIGNED TO HANDLE HIGH DELTA P.
16. NOISE LEVEL CALCULATION TO BE SUBMITTED.

VALVE TAG NOS.	LINE NOS	FLOOR ELEVATION/BUILDING/GRID
1/2 -3612-CV-1226	300-S-3612-1001	116.5M/CB-PCB/GRID C TO GRID E
1/2 -3612-CV-1227	300-S-3612-1003	
1/2 -3612-CV-1228	300-S-3612-1005	
1/2 -3612-CV-1229	300-S-3612-1007	
1/2 -3612-CV-1230	300-S-3612-1009	
1/2 -3612-CV-1231	300-S-3612-1011	
1/2 -3612-CV-1232	300-S-3612-1013	
1/2 -3612-CV-1233	300-S-3612-1015	
	300-S-3612-1017	
QUANTITY	8 NOS. PER UNIT	

ATTACHMENT -1

TECHNICAL DATA TO BE FURNISHED BY BIDDER

The bidder shall furnish the following information along with the offer for ASDV

1.1 VALVES

SR. NO.	DATA	TO BE FURNISHED FOR EACH TYPE
1	Manufacturer and Model No.	
2	Type	
3	Size (mm) ,NPS	
4	(i) Pressure Class , PN	
	(ii) Design Pressure, kg/cm^2	
	(ii) Design Temperature, °C	
5	Design Conditions:	
	(i) Upstream Pressure, kg/cm^2(g)	
	(ii) Downstream Pressure, kg/cm^2(g)	
	(iii) Flow, tons/hr	
6	Noise Level, db	
7	Stroke, mm(total stem travel)(from 0 lift to 100% lift corresponding to above flow)	
8	Valve Flow Coefficient(indicate units used) at different stem travels: 100% open 80% open 60% open 40% open 20% open	
9	Dimensions, (mm)	
	(i) Face to Face, horizontal, if any	
	(ii) Face to Face, vertical, if any	
	(iii) Total height with actuator	
10	End details	
	(i) Type of inlet connection & flange rating (for flanged valves)	

SR. NO	DATA	TO BE FURNISHED FOR EACH TYPE
	(ii) Type of outlet connection & flange rating (for flanged valves)	
	(iii) Flanges drilled as per standard specified in specification (for flanged valves)	Yes / No
	(iv) Counter flanges as specified	Yes / No
11	Material of construction	
	(i) Valve body	
	(ii) Bonnet	
	(iii) Body to bonnet gasket	
	(iv) Valve stem & hardness	
	(v) Seat ring	
	(vi) plug	
	(vii) cage	
	(viii) Other internal parts	
	(ix) Stem	
	(x) Stem gland packing	
	(xi) Hand wheel (if applicable)	
12	Valve construction	
	(i) Number of seats	
	(ii) Type of valve plug	
	(iii) Radiation fin bonnet provided?	Yes / No
	(iv) Body seat ring seal welded?	Yes / No
	(v) Type of valve plug guiding	
	(vi) Valve port size	
	(vii) Hand wheel provided?	Yes / No
	(viii) Estimated thrust on the valve while operating under design condition in Kg. And direction of thrust.	

SR. NO	DATA	TO BE FURNISHED FOR EACH TYPE
	(ix) Details of any special support for valve and / or operator	
	(x) Maximum seat leakage when tested as per FCI 70.2	
	(xi) Stroking time under full	
	differential pressure	
13	Low dB plate provided	Yes / No
14	Seismic Qualification / FQT	Yes / No

1.2 PNEUMATIC OPERATOR

SR. NO.	DATA	
1	Manufacturer and model No.	
2	**Type**	
3	**Size**	
4	(i) Diaphragm dia./Cylinder bore, mm	
	(ii) Effective diaphragm working area or piston area, cm^2	
5	Operator action: Close at Kg/cm^2 Open at Kg/cm^2	
6	Spring thrust for closure/opening on air failure, Kg	
7	Maximum working pressure, Kg/cm^2	
8	(vi) Length of stroke, mm	
9	**Materials of construction** (i) Diaphragm / Cylinder casing (ii) Diaphragm/Piston (iii) Seal	
10	**Type of seal**	

1.3 POSITIONER

SR. NO.	DATA	
1	Manufacturer and model No.	
2	**Type**	

3	**Air signal range – Closed** **Kg/cm²** - Opened Kg/cm²	
4	**Pilot valve capacity** **– feed Nm³/hr** - Bleed Nm³/hr	
5	Steady state pilot valve consumption Nm³/hr	
6	**Material of construction**	
	(i) Base, cover, etc. (ii) Bellows (iii) Relay body (iv) Relay nozzle	
7	Pressure gauges as desired provided?	**Yes/No**
8	Extent of zero and span adjustment available?	**Yes/No**

1.4 LIMIT SWITCHES

SR. NO.	DATA	
1	Manufacturer and model No.	
2	**Number of switches furnished**	
3	**Type**	
4	**Enclosure**	
SR. NO.	**DATA**	
5	Contact rating at: 48 V DC 240 V AC	
6	Number of change over contacts per switch	

1.5 POSITION TRANSMITTER AND INDICATOR

SR. NO.	DATA	
1	Manufacturer and model No.	
2	**Type**	
3	Transmitter output range	

4	**Number furnished**	
5	**Remote indicator** (i) Size (ii) Scale length, mm (iii) Scale division (iv) Suitable for flush mounting on panels (v) Number furnished	
6	Air supply requirements – SCFM per valve assembly	
7	Maximum load across the transmitter output terminals	

1.6 BOOSTER

SR. NO.	DATA	
1	Manufacturer and model No.	
2	**Type**	
3	Damping medium	

1.7 COUNTER FLANGES FOR VALVES (WHERE APPLICABLE)

SR. NO.	DATA	
1	Type	
2	Rating	
3	Material	
4	Materials for nuts & Bolts	

1.8 ENVIRONMENTAL LIMITS FOR ALL EQUIPMENT

SR. NO.	DATA	
1	**Temperature**	
2	**Humidity**	

1.9 WEIGHTS

SR. NO.	DATA		
1	Valve	Kg	
2	Pneumatic operator	Kg	
3	Complete assembly	Kg	

1.10 Reliability Requirements:

Vendors shall furnish following information on reliability parameters for Atmospheric Steam Discharge Valves (ASDV):

SR. NO.	DATA	
1	1) Mean Time Between Failures (MTBF).	
2	Test interval for ASDV if it is used as standby or not in operation during normal plant operation for achieving desired performance as per design intent.	
3	Mean Time Between Inspections.	
4	Apart from the normal functional requirement for operation, ASDVs will be operated 3900 times during the life of plant. Vendors shall note this and take care of this requirement during design of the valves.	
5	Calibration frequency of these valves.	

Vendors should furnish the above information along with supportive documents.

ATTACHMENT - 2

SCHEDULE OF BIDDER'S GENERAL PARTICULARS

1.0 Name of the BIDDER :

2.0 Address of the BIDDER :

3.0 Telephone, fax number, e-mail address of the BIDDER:

4.0 Name and designation of the officer of the BIDDER to whom all references shall be made for expeditious coordination :

5.0 (a) Foreign/indigenous collaborator if any role of foreign/indigenous collaborator: (Furnish complete particulars of collaboration, including copies of Government approval of collaboration agreement with overseas agencies). Evidence of clearance from his government in case of foreign bidder/collaborator

(b) Foreign / indigenous collaborations: Role of the BIDDER / collaborator / principal (as regards the extent & scope of the supply / services between BIDDER and his collaborator principal) shall be clearly brought out.

(c) Modus operandi for executing this contract covering all aspects from Design and engineering to handing over including services during erection, testing commissioning and trial operation.

(d) Evidence of clearance from his government in case of foreign BIDDER.

(e) Blank format (i.e. without price) of the price schedule shall be included along with Part-I with (*) mark against the respective serial numbers for the Supply items, Services, statutory levies etc., considered for pricing.

6.0 Are all technical particulars called in the specification filled-up? Yes/No

7.0 Are all deviations pointed out in Schedule of Deviations? Yes/No

COMPANY SEAL

SIGNATURE _____
NAME _____
DESIGNATION _____
COMPANY _____
DATE _____

ATTACHMENT – 3

SCHEDULE OF BIDDER'S EXPERIENCE

The BIDDER shall furnish here with a list of similar jobs executed by him to whom reference may be made by the PURCHASER in case the PURCHASER considers such a reference necessary

Sl. No.	Name and Description of work, including scope of work	Value of work	Client	Purchase Order No. & Date	Period of construction commissioning and date of	Persons to -whom reference may be made

SIGNATURE _____

NAME _____

COMPANY SEAL DESIGNATION _____

COMPANY _____

DATE _____

ATTACHMENT – 4

SCHEDULE OF DRAWINGS / DOCUMENTS TO BE SUBMITTED ALONG WITH THE BID

The following documents shall be furnished along with the BID.

1.0 Completely filled in DATASHEETS/ ATTACHEMENTS of the specification.

2.0 Detailed organization chart of the BIDDER and his collaborator indicating the list of Personnel who will be deployed for the contract and at projects site if the contract is Awarded

3.0 All Quality assurance plans covering entire' scope of contract.

4.0 Technical literature / catalogues.

5.0 List of makes of actuator

6.0 Bidder's experience

7.0 General arrangement drawing covering all the features of valves as noted below based on specification:

a. Constructional features.

b. Detailed part list with material specification.

c. Overall dimensions with tolerance.

d. End connection details including edge preparation details.

e. Test pressures for hydraulic and seat air tests.

f. Details of operator including make and overall dimension.

g. Weight of assembly.

h. Details of accessories (locking arrangement, extension drive, chain arrangement etc.) where called for.

ATTACHMENT – 5

SCHEDULE OF GUATANTEES

1.0 GUARANTEES

It is guaranteed that the material and workmanship of all components, installation, erection, commissioning and operation of the equipment supplied under this contract meet the requirements of these specifications.

2.0 With respect to the goods covered in the enquiry specifications the CONTRACTOR shall provide to the PURCHASE, guarantees:

2. 1 Of Title

It is guaranteed that the goods are not subject to any security interest, lien or other encumbrance.

2. 2 Against patent infringements

Except when the PURCHASER furnishes design specifications to the CONTRACTOR, the CONTRACTOR will at his own expense, defend and save the PURCHASE harmless from the expenses and consequences of any suit or procedure brought against the PURCHASER, so far as said suit or procedure is based on a claim that the goods furnished constitute an infringement of any patent in existence on the date of the order. In addition, the CONTRACTOR shall secure at his own expense a fully paid up license or licenses that will permit the PURCHASER to continue use of the goods furnished free of further free of further claim for infringement.

2. 3 Of Quality

a) It is guaranteed that the goods are new and of high quality and that the goods will be free of defects in design, materials and workmanship for a period of twelve (12) months from the date of commercial operation of the unit with Reactor Steam.

b) If within the expiry of the above stipulated guarantee period, the subject goods or any parts thereof are found defective because of design, workmanship or materials, it will be repaired or replaced. The guarantee period for the replaced parts or repair work shall be the same as above.

c) The guarantee period will be extended by the length of time required to make any adjustments, changes or repairs necessary to fulfil the guarantees.

d) Similar guarantees will be obtained from each SUB-CONTRATOR, However, the overall responsibility will be with the CONTRACTOR.

2. 4 Of Performance

It is guarantees that the goods furnished are in full accordance with the requirements of this specification including codes and standards referred herein.

SIGNATURE _____

NAME _____

COMPANY SEAL DESIGNATION _____

COMPANY _____

DATE _____

ATTACHMENT – 6

SCHEDULE OF DEVIATIONS FROM TECHNICAL SPECIFICATIONS

All deviations from the Specification shall be filled in by the BIDDER clause by clause in this schedule. BIDDER shall also indicate herein whether he would agree to withdraw the deviations if insisted upon by PURCHASER and whether such withdrawal would be at extra cost/no extra cost to PURCHASER. The extent of cost implications, if any, for withdrawal of deviations shall however be mentioned in Section E.

SL NO.	SECTION NO.	CLAUSE NO.	DEVIATION	WHETHER AGREEABLE TO WITHDRAW IF INSISTED BY PURCHASER (YES/NO.)

The BIDDER hereby certifies that the above mentioned are the only deviations from Technical specification of the enquiry.

SIGNATURE _____

NAME _____

COMPANY SEAL

DESIGNATION _____

COMPANY _____

DATE _____

ATTACHMENT -7

SCHEDULE OF ERECTION AND MAINTENANCE TOOLS AND TACKLES

The BIDDER shall give below the list of maintenance tools and tackles included by him in his quoted prices for carrying out complete disassembly/assembly/ overhauling of equipment offered. BIDDER shall confirm that the maintenance tools/kit are complete in all respects.

SL. NO.	PARTICULARS	QTY.

SIGNATURE _____

NAME _____

COMPANY SEAL

DESIGNATION _____

COMPANY _____

DATE _____

ATTACHMENT -8

SCHEDULE OF WEIGHTS AND DIMENSIONS

The BIDDER shall state below the weights and dimensions of various packages for shipment comprising the complete scope.

SL. NO.	DESCRIPTION	DIMENSION IN METRES)	WEIGHT (IN TONNES)

SIGNATURE _____

NAME _____

COMPANY SEAL

DESIGNATION _____

COMPANY _____

DATE _____

ATTACHMENT - 9

SCHEDULE OF ACTIVITIES

The BIDDER shall indicate the times for manufacture, delivery and other activities of each Equipment as shown below unit wise.

For KAIGA U-5

SL. No.	Equipment	Time from date of order to works test (weeks)	Time for works test, dismantling, packing and ready for dispatch from works (weeks)	Time required for shipment to site (weeks)	Total time from date of order to shipment to site (weeks)	Time required for erection, testing & commissioning (weeks)	Total time from date of order to commissioning and handing over, (weeks)

For KAIGA U-6

SL. No.	Equipment	Time from date of order to works test (weeks)	Time for works test, dismantling, packing and ready for dispatch from works (weeks)	Time required for shipment to site (weeks)	Total time from date of order to shipment to site (weeks)	Time required for erection, testing & commissioning (weeks)	Total time from date of order to commissioning and handing over, (weeks)

We, the undersigned, hereby undertake to meet the above time schedule from the date of order.
(BIDDER shall submit the detailed bar chart covering complete scope of this package)

SIGNATURE _____

NAME _____

COMPANY SEAL

DESIGNATION _____

COMPANY _____

DATE _____

ATTACHMENT – 10 (if required)

SCHEDULE OF PERFORMANCE AND EFFICIENCY TEST INSTRUMENTS

The BIDDER should indicate hereunder all necessary instruments to be loaned by him to the PURCHASER for performance and efficiency tests on the Equipment supplied by him.

SL. No.	Measurement point	Measured variable	Instrument required	Quantity required	Remarks

The BIDDER shall furnish 'all instruments with calibration certificates or otherwise as required for performance evaluation of complete plant as specified in this contract.

SIGNATURE _____

NAME _____

COMPANY SEAL

DESIGNATION _____

COMPANY _____

DATE _____

ATTACHMENT -11

SCHEDULE OF PLACES OF TESTS AND INSPECTION

The BIDDER shall indicate the item of equipment supplied, name of the MANUFACTURER or SUB-CONTRACTOR and place of test and inspection as shown below:

SL. NO.	Item / equipment	Manufacturer or subcontractor	Place of test or inspection

SIGNATURE _____

NAME _____

COMPANY SEAL

DESIGNATION _____

COMPANY _____

DATE _____

ATTACHMENT 12

SCHEDULE OF SUB CONTRACTORS & SUB VENDORS

The BIDDER shall indicate the details of SUB- CONTRACTORS. Details of each SUB- CONTRACTORS shall be provided in following format.

SL. No.	Item/equipment	Name of sub vendor /sub-contractor	List of plants where equipment supplied	Rating of plant where equipment / system supplied / service provided	Complete address, telephone numbers, e-mail ID	Location of works	Remarks

SIGNATURE _____

NAME _____

COMPANY SEAL

DESIGNATION _____

COMPANY _____

DATE _____

ATTACHMENT – 13 (if required)

SCHEDULE OF ERECTION EQUIPMENT

The BIDDER shall furnish herein the details of all erection equipment and tools as required for the execution of the contract.

SL. N0.	Item	Details of quantity, capacity , etc.	Remarks

SIGNATURE _____

NAME _____

COMPANY SEAL

DESIGNATION _____

COMPANY _____

DATE _____

ATTACHMENT – 14

DOCUMENT DISTRIBUTION SCHEDULE

VENDOR shall distribute the documents as per the distribution schedule indicated below:

SL. No.	Item	OWNER's OFFICE	OWNER's SITE OFFICE
1.0	Correspondence	O+1	1
2.0	Minutes of meeting	1	1
3.0	Contract drawing / documents		
	a) Preliminary	1	1
	b) Final	1	1
	c) As built (Including 2 CD)	1	1
4.0	Test Certificates	O + 1	1
5.0	Progress report	1	1
6.0	All Photographs	1	1
7.0	Instruction manuals		
	(Final instruction manual on soft copy in MS office copied into CD)		
	a) Preliminary	1	1
	b) Final (including 2 CD)	1	1

O-Original

ATTACHMENT -15

TYPICAL QUALITY ASSURANCE PLAN FOR LARGE CONTROL VALVES

1. SCOPE AND PURPOSE:

The purpose of this typical Quality Assurance Plan is to describe general practices and sequences of activities (such as inspection, testing, control, etc..) to be performed during the manufacture of the equipment. This is a typical QAP and should be tailored by suitable modifications keeping in mind requirements included in this QAP & else where in this specification, codes, standards and vendor/sub-vendor good practices.

2. ABBREVIATIONS AND DEFINITIONS:

P – PERFORMED BY **W – WITNESSED BY** **R – REVIEWED BY**

1 – NPC QS **2 – VENDOR QC** **3 – EXTERNAL LABORATORY OR SUB VENDOR.**

WHEREVER "CHP" IS MENTIONED, IT IS A CUSTOMER HOLD POINT.

CLASS OF CHECK:

MINOR - The characteristic of a component, process or operation whose failure neither materially reduces the usability of the product in operation, nor does it affect the aesthetic aspects.

MAJOR - The characteristic of a component, process or operation whose failure may cause operation failure which can not be readily corrected at site or cause substandard performance, increased erection and maintenance cost, reduced life or seriously affect aesthetics.

CRITICAL The characteristic of a component, process or operation whose failure will surely cause operation failure or intermittent troubles which is difficult to rectify at site or render the unit unfit for use or cause safety hazard.

NOTE: THIS TYPICAL QA PLAN IS ENCLOSED WITH TENDER SPECIFICATION FOR BIDDERS REFERENCE AND TO GIVE THEM AN IDEA OF INTENDED SCOPE OF QS ACTIVITIES TO BE UNDERTAKEN DURING EXECUTION OF THIS CONTRACT. IT IS TO BE NOTED THAT THIS IS NOT A COPY OF FINAL QA PLAN. THE FINAL QA PLAN IS TO BE PREPARED BY SUCCESSFUL BIDDER AND GOT APPROVED PRIOR TO EXECUTION OF CONTRACT.

TYPICAL QUALITY ASSURANCE PLAN FOR LARGE CONTROL VALVES

Sl. No.	COMPONENT	CHARACTERISTIC		TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	REMARKS	AGENCY		
										P	W	V
1	Body & Bonnet	1.01	Chemical composition	Analysis / Test	Sample per heat	As per relevant MTL standard as specified in specification	As per relevant MTL standard as specified in specification	Product Analysis report	--	3	2	1
		1.02	Physical properties (tensile, yield, % elongation & % reduction in area, hardness)	Mecha-nical testing	Sample per heat	-do-	-do-	test certificate		3	2 1	1
		1.03	Dimensions	Measu-rement	100%	Component drawings	Component drawings	Internal quality control report	Dimensional check to be carried out after finish machining.	2	2	1
		1.04	Radiography	Radio-graphy	100%	R.T. procedure/ ASTM E94 & ASTM E142 & ASME section III, NC/ND/ ANSI B16.34 as acceptable	Level-2 of ASTM E446	As per Radio-graphy procedure	100% area of body & bonnet shall be covered For valves designed as per ASME section III NC. For other valves as specified.	3	2	1

Sl. No.	COMPONENT	CHARACTERISTIC		TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	REMARKS	AGENCY		
										P	W	V
		1.05	Magnetic Particle / LP Tests	MP/LP	100%	MP/LP procedure	ASME Sec.III NC/ND as applicable	MP/LP procedure	-	2	1	1
		1.06	Visual Examination	Visual (for any visible defects)	100%	--	--	Internal quality control (IQC) report	Examination for any visible surface defects	2	2	1
2.	Plug & Cage Stem & seat	2.01	Chemical composition	Analysis /Tests	Sample per heat	As per relevant MTL standard as specified in specification	As per relevant MTL standard as specified in specification	Product analysis report	--	3	2	1
		2.02 (a) (b) (c) (d)	Mechanical properties Tensile Yield % Elongation % reduction in area	Mecha-nical testing	Sample per heat	-do-	-do-	Test certificate	--	3	2 1	1

Sl. No.	COMPONENT	CHARACTERISTIC		TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	REMARKS	AGENCY		
										P	W	V
		2.03	MP/LP test	MP	100% Plug & Cage only	NPC approved procedure	NPC approved procedure	Inspection report	--	2	1	1
		2.04	UT test for stem	UT	100%	NPC approved UT procedure	-do-	UT Exam., Test Reports	--	3	1 2	1
		2.05	Hardness	--	100%	Relevant material spec.	Relevant material spec.	Test report	For seat rings hardness of hardfaced portion shall also be tested	2	1	1
		2.06	Visual & Dimensional	--	100%	Component drawing	Component drawing	Internal QC records	--	2	2	1
3	Yoke	3.00	Dimensions	Measu-rement	100%	-do-	-do-	-do-	--	2	2	1
		3.01	Chemical & physical properties	Analysis /Mecha-nical testing	One sample per heat	As per relevant MTL standard as specified in specification	As per relevant MTL standard as specified in specification	material tests reports		3	2	1

Sl. No.	COMPONENT	CHARACTERISTIC		TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	REMARKS	AGENCY		
										P	W	V
4	Actuator	4.01	Dimensions	Measu-rement	100%	Component drawing	Component drawing	Internal QC records	--	2	2	1
		4.02	Chemical & physical properties	Analysis /Mecha-nical test	One sample per heat	As per relevant MTL standard as specified in specification	As per relevant MTL standard as specified in specification	Test report		3	2	1
5	Diaphragm of the actuator	5.01	Tensile strength, %elongation, compression test, ageing test	Mecha-nical & ageing tests	One sample per batch	Relevant material spec.	Relevant material spec.	Test certificate		3	2	1
		5.02	Hardness		-do-	-do-	-do-	Test report		2	2	1
		5.03	Burst Pr. Test		One sample per batch	NPC approved test procedure	NPC approved test procedure	-do-		2	1	1
		5.04	Visual and dimensions		100%	Component drawing	Component drawing	IQC records		2	2	1

Sl. No.	COMPONENT	CHARACTERISTIC		TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	REMARKS	AGENCY		
										P	W	V
6	Noise reduction device(Diffuser plates) (wherever applicable)	6.01	Chemical	Analysis /Test	Sample per heat	Relevant material spec.	Relevant material spec.	IQC report	---	3	2	1
		6.02	Mechanical properties	Test	-do-	-do-	-do-	-do-	---	3	2	1
		6.03	Hardness	--	100%	-do-	-do-	-do-	---	2	1	1
		6.04	UT tests	--	100%	NPC approved UT procedure	NPC approved UT procedure	-do-	---	3	1 2	1
		6.05	LP Exam.	--	100%	LPE procedure	LPE procedure	IQC reports	---	2	1	1
		6.06	Dimensional & visual	--	100%	Component drawing	Component drawing	IQC report	---	2	2	1
7	Spring	7.01	Dimensions	Measu-rement	100%	-do-	-do-	IQC records	---	3	2	1
		7.02	Chemical composition	Analysis	Sample per batch	As per relevant MTL standard as specified in specification	As per relevant MTL standard as specified in specification	Product analysis report	---	3	2	1
		7.03	Spring rate	--	100%	Component drawing	Component drawing	IQC records	---	3	2	1
		7.04	Hardness	--	One sample per heat	-do-	-do-	IQC records	---	3	2	1

SI.	COMPONENT	CHARACTERISTIC	TYPE	QUANTUM	REFERENCE	ACCEPTANCE	FORMAT OF	REMARKS	AGENCY

No.				OF CHECK	OF CHECK	DOCUMENT	NORMS	RECORDS		P	W	V
8	Valve positioner (including position transducer) along with booster	8.01	Visual		100%	Relevant engineering standard	Relevant engineering standard	IQC records	---	2	2	1
		8.02	Performance, accuracy of positioning	Func-tional	100%	NPC approved test procedure	NPC approved test procedure	Test reports	---	2	1	1
9	Limit switches	9.01	Continuity	Check	100%	General engineering standard	General engineering standard	IQC report	---	2	1	1
		9.02	Contact resistance check	Check	100%	-do-	Shall be less than 50 m ohms	-do-	---	2	1	1
10	Studs & Nuts for flange & counter flange	10.1	Dimensions	Measu-rement	Sample	Component drawing	Component drawing	IQC records	---	3	2	1
		10.2	Chemical composition	Analysis /Test	Sample/ Heat	As per relevant MTL standard as specified in specification	As per relevant MTL standard as specified in specification	Test report	---	3	2	1
		10.3	Mech. Tests	Tests	Sample/ Heat	-do-	-do-	-do-	---	3	2	1

Sl. No.	COMPONENT	CHARACTERISTIC		TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	REMARKS	AGENCY		
										P	W	V
11	Seat & Body Gaskets	11.1	Dimensions	Measu-rement	Sample	Component drawing	Component drawing	IQC record	---	3	2	1
		11.2	Material	TC review	Sample	-do-	-do-	-do-	---	3	2	1
12	Gland packing	12.1	Dimensions	Measu-rement	Sample	-do-	-do-	IQC record	---	3	2	1
		12.2	Material	TC review	Sample	-do-	-do-	-do-	---	3	2	1
13	Counter flanges (Wherever applicable)	13.1	Chemical	Analysis / Test	Sample per heat	As per relevant MTL standard as specified in specification	As per relevant MTL standard as specified in specification	Product analysis report	---	3	2	1
		13.2	Dimensions	Measu-rement	100%	NPC approved drawing	NPC approved drawing	IQC report	---	3	2	1
		13.3	UT	UT	100%	UT procedure	ASME Sec.III NC	UT report	---	3	1 2	1
		13.4	LP Exam.	LP	100% on machined surface	NPC approved LPE procedure	NPC approved LPE procedure	IQC records	---	2	1	1

Sl. No.	COMPONENT	CHARACTERISTIC	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	REMARKS	AGENCY		
									P	W	V
	FINAL TESTING (final assembled valves)										
1.	Hydrostatic shell test for Body & Bonnet	Body, bonnet's mechanical integrity	Hydro test	100%	ISA S.75, 19-1989	ISA S.75, 19	Test report	(1) Customer hold point (2) Hydrostatic pressure shall be atleast 1.5 times cold rating pressure for duration of not less than one minute, per milli meter of thickness, based on the thickest pressure bearing part, as per ISA S.75, 19-1989 (or) min. 10 (ten) minutes, whichever is larger	2	1	1
2	Stem packing test	Hydro test Leak tightness of stem packing	Hydro test (body mount test)	100%	NPC approved procedure	NPC approved procedure	Test report	Customer hold point	2	1	1
3	Actuator assembly	Air leak tightness	Pneum-atic test	100%	-do-	-do-	-do-	1) Customer hold point 2) Test will be carried out at 1.2 times actuator design pressure (i.e. 8.3 kg/cm^2(g). The assembled actuator will be dipped in the water tank & the air pressure will be applied. Any leakage shall be noticed in the form of bubbles.	2	1	1
Sl.	COMPONENT	CHARACTERISTIC	TYPE	QUANTUM	REFERENCE	ACCEPTANCE	FORMAT OF	REMARKS	AGENCY		

No.				OF CHECK	OF CHECK	DOCUMENT	NORMS	RECORDS		P	W	V
4	Seat leakage test	Seat leakage		Leak test	100%	ANSI FCI 70.2 approved procedure	ANSI FCI 70.2 approved procedure	Test report	Customer hold point	2	1	1
5	Performance test	5.01	Positioning accuracy, repeatability, hysterisis, linearity, dead band etc.	Func-tional	100%	NPC approved test procedure	NPC approved test procedure	Test report	Customer hold point	2	1	1
		5.02	Valve travel	-do-	100%	NPC approved valve data sheet	NPC approved valve data sheet	Test report	-do-	2	1	1
6	Flow capacity test (CV test)	Flow characteristic		CV test	One sample of each type and size	NPC approved procedure	NPC approved procedure	Test report	-do-	3 2	2 1	1
7	7.1) Seismic qualification (Wherever applicable)	Seismic analysis / test		Perfor-mance	One sample of each type & size	NPC approved procedure	NPC approved procedure	Test reports	Seismic analysis will be carried out in the following manner: (a) Theoritical analysis of all the valve (for pressure boundary integrity)	3 2	1	1

Sl. No.	COMPONENT	CHARACTERISTIC	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	REMARKS	AGENCY		
									P	W	V
	7.2) Functional Qualification Testing (FQT) (Wherever applicable)	Operational reliability	Perfor-mance	One sample of each type & size	NPC approved procedure	NPC approved procedure	Test reports	(b) Natural frequency determination (by hammer test / analysis) (c) Static equivalent test at factory for one valve (customer hold point) FQT as per ASME-QME-1 shall be carried out only on ASDVs	3 2	1	1
8	Dynamic response test	Frequency response, opening / closing time	---	100%	NPC approved procedure	NPC approved procedure	Test report	Customer hold point	2	1	1
9	Cleaning & painting of assembled valve	Cleaning painting	Visual check	100%	-do-	-do-	IQC record	---	2	2	1
10	Documentation & final shipping release, name plate details	Final valve packing	Review	100%	--	--	-do-	---	2	2	1
11	Packing	Final valve packing	Check	100%	NPC approved procedure	NPC approved procedure	-do-	---	2	1	1

REMARKS

P - PERFORMED BY
W - WITNESSED BY
V - VERIFIED BY

1. BY NPC
2. BY VALVE VENDOR
3. SUB-SUPPLIER / VENDOR

LPE - LIQUID PENETRANT EXAMINATION
RE - RADIOGRAPHIC EXAMINATION
MP - MAGNETIC PARTICLE EXAMINATION
UT - ULTRASONIC EXAMINATION
TC - TEST CERTIFICATE

NOTES

1. WELD REPAIR, IF ANY, SHALL BE CARRIED OUT IN ACCORDANCE WITH APPROVED WPS (WELDING PROCEDURE SPECIFICATION) AND THE WELDER SHALL BE QUALIFIED AS PER ASME SEC. IX

2. MAJOR WELD REPAIRS SHALL CALL FOR HEAT TREATMENT AS PER RELEVANT MATERIAL SPECIFICATION.

3. ANY DEFECT, THAT IS PROVED TO PENETRATE DEEPER THAN 2.5% OF THE FINISHED THICKNESS OF FORGING/CASTING SHALL BE REPORTED TO NPC, GIVING LOCATION, LENGTH, WIDTH AND DEPTH. REPAIRED PORTION SHALL BE LP/MP CHECKED.

4. COMPLIANCE CERTIFICATES SHALL BE FURNISHED FOR THE ITEMS FOR WHICH CHEMICAL & MECHANICAL TESTS ARE NOT SPECIFIED.

5. INSPECTION HISTORY DOCUMENTS (INCLUDING ALL TEST/ANALYSIS REPORTS) FOR ALL THE VALVES SHALL BE COMPILED AND SIX (6) COPIES SHALL BE SUBMITTED TO NPC FOR REFERENCE & RECORDS.

ATTACHMENT – 16

Control building floor response spectra at elevation 116 m.

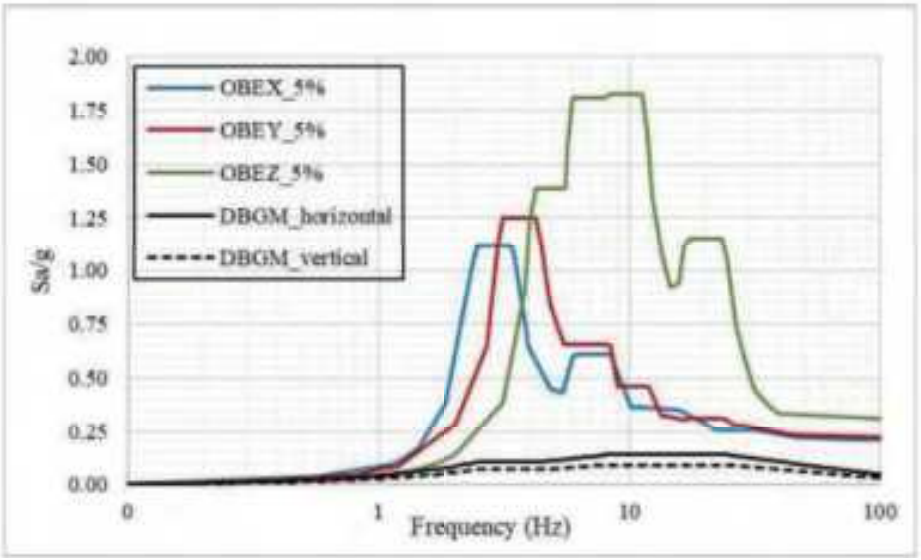
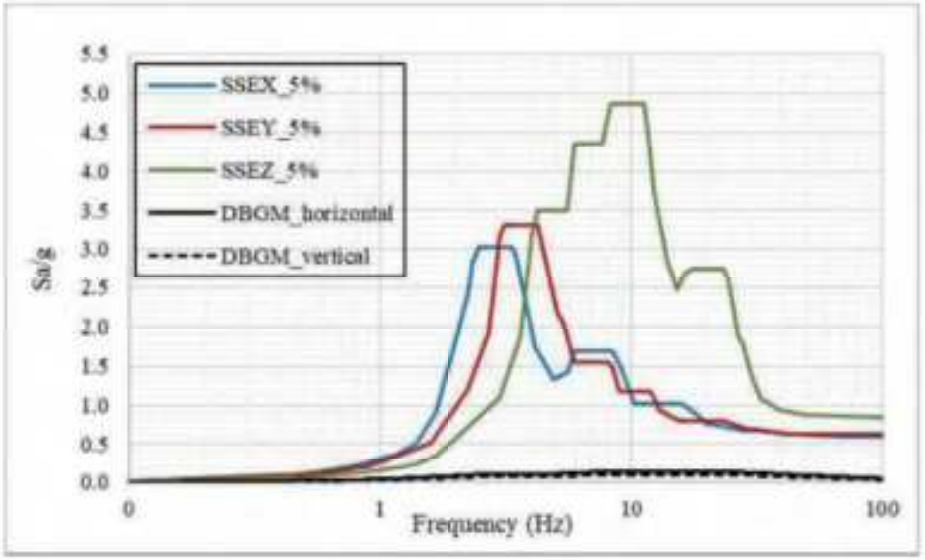


Figure-.33 5% damping OBE spectra for floor at EL.116000 of CB



5% damping SSE spectra for floor at EL.116000 of CB

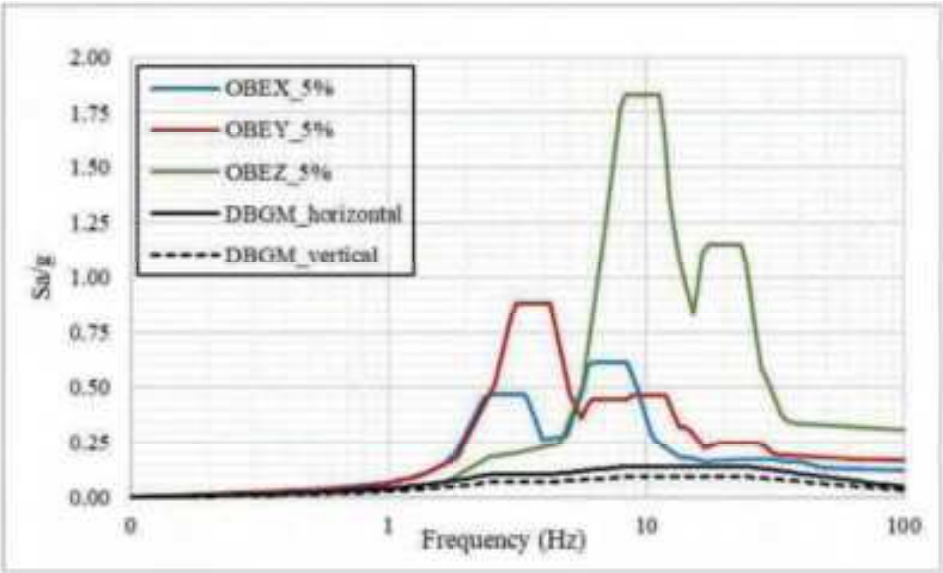


Figure-.35 5% damping OBE spectra for PCB floor at EL.116000 of CB

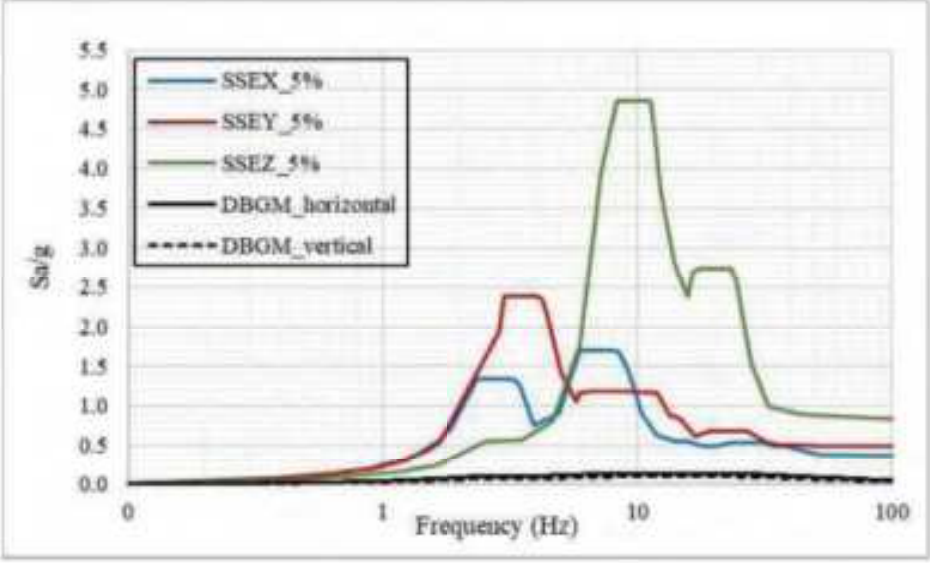


Figure-.36 5% damping SSE spectra for PCB floor at EL.116000 of CB

TABLE NO : 4.1.1.9(a) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : OBE LOCATION : Floor - 116 (m)
DIRECTION : X (E-W) ZPA : 0.2098 (g)

0.5%		1.0%		2.0%		3.0%		4.0%	
Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)
0.100	0.003	0.100	0.003	0.100	0.003	0.100	0.003	0.100	0.003
0.275	0.021	0.288	0.023	0.232	0.015	0.517	0.038	0.249	0.014
0.405	0.036	0.337	0.023	0.317	0.021	0.710	0.053	0.802	0.063
0.445	0.042	0.446	0.039	0.492	0.039	0.928	0.090	0.901	0.073
0.469	0.042	0.517	0.053	0.564	0.045	0.975	0.092	0.944	0.082
0.497	0.051	0.676	0.057	0.699	0.055	1.143	0.111	1.128	0.102
0.543	0.059	0.730	0.069	0.802	0.077	1.350	0.160	1.306	0.147
0.628	0.062	0.850	0.101	0.928	0.106	1.440	0.200	1.454	0.201
0.842	0.108	0.975	0.131	0.952	0.107	1.732	0.344	2.026	0.549
0.928	0.151	1.074	0.143	1.311	0.175	2.128	0.802	2.346	1.133
1.074	0.155	1.440	0.257	1.512	0.267	2.234	1.063	2.463	1.274
1.454	0.319	1.588	0.344	2.026	0.701	2.346	1.303	3.333	1.274
1.667	0.521	1.681	0.438	2.234	1.299	2.463	1.487	3.478	1.217
2.026	1.023	2.026	0.863	2.463	1.784	3.333	1.487	4.133	0.615
2.234	2.077	2.234	1.684	3.333	1.784	3.478	1.376	5.031	0.462
2.346	2.617	2.346	2.041	3.478	1.588	3.957	0.726	5.430	0.462
2.463	2.725	2.463	2.236	3.790	0.950	4.133	0.680	5.928	0.687
3.333	2.725	3.333	2.236	4.820	0.589	4.649	0.520	6.224	0.706
3.478	2.425	3.957	1.058	5.627	0.691	5.646	0.595	8.420	0.706
3.630	2.046	4.092	1.015	5.928	0.990	5.928	0.808	9.171	0.561
3.896	1.305	4.676	0.761	6.224	1.037	8.020	0.808	9.900	0.394
4.050	1.305	5.449	0.761	8.420	1.037	8.735	0.723	11.849	0.394
4.226	1.250	5.928	1.388	9.824	0.527	9.119	0.638	15.123	0.386
4.697	0.962	6.224	1.426	11.177	0.532	9.905	0.433	16.996	0.327
5.438	0.962	8.420	1.426	15.123	0.532	15.123	0.434	19.181	0.326
5.928	1.960	9.769	0.694	16.441	0.392	15.781	0.411	21.786	0.270
8.020	1.960	10.645	0.737	19.301	0.392	16.895	0.352	24.633	0.270
8.368	1.836	14.403	0.737	21.003	0.317	19.301	0.353	29.897	0.260
8.735	1.591	15.014	0.733	24.633	0.317	21.545	0.289	35.748	0.255
9.493	0.854	16.544	0.505	31.439	0.283	24.633	0.289	40.737	0.231
10.242	0.854	19.301	0.505	38.215	0.273	30.551	0.269	66.761	0.212
10.645	1.039	20.748	0.378	47.395	0.225	36.394	0.262	100.000	0.210
14.403	1.039	25.865	0.378	100.000	0.212	45.261	0.225		
15.029	0.985	26.990	0.370			100.000	0.211		
16.055	0.689	28.855	0.324						
19.301	0.689	31.439	0.324						
20.088	0.500	32.090	0.309						
26.990	0.499	38.215	0.309						
28.171	0.462	45.286	0.235						
29.996	0.386	53.330	0.216						
38.215	0.386	100.000	0.211						
41.620	0.290								
45.245	0.244								
58.081	0.214								
100.000	0.210								

TABLE NO : 4.1.1.9(a) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : OBE LOCATION : Floor - 116 (m)
DIRECTION : X (E-W) ZPA : 0.2098 (g)

5.0%		7.0%		10.0%		20.0%	
Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)
0.100	0.003	0.100	0.003	0.100	0.002	0.100	0.002
0.570	0.037	0.425	0.023	0.405	0.020	0.405	0.015
1.129	0.095	0.737	0.046	0.504	0.023	0.469	0.015
1.212	0.111	0.940	0.067	0.933	0.058	0.920	0.044
1.440	0.172	1.079	0.085	1.160	0.082	1.500	0.119
1.838	0.380	1.159	0.091	1.196	0.088	2.586	0.416
2.346	0.999	1.221	0.103	1.527	0.159	3.651	0.414
2.463	1.119	1.527	0.178	2.128	0.465	3.857	0.397
3.333	1.119	2.128	0.541	2.346	0.644	4.534	0.324
3.478	1.084	2.234	0.694	2.463	0.703	6.840	0.268
3.957	0.643	2.463	0.908	3.499	0.703	7.779	0.266
4.849	0.451	3.333	0.908	3.752	0.623	10.109	0.254
5.447	0.434	3.468	0.887	4.617	0.398	11.364	0.257
5.928	0.598	3.869	0.644	5.928	0.362	15.813	0.256
6.224	0.612	4.512	0.442	6.224	0.372	23.195	0.224
8.420	0.612	5.541	0.388	8.420	0.372	100.000	0.211
10.176	0.366	5.928	0.475	8.787	0.368		
11.541	0.366	6.224	0.481	10.137	0.297		
15.781	0.353	8.420	0.481	11.177	0.299		
18.756	0.307	10.167	0.333	15.123	0.299		
22.322	0.256	11.849	0.333	16.010	0.294		
31.439	0.253	15.686	0.322	21.990	0.239		
46.222	0.222	22.605	0.244	100.000	0.212		
80.264	0.211	35.748	0.241				
100.000	0.210	45.645	0.221				
		100.000	0.211				

TABLE NO : 4.1.1.9(b) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : OBE LOCATION : Floor - 116 (m)
DIRECTION : Y (N-S) ZPA : 0.2214 (g)

0.5%		1.0%		2.0%		3.0%		4.0%	
Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)
0.100	0.003	0.100	0.004	0.100	0.003	0.100	0.003	0.100	0.003
0.275	0.021	0.367	0.029	0.336	0.020	0.373	0.023	0.746	0.050
0.343	0.024	0.390	0.029	0.445	0.033	0.517	0.037	0.802	0.052
0.390	0.033	0.469	0.038	0.497	0.041	0.676	0.047	0.963	0.069
0.446	0.041	0.497	0.046	0.598	0.044	0.746	0.054	1.074	0.089
0.517	0.059	0.543	0.053	0.628	0.048	0.842	0.068	1.237	0.095
0.693	0.060	0.652	0.054	0.673	0.050	1.032	0.090	1.337	0.107
0.797	0.086	0.767	0.072	0.732	0.058	1.185	0.101	2.234	0.388
0.878	0.104	0.807	0.080	0.842	0.078	1.512	0.166	2.716	0.698
0.928	0.130	0.928	0.112	0.928	0.090	2.463	0.570	2.994	1.292
1.023	0.132	1.023	0.116	1.074	0.105	2.716	0.789	3.143	1.434
1.244	0.171	1.116	0.117	1.185	0.110	2.994	1.514	4.253	1.434
1.440	0.237	1.306	0.152	1.372	0.132	3.143	1.703	4.438	1.274
1.838	0.428	1.440	0.206	1.512	0.189	4.253	1.703	4.836	0.891
2.366	0.953	1.667	0.292	1.667	0.220	4.836	0.989	5.511	0.701
2.716	1.712	2.346	0.766	2.346	0.601	5.511	0.766	5.928	0.727
3.143	3.995	2.852	1.531	2.852	1.281	5.928	0.822	8.020	0.727
4.253	3.995	2.994	2.514	2.994	1.887	8.020	0.822	8.368	0.720
4.632	1.956	3.143	2.895	3.143	2.119	8.368	0.814	8.841	0.532
4.836	1.819	4.253	2.895	4.253	2.119	8.794	0.629	11.849	0.532
5.511	1.346	4.836	1.471	4.632	1.323	11.849	0.629	13.407	0.346
5.928	1.862	5.236	1.125	5.242	0.892	13.311	0.382	14.403	0.346
8.020	1.862	5.699	1.125	5.699	0.892	14.403	0.382	15.029	0.340
8.368	1.587	5.928	1.377	5.928	0.982	14.989	0.376	17.340	0.332
11.849	1.580	8.020	1.377	8.020	0.982	16.515	0.346	23.460	0.332
12.720	0.822	8.368	1.273	8.368	0.972	17.340	0.355	24.480	0.328
14.403	0.822	8.758	1.135	8.758	0.787	24.633	0.356	26.291	0.292
15.168	0.709	11.849	1.135	11.849	0.787	25.704	0.310	28.517	0.292
16.049	0.572	12.783	0.616	12.880	0.455	28.010	0.306	43.374	0.236
17.340	0.670	14.403	0.616	14.403	0.455	30.551	0.294	100.000	0.222
23.460	0.670	15.687	0.490	15.687	0.387	32.354	0.276		
24.480	0.641	17.340	0.500	17.340	0.400	36.394	0.276		
27.857	0.539	23.460	0.500	24.633	0.401	46.847	0.234		
28.703	0.437	24.480	0.493	26.403	0.332	100.000	0.223		
31.439	0.437	25.551	0.416	28.517	0.332				
38.162	0.424	27.857	0.405	31.058	0.313				
39.869	0.331	28.722	0.359	44.356	0.241				
43.446	0.259	31.439	0.359	100.000	0.224				
54.073	0.228	37.958	0.341						
100.000	0.222	43.215	0.252						
		53.842	0.228						
		100.000	0.222						

TABLE NO : 4.1.1.9(b) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : OBE LOCATION : Floor - 116 (m)
DIRECTION : Y (N-S) ZPA : 0.2214 (g)

5.0%		7.0%		10.0%		20.0%	
Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)
0.100	0.003	0.100	0.002	0.100	0.002	0.100	0.002
0.446	0.025	0.446	0.022	0.454	0.020	0.367	0.013
0.764	0.047	0.704	0.041	0.584	0.030	0.425	0.014
0.802	0.047	0.791	0.042	0.782	0.038	1.440	0.073
1.006	0.073	1.002	0.063	1.027	0.059	2.234	0.198
1.185	0.087	1.154	0.073	1.128	0.064	2.984	0.401
2.026	0.287	1.372	0.093	1.588	0.115	3.143	0.428
2.716	0.647	1.454	0.109	2.586	0.406	3.300	0.442
2.994	1.126	2.498	0.410	2.994	0.697	4.465	0.442
3.143	1.248	2.994	0.903	3.143	0.769	4.660	0.438
4.253	1.248	3.143	0.998	4.253	0.769	6.539	0.335
4.438	1.137	4.253	0.998	4.438	0.764	8.020	0.335
4.836	0.833	4.438	0.954	5.050	0.584	8.368	0.331
5.511	0.656	5.275	0.633	5.928	0.463	10.222	0.284
8.020	0.656	5.511	0.588	8.020	0.463	17.829	0.255
8.368	0.648	5.928	0.555	8.368	0.458	100.000	0.223
8.968	0.464	8.020	0.555	9.523	0.340		
11.849	0.464	8.368	0.548	10.664	0.308		
13.474	0.324	9.392	0.377	12.442	0.308		
14.069	0.323	11.849	0.377	16.145	0.275		
16.515	0.308	12.365	0.365	20.265	0.275		
17.340	0.315	13.217	0.312	44.380	0.232		
23.460	0.315	15.942	0.288	100.000	0.222		
24.480	0.309	17.340	0.292				
26.434	0.281	23.460	0.292				
28.517	0.281	27.573	0.270				
45.364	0.233	29.758	0.270				
100.000	0.222	44.272	0.233				
		100.000	0.223				

TABLE NO : 4.1.1.9(c) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : OBE LOCATION : Floor - 116 (m)
DIRECTION : Z (VER) ZPA : 0.3107 (g)

0.5%		1.0%		2.0%		3.0%		4.0%	
Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)
0.100	0.002	0.100	0.002	0.100	0.002	0.100	0.002	0.100	0.002
0.446	0.027	0.145	0.004	0.517	0.028	0.469	0.019	0.517	0.021
0.517	0.038	0.215	0.011	0.628	0.030	0.541	0.024	1.211	0.059
0.628	0.038	0.461	0.025	0.874	0.051	0.660	0.028	1.306	0.071
0.803	0.056	0.497	0.030	1.053	0.062	1.205	0.062	1.438	0.081
0.975	0.085	0.570	0.034	1.112	0.063	1.306	0.078	2.463	0.212
1.244	0.110	0.676	0.035	1.425	0.097	1.512	0.105	3.300	0.506
1.372	0.111	0.928	0.072	1.524	0.122	1.654	0.116	3.821	0.981
1.512	0.162	1.031	0.076	1.768	0.155	2.994	0.393	4.012	1.416
1.667	0.206	1.260	0.094	2.463	0.293	3.821	1.071	4.213	1.603
1.830	0.232	1.389	0.100	3.300	0.632	4.012	1.653	5.538	1.603
3.300	0.898	1.527	0.147	3.821	1.194	4.213	1.895	5.646	1.828
3.821	1.846	1.667	0.177	4.012	2.014	5.552	1.895	5.928	2.108
4.012	3.286	1.838	0.199	4.213	2.338	5.646	2.149	8.020	2.108
4.213	4.018	3.300	0.771	5.551	2.338	5.928	2.528	8.341	2.076
5.481	4.018	3.821	1.499	5.646	2.660	8.020	2.528	11.285	2.076
5.646	5.470	4.012	2.664	5.928	3.185	8.341	2.469	11.775	1.858
5.928	6.651	4.213	3.184	8.020	3.185	11.285	2.469	12.291	1.505
8.020	6.651	5.499	3.184	8.341	3.114	11.775	2.155	13.400	1.160
8.162	6.015	5.646	3.784	11.285	3.114	12.291	1.692	14.130	1.046
10.748	6.015	5.928	4.707	11.775	2.719	13.804	1.222	15.728	1.051
11.849	5.887	8.020	4.707	12.291	1.974	15.750	1.222	16.515	1.243
12.365	3.464	8.341	4.349	13.087	1.523	16.515	1.409	17.340	1.287
12.581	3.072	11.285	4.349	13.717	1.523	17.340	1.459	23.460	1.287
14.266	3.118	11.849	4.049	15.728	1.494	23.460	1.459	24.480	1.204
15.887	3.118	12.365	2.628	16.515	1.701	24.480	1.388	25.551	0.960
16.515	3.721	12.924	2.129	17.340	1.736	25.551	1.050	27.118	0.725
22.343	3.721	15.728	2.144	23.460	1.736	26.835	0.836	27.857	0.717
24.334	3.330	16.515	2.439	24.480	1.651	27.857	0.833	30.398	0.527
25.552	2.268	22.343	2.439	25.551	1.220	30.398	0.556	33.200	0.419
27.711	2.138	23.314	2.370	26.638	1.026	32.781	0.470	36.290	0.402
29.734	1.258	24.334	2.260	28.517	1.026	38.215	0.470	39.277	0.337
38.215	1.258	26.052	1.491	31.380	0.585	40.866	0.380	100.000	0.313
39.875	0.750	28.517	1.491	38.215	0.585	43.452	0.368		
43.452	0.668	30.878	0.827	40.869	0.446	47.395	0.327		
48.314	0.331	38.215	0.827	43.452	0.445	100.000	0.313		
100.000	0.313	39.875	0.613	46.706	0.329				
		43.452	0.573	100.000	0.313				
		47.195	0.331						
		100.000	0.313						

TABLE NO : 4.1.1.9(c) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : OBE LOCATION : Floor - 116 (m)
DIRECTION : Z (VER) ZPA : 0.3107 (g)

5.0%		7.0%		10.0%		20.0%	
Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)
0.100	0.002	0.100	0.002	0.100	0.001	0.100	0.001
0.764	0.030	0.770	0.027	0.884	0.030	2.586	0.139
1.374	0.066	0.980	0.036	0.980	0.032	3.300	0.262
1.722	0.100	1.334	0.060	1.355	0.056	4.012	0.443
2.026	0.144	1.684	0.088	2.852	0.227	4.213	0.468
3.143	0.388	2.852	0.251	3.639	0.520	4.451	0.476
3.821	0.906	3.639	0.609	4.012	0.780	5.370	0.501
4.012	1.238	4.012	0.999	4.213	0.838	5.646	0.554
4.213	1.389	4.213	1.101	5.411	0.838	5.928	0.591
5.522	1.389	5.470	1.101	5.646	0.967	6.536	0.637
5.646	1.590	5.646	1.259	5.928	1.056	6.862	0.660
5.928	1.809	5.928	1.403	6.862	1.153	8.341	0.696
8.020	1.809	6.862	1.467	8.341	1.164	11.285	0.696
8.341	1.828	8.341	1.479	11.285	1.164	11.775	0.696
11.285	1.828	11.285	1.479	11.775	1.107	18.039	0.468
11.775	1.657	11.775	1.381	13.371	0.814	24.633	0.468
12.291	1.356	12.584	1.079	15.560	0.646	26.829	0.440
13.400	1.077	14.622	0.810	16.515	0.732	32.464	0.351
14.552	0.924	15.612	0.773	17.340	0.749	100.000	0.313
15.728	0.940	16.515	0.914	23.460	0.749		
16.515	1.110	17.340	0.945	24.480	0.721		
17.340	1.150	23.460	0.945	25.551	0.664		
23.460	1.150	24.480	0.881	27.857	0.520		
24.480	1.067	25.551	0.783	31.765	0.403		
26.676	0.735	27.857	0.559	34.615	0.352		
29.096	0.563	33.200	0.385	100.000	0.314		
31.765	0.442	35.020	0.352				
36.290	0.370	43.619	0.328				
39.696	0.336	100.000	0.312				
100.000	0.313						

TABLE NO : 4.1.1.10(a) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : OBE LOCATION : Floor - 116(PCB) (m)
DIRECTION : X (E-W) ZPA : 0.1233 (g)

0.5%		1.0%		2.0%		3.0%		4.0%	
Freq	Accl	Freq	Accl	Freq	Accl	Freq	Accl	Freq	Accl
0.100	0.003	0.100	0.003	0.100	0.003	0.100	0.003	0.100	0.003
0.215	0.018	0.236	0.017	0.367	0.026	0.842	0.062	0.261	0.014
0.446	0.040	0.317	0.022	0.517	0.041	0.928	0.073	0.543	0.032
0.517	0.057	0.367	0.029	0.628	0.045	1.244	0.104	1.074	0.079
0.764	0.079	0.409	0.032	0.842	0.073	1.440	0.137	1.440	0.124
0.842	0.098	0.517	0.051	0.928	0.087	1.667	0.191	1.838	0.231
0.928	0.128	0.693	0.052	1.074	0.100	1.838	0.252	2.346	0.515
1.244	0.162	0.802	0.077	1.244	0.118	2.346	0.594	2.463	0.531
1.512	0.246	0.888	0.088	1.512	0.181	2.463	0.611	3.333	0.531
1.667	0.344	1.023	0.110	2.128	0.479	3.333	0.611	3.478	0.493
1.838	0.398	1.244	0.139	2.234	0.623	3.478	0.551	3.790	0.322
2.234	1.015	1.440	0.183	2.346	0.701	3.937	0.306	4.518	0.277
2.346	1.164	1.588	0.233	2.463	0.725	4.213	0.312	4.877	0.303
3.174	1.164	1.667	0.284	3.333	0.725	4.877	0.332	5.669	0.538
3.312	1.124	2.026	0.473	3.902	0.357	5.676	0.615	5.928	0.687
3.775	0.569	2.234	0.817	4.213	0.366	5.928	0.808	6.224	0.706
4.423	0.625	2.346	0.919	4.877	0.373	6.224	0.837	8.420	0.706
5.120	0.739	3.174	0.919	5.661	0.719	8.420	0.837	9.171	0.561
5.468	0.995	3.312	0.907	5.928	0.990	9.171	0.638	10.444	0.310
5.928	1.960	3.731	0.447	6.224	1.037	9.999	0.400	11.917	0.220
8.020	1.960	4.423	0.480	8.420	1.037	10.911	0.296	13.599	0.189
8.368	1.836	5.120	0.578	9.999	0.451	13.026	0.204	15.879	0.189
8.735	1.591	5.545	0.832	11.401	0.296	14.906	0.202	18.207	0.176
9.568	0.811	5.928	1.388	12.538	0.225	17.424	0.170	22.492	0.176
9.947	0.705	6.224	1.426	15.879	0.225	18.207	0.186	23.237	0.184
10.619	0.501	8.420	1.426	17.582	0.187	19.117	0.194	31.439	0.184
11.849	0.501	9.575	0.702	19.117	0.224	32.806	0.195	32.781	0.182
12.660	0.317	10.899	0.400	25.865	0.224	34.863	0.180	35.240	0.169
15.879	0.317	11.401	0.381	26.500	0.214	38.243	0.180	38.215	0.169
17.340	0.297	12.347	0.266	32.887	0.214	39.778	0.177	39.433	0.168
19.117	0.411	15.879	0.266	39.875	0.192	49.519	0.133	49.034	0.134
25.865	0.411	17.340	0.228	43.452	0.171	100.000	0.124	100.000	0.125
28.171	0.357	19.117	0.297	47.395	0.144				
28.524	0.344	25.865	0.297	52.868	0.130				
34.661	0.344	27.725	0.262	100.000	0.124				
37.751	0.304	34.661	0.262						
42.989	0.222	41.157	0.206						
49.977	0.135	42.989	0.199						
100.000	0.125	49.052	0.135						
		100.000	0.125						

TABLE NO : 4.1.1.10(a) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : OBE LOCATION : Floor - 116(PCR) (m)
DIRECTION : X (E-W) ZPA : 0.1233 (g)

5.0%		7.0%		10.0%		20.0%	
Freq	Accl	Freq	Accl	Freq	Accl	Freq	Accl
0.100	0.002	0.100	0.002	0.100	0.002	0.100	0.002
0.425	0.023	0.415	0.021	0.842	0.040	0.895	0.031
1.074	0.072	0.446	0.021	1.531	0.094	2.234	0.165
1.440	0.114	0.575	0.029	1.929	0.182	2.346	0.174
1.667	0.156	1.023	0.060	2.346	0.292	2.586	0.183
1.838	0.214	1.185	0.068	2.463	0.304	3.651	0.182
2.346	0.456	1.440	0.102	3.333	0.304	4.591	0.159
2.463	0.471	1.588	0.117	3.478	0.299	5.646	0.210
3.333	0.471	1.838	0.188	4.318	0.201	6.224	0.232
3.478	0.445	2.346	0.371	4.877	0.221	6.536	0.235
3.957	0.267	2.463	0.386	5.376	0.297	8.842	0.235
4.877	0.283	3.333	0.386	5.928	0.362	9.226	0.232
5.678	0.488	3.478	0.373	6.224	0.372	14.246	0.155
5.928	0.598	4.133	0.228	8.420	0.372	15.796	0.148
6.224	0.612	4.877	0.254	8.787	0.368	23.337	0.138
8.420	0.612	5.928	0.475	9.575	0.321	100.000	0.124
9.171	0.502	6.224	0.481	10.911	0.231		
10.444	0.298	8.420	0.481	13.891	0.169		
10.911	0.262	9.171	0.420	18.380	0.149		
13.622	0.182	9.575	0.376	100.000	0.125		
14.906	0.181	10.444	0.280				
16.922	0.160	11.616	0.214				
18.944	0.166	13.998	0.175				
20.074	0.168	14.870	0.171				
23.237	0.176	16.844	0.154				
31.439	0.176	18.207	0.158				
34.513	0.162	23.237	0.164				
39.728	0.161	31.439	0.164				
48.623	0.135	37.129	0.154				
100.000	0.125	39.875	0.152				
		50.957	0.131				
		100.000	0.124				

TABLE NO : 4.1.1.10(b) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : OBE LOCATION : Floor - 116(PCB) (m)
DIRECTION : Y (N-S) ZPA : 0.1688 (g)

0.5%		1.0%		2.0%		3.0%		4.0%	
Freq	Accl	Freq	Accl	Freq	Accl	Freq	Accl	Freq	Accl
0.100	0.003	0.100	0.003	0.100	0.003	0.100	0.003	0.100	0.003
0.215	0.018	0.236	0.017	0.328	0.019	0.326	0.018	0.728	0.047
0.288	0.024	0.325	0.022	0.469	0.032	0.746	0.051	0.770	0.047
0.350	0.025	0.367	0.029	0.517	0.043	0.842	0.065	0.984	0.068
0.398	0.033	0.407	0.032	0.628	0.046	0.989	0.076	1.074	0.082
0.517	0.057	0.517	0.052	0.699	0.051	1.074	0.089	1.185	0.087
0.693	0.058	0.733	0.063	0.742	0.056	1.306	0.113	1.306	0.103
0.764	0.079	0.764	0.072	0.842	0.075	1.512	0.154	1.512	0.138
0.867	0.100	0.830	0.086	0.928	0.086	2.463	0.570	2.463	0.505
0.989	0.128	0.859	0.090	1.074	0.098	2.852	0.837	2.994	0.939
1.185	0.130	0.928	0.109	1.185	0.104	2.994	1.110	3.143	1.007
1.306	0.167	1.074	0.113	1.372	0.128	3.143	1.188	4.253	1.007
1.492	0.241	1.185	0.120	1.825	0.281	4.253	1.188	4.932	0.528
1.667	0.345	1.306	0.150	2.346	0.601	4.836	0.615	5.579	0.384
2.346	0.953	1.588	0.236	2.852	0.957	5.646	0.421	5.928	0.473
2.716	1.423	1.667	0.281	2.994	1.382	5.928	0.536	6.224	0.496
2.864	1.423	1.838	0.323	3.143	1.483	6.224	0.565	8.420	0.496
2.994	2.203	2.716	1.101	4.253	1.483	8.420	0.565	8.758	0.532
3.143	2.803	2.852	1.156	4.836	0.695	8.758	0.629	11.849	0.532
4.253	2.803	2.994	1.839	5.438	0.457	11.849	0.629	13.407	0.346
4.632	1.208	3.143	2.057	5.928	0.629	12.365	0.529	14.403	0.346
5.190	0.733	4.253	2.057	6.224	0.690	12.905	0.399	15.029	0.340
5.612	0.733	4.632	1.046	8.420	0.690	14.656	0.376	16.917	0.241
5.928	1.079	5.231	0.561	8.758	0.787	16.697	0.258	18.207	0.258
6.224	1.173	5.646	0.593	11.849	0.787	18.207	0.282	20.074	0.263
8.392	1.173	5.928	0.845	12.880	0.455	28.010	0.278	27.158	0.263
8.758	1.580	6.224	0.922	14.403	0.455	30.551	0.215	28.339	0.259
11.849	1.580	8.421	0.922	15.687	0.387	33.507	0.204	30.880	0.208
12.661	0.822	8.758	1.135	16.646	0.288	38.215	0.204	33.189	0.195
14.403	0.822	11.849	1.135	18.207	0.318	43.452	0.185	36.394	0.195
15.168	0.709	12.783	0.616	25.889	0.318	100.000	0.171	45.138	0.182
16.354	0.464	14.403	0.616	28.171	0.308			67.407	0.171
19.117	0.563	15.687	0.490	29.410	0.256			100.000	0.169
25.865	0.563	16.533	0.350	32.136	0.220				
28.517	0.539	18.207	0.399	38.215	0.220				
29.735	0.347	19.117	0.416	39.875	0.214				
38.215	0.347	25.865	0.416	42.267	0.190				
39.875	0.266	28.171	0.388	100.000	0.171				
45.375	0.204	29.410	0.294						
51.743	0.182	30.723	0.268						
100.000	0.170	38.215	0.268						
		43.583	0.195						
		46.450	0.195						
		52.817	0.178						
		100.000	0.170						

TABLE NO : 4.1.1.10(b) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : OBE LOCATION : Floor - 116(PCR) (m)
DIRECTION : Y (N-S) ZPA : 0.1688 (g)

5.0%		7.0%		10.0%		20.0%	
Freq	Accl	Freq	Accl	Freq	Accl	Freq	Accl
0.100	0.002	0.100	0.002	0.100	0.002	0.100	0.002
0.740	0.044	0.704	0.038	0.458	0.019	0.367	0.013
0.777	0.044	0.774	0.039	0.582	0.027	0.577	0.021
0.941	0.058	1.074	0.068	0.728	0.034	0.884	0.032
1.001	0.065	1.440	0.098	0.811	0.035	1.588	0.078
1.074	0.077	2.026	0.246	1.074	0.059	2.994	0.307
1.306	0.095	2.716	0.493	1.838	0.147	3.143	0.317
1.838	0.180	2.994	0.661	2.026	0.211	4.465	0.318
2.026	0.278	3.143	0.703	2.994	0.521	4.660	0.311
2.586	0.516	4.253	0.703	3.143	0.543	5.786	0.245
2.994	0.821	4.438	0.660	4.253	0.543	6.305	0.230
3.143	0.879	5.050	0.426	4.438	0.533	8.420	0.230
4.253	0.879	5.646	0.332	5.511	0.305	9.362	0.225
5.050	0.464	5.928	0.362	6.536	0.319	12.442	0.225
5.586	0.360	6.224	0.376	8.842	0.319	19.749	0.189
5.928	0.427	6.536	0.378	9.351	0.306	100.000	0.170
6.224	0.446	11.849	0.377	12.442	0.306		
8.420	0.446	12.365	0.365	16.121	0.222		
8.758	0.464	13.474	0.300	18.023	0.208		
11.849	0.464	14.069	0.294	19.117	0.212		
12.365	0.427	16.768	0.219	27.158	0.213		
13.474	0.324	20.074	0.231	33.682	0.181		
14.069	0.323	27.158	0.231	100.000	0.170		
14.695	0.311	28.339	0.224				
16.943	0.227	29.578	0.208				
18.207	0.240	33.739	0.185				
19.117	0.247	100.000	0.170				
20.074	0.249						
27.158	0.249						
28.339	0.244						
30.880	0.203						
33.059	0.191						
36.394	0.191						
64.423	0.171						
100.000	0.169						

TABLE NO : 4.1.1.10(c) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : OBE LOCATION : Floor - 116(PCR) (m)
DIRECTION : Z (VER) ZPA : 0.3107 (g)

0.5%		1.0%		2.0%		3.0%		4.0%	
Freq	Accl	Freq	Accl	Freq	Accl	Freq	Accl	Freq	Accl
0.100	0.002	0.100	0.002	0.100	0.002	0.100	0.002	0.100	0.002
0.139	0.004	0.215	0.011	0.215	0.010	0.517	0.023	0.517	0.021
0.215	0.012	0.570	0.033	0.328	0.013	0.579	0.023	1.194	0.047
0.446	0.026	0.738	0.040	0.579	0.027	0.669	0.026	1.306	0.056
0.517	0.037	0.796	0.047	0.686	0.030	0.928	0.043	1.624	0.072
0.705	0.038	0.928	0.065	0.928	0.051	1.201	0.052	2.463	0.212
0.741	0.045	1.074	0.066	1.213	0.060	1.306	0.062	4.644	0.259
0.928	0.077	1.253	0.080	1.306	0.071	1.429	0.068	5.120	0.415
1.244	0.094	1.359	0.084	1.443	0.080	1.540	0.077	6.224	0.823
1.342	0.096	1.491	0.106	1.508	0.088	1.661	0.082	6.862	1.315
1.571	0.127	1.526	0.110	1.667	0.099	2.463	0.246	7.566	1.777
1.602	0.134	1.575	0.113	2.463	0.293	3.143	0.260	7.944	1.990
1.805	0.165	1.667	0.133	3.143	0.312	4.644	0.273	8.341	2.076
1.929	0.172	1.838	0.144	4.253	0.312	5.120	0.463	11.285	2.076
2.234	0.377	2.234	0.286	5.120	0.539	5.503	0.512	11.775	1.858
2.586	0.486	2.464	0.366	6.224	1.095	6.536	1.149	12.291	1.505
3.143	0.561	3.143	0.413	7.206	1.990	6.862	1.461	13.400	1.160
4.253	0.561	4.253	0.413	7.566	2.467	7.206	1.745	15.284	0.915
5.120	0.877	5.120	0.687	7.944	2.841	7.566	2.027	15.728	1.051
6.862	2.596	5.928	1.199	8.341	3.114	7.944	2.305	16.515	1.243
7.206	2.908	7.206	2.397	11.285	3.114	8.341	2.469	17.340	1.287
7.566	5.053	7.566	3.591	11.775	2.719	11.285	2.469	23.460	1.287
7.944	6.015	7.944	4.128	12.291	1.974	11.775	2.155	24.480	1.204
10.748	6.015	8.341	4.349	13.087	1.523	12.291	1.692	25.551	0.960
11.849	5.887	11.285	4.349	13.717	1.523	13.400	1.283	27.857	0.622
12.365	3.115	11.849	4.049	14.939	1.308	15.251	1.015	30.398	0.527
12.763	2.775	12.365	2.514	15.728	1.494	15.728	1.217	33.200	0.397
15.631	2.775	12.939	2.080	16.515	1.701	16.515	1.409	34.707	0.359
15.728	2.966	13.717	2.080	17.340	1.736	17.340	1.459	37.951	0.339
16.515	3.721	14.429	1.878	23.460	1.736	23.460	1.459	100.000	0.313
22.343	3.721	15.521	1.878	24.480	1.651	24.480	1.388		
24.334	3.330	15.728	2.144	25.551	1.220	25.551	1.050		
25.405	2.351	16.515	2.439	26.676	0.987	26.676	0.865		
26.530	1.744	22.343	2.439	27.857	0.723	27.857	0.654		
27.711	1.055	23.314	2.370	31.765	0.484	30.398	0.556		
29.165	0.905	24.334	2.260	35.098	0.361	33.200	0.404		
31.439	0.905	25.405	1.644	41.744	0.336	34.707	0.360		
34.154	0.546	26.530	1.276	100.000	0.313	39.360	0.339		
36.394	0.546	27.711	0.862			100.000	0.313		
41.280	0.356	28.743	0.709						
44.187	0.356	31.439	0.709						
54.859	0.329	33.737	0.475						
100.000	0.313	40.077	0.350						
		42.569	0.347						
		55.651	0.320						
		100.000	0.312						

TABLE NO : 4.1.1.10(c) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : OBE LOCATION : Floor - 116(PCR) (m)
DIRECTION : Z (VER) ZPA : 0.3107 (g)

5.0%		7.0%		10.0%		20.0%	
Freq	Accl	Freq	Accl	Freq	Accl	Freq	Accl
0.100	0.002	0.100	0.002	0.100	0.001	0.100	0.001
0.845	0.030	0.802	0.024	0.802	0.021	0.469	0.009
0.884	0.033	1.440	0.051	1.440	0.045	1.608	0.038
1.677	0.068	1.620	0.055	1.588	0.047	2.066	0.060
2.463	0.186	1.684	0.059	1.660	0.050	2.858	0.088
3.143	0.201	2.463	0.151	2.346	0.116	3.639	0.107
4.644	0.248	3.163	0.165	2.586	0.125	5.120	0.239
5.120	0.382	4.644	0.230	3.429	0.134	6.862	0.535
5.697	0.508	6.224	0.660	4.644	0.214	7.206	0.589
6.862	1.195	6.862	1.010	6.224	0.576	7.944	0.677
7.566	1.594	7.206	1.174	6.862	0.825	8.341	0.696
7.944	1.775	7.566	1.325	7.206	0.954	11.285	0.696
8.341	1.828	7.944	1.452	7.566	1.058	11.775	0.694
11.285	1.828	8.341	1.479	7.944	1.142	14.622	0.559
11.775	1.657	11.285	1.479	8.341	1.164	15.970	0.508
12.291	1.356	11.775	1.381	11.285	1.164	18.207	0.468
13.400	1.077	12.832	1.037	11.775	1.107	24.633	0.468
15.292	0.833	15.291	0.741	13.371	0.814	26.829	0.440
15.728	0.940	16.515	0.914	13.996	0.766	32.464	0.351
16.515	1.110	17.340	0.945	15.541	0.644	100.000	0.313
17.340	1.150	23.460	0.945	16.515	0.732		
23.460	1.150	24.480	0.881	17.340	0.749		
24.480	1.067	25.551	0.783	23.460	0.749		
26.676	0.735	27.857	0.559	24.480	0.721		
27.943	0.590	33.200	0.385	25.551	0.664		
30.398	0.506	35.020	0.352	27.857	0.520		
33.200	0.393	100.000	0.314	29.096	0.473		
34.707	0.359			34.562	0.352		
37.951	0.339			100.000	0.314		
100.000	0.313						

TABLE NO : 4.1.2.9(a) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : SSE LOCATION : Floor - 116 (m)
DIRECTION : X (E-W) ZPA : 0.5949 (g)

0.5%		1.0%		2.0%		3.0%		4.0%	
Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)
0.100	0.014	0.100	0.014	0.100	0.013	0.100	0.011	0.100	0.011
0.225	0.068	0.249	0.068	0.237	0.057	0.350	0.084	0.288	0.063
0.249	0.071	0.303	0.084	0.275	0.066	0.517	0.140	0.333	0.071
0.291	0.090	0.367	0.113	0.367	0.099	0.570	0.152	0.367	0.082
0.336	0.091	0.445	0.143	0.405	0.109	0.633	0.168	0.543	0.129
0.367	0.121	0.469	0.143	0.446	0.123	0.802	0.248	0.719	0.184
0.405	0.132	0.492	0.166	0.492	0.145	0.886	0.269	1.128	0.372
0.517	0.221	0.570	0.195	0.577	0.165	0.941	0.330	1.306	0.494
0.628	0.229	0.604	0.196	0.631	0.184	1.306	0.535	1.440	0.626
0.842	0.403	0.668	0.209	0.669	0.191	1.440	0.686	1.667	0.996
0.928	0.551	0.699	0.230	0.755	0.244	1.667	1.100	2.026	1.838
1.051	0.551	0.842	0.365	0.842	0.305	2.026	2.076	2.234	2.796
1.085	0.569	0.928	0.478	0.928	0.387	2.234	3.303	2.346	3.213
1.185	0.611	1.023	0.485	0.997	0.406	2.463	3.922	2.463	3.420
1.256	0.754	1.074	0.525	1.140	0.456	3.333	3.922	3.333	3.420
1.352	0.857	1.185	0.570	1.168	0.476	3.478	3.724	3.478	3.287
1.454	1.075	1.344	0.777	1.189	0.503	3.957	2.343	3.957	2.057
1.588	1.432	1.512	1.134	1.372	0.624	4.930	1.583	4.660	1.457
1.667	1.875	1.667	1.563	1.667	1.247	5.689	1.872	5.271	1.403
1.838	2.307	2.026	2.937	2.026	2.374	5.928	2.309	5.928	1.958
2.128	4.705	2.234	5.311	2.234	4.062	8.020	2.309	8.020	1.958
2.234	6.744	2.346	5.953	2.463	4.615	8.368	2.287	8.368	1.939
2.346	7.345	3.174	5.953	3.333	4.615	9.119	1.911	9.119	1.669
3.174	7.345	3.312	5.712	3.478	4.256	10.106	1.279	10.212	1.122
3.609	6.720	3.609	5.036	4.133	2.534	11.285	1.279	11.285	1.122
3.834	4.235	3.762	3.519	4.716	1.878	12.073	1.201	15.879	1.087
4.050	4.235	4.050	3.519	5.183	1.766	14.403	1.201	16.569	1.015
4.569	2.994	4.226	3.216	5.637	2.122	15.687	1.187	17.294	0.903
4.923	2.994	4.591	2.468	5.928	2.817	16.948	0.989	18.854	0.898
5.413	3.178	4.923	2.468	8.020	2.817	18.382	0.989	19.693	0.795
5.928	5.352	5.227	2.330	8.368	2.806	19.181	0.970	27.936	0.683
8.020	5.352	5.928	3.836	9.119	2.245	20.848	0.789	31.924	0.682
8.368	4.927	6.224	3.882	9.964	1.546	22.343	0.789	40.125	0.656
9.119	3.756	8.420	3.882	11.285	1.546	24.334	0.766	46.720	0.626
9.475	2.740	9.836	2.059	11.889	1.435	30.252	0.704	65.904	0.599
10.645	2.886	10.645	2.072	14.403	1.435	49.177	0.613	100.000	0.596
14.403	2.886	14.403	2.072	15.029	1.426	100.000	0.597		
15.029	2.621	15.029	1.973	15.687	1.373				
16.598	1.856	16.377	1.456	17.475	1.098				
19.301	1.856	19.301	1.388	18.382	1.098				
20.139	1.323	21.021	0.975	19.181	1.077				
21.287	1.233	23.938	0.933	20.902	0.864				
28.517	1.233	29.855	0.826	23.818	0.820				
29.615	0.953	36.394	0.750	26.599	0.741				
34.661	0.953	37.977	0.744	29.941	0.741				
36.168	0.943	51.505	0.619	31.243	0.738				
37.751	0.897	70.540	0.598	47.470	0.626				
38.243	0.830	100.000	0.595	53.000	0.610				

44.912	0.683	100.000	0.597
51.732	0.641		
65.973	0.601		
100.000	0.596		

TABLE NO : 4.1.2.9(a) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : SSE LOCATION : Floor - 116 (m)
DIRECTION : X (E-W) ZPA : 0.5949 (g)

5.0%		7.0%		10.0%		20.0%	
Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)
0.100	0.010	0.100	0.010	0.100	0.009	0.100	0.007
0.386	0.086	0.616	0.131	0.543	0.091	0.461	0.054
0.439	0.094	0.842	0.204	0.605	0.115	0.957	0.161
0.543	0.119	1.095	0.308	1.074	0.268	1.667	0.511
0.575	0.135	1.372	0.456	1.247	0.331	2.346	1.060
0.842	0.225	1.512	0.594	1.372	0.405	2.586	1.160
1.074	0.346	2.128	1.652	1.512	0.518	3.499	1.160
1.129	0.346	2.346	2.287	2.234	1.580	3.651	1.155
1.372	0.495	2.463	2.461	2.346	1.794	4.951	0.859
1.454	0.608	3.333	2.461	2.463	1.940	6.996	0.797
1.667	0.915	3.474	2.448	2.586	1.960	8.020	0.797
2.234	2.422	3.578	2.315	3.499	1.960	8.368	0.789
2.346	2.838	4.053	1.562	3.686	1.808	10.139	0.736
2.463	3.024	4.716	1.226	4.339	1.209	13.717	0.736
3.333	3.024	5.393	1.153	5.588	1.007	20.483	0.660
3.478	2.937	5.928	1.346	5.928	1.048	31.570	0.625
4.133	1.738	8.368	1.344	6.224	1.069	100.000	0.597
4.930	1.336	9.119	1.227	8.420	1.069		
5.637	1.425	9.523	1.124	8.787	1.039		
5.928	1.697	10.225	0.919	9.319	0.978		
8.020	1.697	11.177	0.933	10.645	0.860		
8.368	1.685	15.123	0.933	11.177	0.869		
9.119	1.485	15.781	0.923	15.123	0.869		
10.267	1.019	16.471	0.903	15.781	0.859		
15.879	1.015	17.956	0.807	16.471	0.842		
18.854	0.846	22.372	0.705	18.566	0.750		
19.693	0.762	27.605	0.656	23.392	0.679		
22.471	0.735	32.326	0.656	30.609	0.645		
28.170	0.671	55.460	0.605	54.038	0.604		
31.439	0.671	100.000	0.596	100.000	0.596		
40.125	0.668						
45.722	0.626						
71.027	0.598						
100.000	0.596						

TABLE NO : 4.1.2.9(b) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : SSE LOCATION : Floor - 116 (m)
DIRECTION : Y (N-S) ZPA : 0.6157 (g)

0.5%		1.0%		2.0%		3.0%		4.0%	
Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)
0.100	0.014	0.100	0.013	0.100	0.013	0.100	0.011	0.100	0.010
0.229	0.067	0.288	0.083	0.261	0.064	0.333	0.069	0.378	0.082
0.275	0.077	0.350	0.090	0.303	0.074	0.411	0.097	0.492	0.108
0.291	0.090	0.446	0.141	0.367	0.096	0.469	0.108	0.543	0.127
0.367	0.118	0.517	0.196	0.412	0.106	0.556	0.137	0.628	0.148
0.390	0.119	0.652	0.198	0.446	0.122	0.583	0.140	0.728	0.178
0.441	0.150	0.764	0.268	0.517	0.162	0.628	0.160	0.842	0.218
0.492	0.178	0.928	0.415	0.606	0.162	0.699	0.177	0.915	0.232
0.602	0.219	1.011	0.419	0.660	0.176	0.802	0.212	1.074	0.315
0.693	0.220	1.158	0.440	0.842	0.285	0.890	0.248	1.185	0.334
0.884	0.383	1.256	0.530	0.940	0.329	1.074	0.345	1.372	0.395
1.023	0.484	1.372	0.577	1.185	0.396	1.185	0.362	1.588	0.578
1.244	0.625	1.454	0.763	1.372	0.478	1.306	0.421	2.671	1.980
1.440	0.867	1.519	0.821	1.440	0.601	1.512	0.595	2.994	3.663
1.667	1.302	1.838	1.300	1.588	0.760	2.234	1.480	3.143	3.776
2.234	2.918	2.234	2.279	1.768	0.963	2.635	2.135	4.253	3.776
2.610	3.853	2.346	2.421	2.586	2.232	2.994	4.350	5.050	2.362
2.716	5.816	2.716	4.372	2.994	5.356	3.143	4.401	5.928	1.729
2.874	5.816	2.852	4.590	4.050	5.356	4.253	4.401	8.020	1.729
2.994	8.498	2.994	7.034	4.226	5.338	4.836	2.887	8.368	1.648
3.143	9.354	4.050	7.034	4.809	3.515	5.511	2.237	8.992	1.331
4.253	9.354	4.226	6.959	5.484	2.559	5.928	1.953	11.849	1.331
4.632	5.893	5.248	3.273	5.928	2.285	8.020	1.953	13.474	0.931
4.836	5.879	5.484	3.155	8.020	2.285	8.368	1.871	14.069	0.931
5.050	4.459	5.928	3.135	8.368	2.207	8.758	1.565	14.695	0.912
5.511	3.741	8.020	3.135	8.758	1.974	11.849	1.565	16.515	0.832
5.928	4.159	8.758	2.857	11.849	1.974	13.590	1.029	22.343	0.832
8.020	4.159	11.849	2.857	12.905	1.257	14.403	1.029	23.314	0.820
8.455	3.351	12.871	1.627	14.069	1.204	15.029	1.003	29.579	0.700
8.758	4.003	14.403	1.627	14.695	1.136	16.515	0.875	32.806	0.700
11.849	4.003	15.892	1.145	16.515	0.951	22.343	0.875	34.241	0.678
12.365	2.561	17.340	1.163	17.340	0.961	23.314	0.869	48.632	0.625
12.936	2.189	23.460	1.163	23.460	0.961	24.334	0.850	100.000	0.617
14.403	2.189	25.551	1.093	24.480	0.934	28.914	0.724		
15.029	1.893	26.676	1.037	29.323	0.764	31.439	0.724		
16.515	1.478	31.765	0.813	31.439	0.764	32.806	0.718		
17.340	1.490	38.215	0.794	48.632	0.626	48.632	0.625		
23.460	1.490	46.003	0.645	100.000	0.617	100.000	0.617		
25.865	1.456	48.771	0.645						
28.171	1.300	50.893	0.633						
29.350	1.017	100.000	0.618						
31.439	1.017								
32.724	0.947								
38.215	0.947								
41.620	0.707								
47.395	0.655								
59.326	0.619								
100.000	0.616								

TABLE NO : 4.1.2.9(b) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : SSE LOCATION : Floor - 116 (m)
DIRECTION : Y (N-S) ZPA : 0.6157 (g)

5.0%		7.0%		10.0%		20.0%	
Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)
0.100	0.010	0.100	0.009	0.100	0.009	0.100	0.007
0.425	0.090	0.458	0.083	0.457	0.072	0.441	0.051
0.493	0.099	0.571	0.111	0.628	0.116	0.884	0.118
0.543	0.118	0.628	0.127	0.728	0.130	1.306	0.225
0.598	0.127	0.728	0.148	0.842	0.143	1.440	0.243
0.660	0.145	0.842	0.168	0.928	0.165	2.331	0.660
0.764	0.166	1.023	0.236	1.023	0.207	2.852	1.027
0.842	0.196	1.097	0.258	1.512	0.354	2.994	1.121
0.884	0.199	1.244	0.310	2.586	1.198	3.143	1.189
1.074	0.292	1.667	0.504	2.994	1.937	3.300	1.227
1.588	0.521	2.234	1.023	3.143	2.053	3.466	1.232
2.234	1.207	2.716	1.668	4.253	2.053	4.688	1.232
2.716	1.922	2.852	2.122	4.438	2.043	5.107	1.198
2.852	2.584	2.994	2.500	5.511	1.529	5.568	1.141
2.994	3.165	3.143	2.659	6.292	1.121	6.937	0.929
3.143	3.312	4.253	2.659	8.020	1.102	9.089	0.792
4.253	3.312	4.438	2.569	8.368	1.091	16.259	0.677
5.050	2.179	5.050	1.960	9.947	0.827	19.115	0.677
5.275	2.089	5.511	1.743	11.865	0.798	22.031	0.665
5.511	1.944	6.073	1.311	14.478	0.723	69.694	0.618
5.928	1.552	8.020	1.311	14.979	0.728	100.000	0.616
8.020	1.552	8.368	1.276	21.280	0.728		
8.368	1.486	9.542	0.971	22.205	0.725		
8.946	1.171	11.849	0.971	30.114	0.665		
11.849	1.171	12.365	0.942	41.244	0.631		
12.365	1.097	14.643	0.748	100.000	0.617		
12.905	0.943	15.728	0.761				
15.559	0.791	22.205	0.760				
16.515	0.801	30.114	0.676				
22.343	0.801	41.244	0.633				
23.314	0.790	100.000	0.617				
29.459	0.689						
31.619	0.687						
43.305	0.631						
100.000	0.617						

TABLE NO : 4.1.2.9(c) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : SSE LOCATION : Floor - 116 (m)
DIRECTION : Z (VER) ZPA : 0.8363 (g)

0.5%		1.0%		2.0%		3.0%		4.0%	
Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)
0.100	0.009	0.100	0.009	0.100	0.009	0.100	0.008	0.100	0.007
0.275	0.050	0.288	0.055	0.293	0.049	0.261	0.040	0.275	0.037
0.295	0.059	0.322	0.056	0.317	0.050	0.317	0.045	0.317	0.043
0.333	0.060	0.367	0.073	0.367	0.064	0.416	0.066	0.469	0.066
0.367	0.079	0.397	0.076	0.410	0.070	0.517	0.089	0.498	0.075
0.397	0.083	0.464	0.093	0.615	0.108	0.669	0.106	0.705	0.107
0.476	0.101	0.570	0.127	0.688	0.119	0.731	0.124	0.730	0.114
0.543	0.141	0.628	0.127	0.759	0.145	0.794	0.139	0.891	0.149
0.628	0.141	0.679	0.130	0.887	0.186	0.842	0.160	0.976	0.161
0.728	0.174	0.756	0.169	0.975	0.223	0.931	0.174	1.034	0.180
0.794	0.205	0.796	0.184	1.074	0.234	0.990	0.189	1.128	0.200
0.842	0.248	0.842	0.223	1.189	0.236	1.132	0.213	1.266	0.241
1.185	0.313	0.928	0.268	1.397	0.309	1.185	0.216	1.387	0.255
1.244	0.405	1.041	0.276	1.517	0.437	1.306	0.278	1.512	0.327
1.372	0.409	1.512	0.527	1.667	0.496	1.541	0.374	1.667	0.374
1.757	0.809	1.563	0.536	2.994	1.551	2.994	1.333	2.994	1.196
2.234	1.347	1.667	0.637	3.821	3.420	3.821	2.903	3.821	2.632
3.300	2.942	1.838	0.720	4.012	5.146	4.012	4.194	4.012	3.579
4.012	8.178	3.300	2.487	4.213	5.703	4.213	4.710	4.213	4.022
4.213	9.400	3.639	3.849	5.568	5.703	5.581	4.710	5.576	4.022
4.423	9.709	4.012	6.778	5.646	6.139	5.928	5.939	5.646	4.255
5.439	9.709	4.213	7.588	5.928	7.388	7.981	5.939	5.928	5.016
5.646	13.087	5.488	7.588	8.020	7.388	8.341	6.388	7.799	5.016
5.928	14.926	5.646	9.005	8.341	7.825	11.285	6.388	8.341	5.502
8.020	14.926	5.928	10.700	11.285	7.825	11.775	5.612	11.285	5.502
8.527	14.335	8.020	10.700	11.775	7.050	12.291	4.596	11.775	4.874
8.758	14.755	8.341	10.830	12.291	5.429	13.992	3.276	12.114	4.243
11.849	14.755	11.285	10.830	13.170	4.375	15.123	3.276	13.400	3.371
12.483	8.158	11.775	10.428	13.717	4.375	15.799	3.141	15.280	2.755
14.069	8.158	12.291	6.886	15.670	3.764	16.515	3.495	16.515	3.053
14.266	8.556	12.929	5.984	15.728	3.852	17.340	3.500	17.340	3.074
19.301	8.556	13.717	5.984	16.515	4.096	23.460	3.500	23.460	3.074
19.355	8.355	14.266	5.785	22.343	4.096	24.480	3.403	24.480	2.928
22.343	8.355	19.301	5.785	24.334	4.085	25.745	2.603	26.223	2.171
23.314	8.215	19.406	5.620	25.482	3.163	27.857	2.319	27.857	2.007
24.334	7.895	22.343	5.620	27.711	2.788	30.721	1.522	29.096	1.698
26.530	6.420	23.314	5.524	28.950	2.190	33.201	1.245	33.200	1.128
27.711	5.494	24.334	5.393	32.179	1.492	36.394	1.245	34.707	1.125
28.950	4.060	25.405	4.616	34.661	1.492	37.977	1.194	37.951	0.989
31.420	2.852	26.530	4.359	37.751	1.442	41.168	1.050	41.528	0.933
38.215	2.852	27.711	3.868	40.606	1.236	44.238	1.050	49.818	0.877
39.875	2.054	28.950	2.876	44.238	1.236	46.216	0.904	100.000	0.840
43.452	1.809	31.872	2.000	46.807	0.901	65.446	0.858		
47.395	1.108	34.661	2.000	65.446	0.858	100.000	0.840		
51.549	0.893	37.751	1.945	100.000	0.840				
56.459	0.893	40.900	1.548						
100.000	0.839	44.238	1.548						
		48.252	0.897						

50.301	0.896
86.027	0.841
100.000	0.838

TABLE NO : 4.1.2.9(c) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : SSE LOCATION : Floor - 116 (m)
DIRECTION : Z (VER) ZPA : 0.8363 (g)

5.0%		7.0%		10.0%		20.0%	
Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)	Freq (Hz)	Accl (g)
0.100	0.007	0.100	0.006	0.100	0.006	0.100	0.005
0.395	0.054	0.425	0.054	0.295	0.033	0.377	0.033
0.473	0.063	0.460	0.054	0.380	0.043	0.446	0.035
0.610	0.084	0.513	0.060	0.476	0.048	0.903	0.077
0.716	0.103	0.547	0.067	0.572	0.061	2.463	0.396
0.770	0.109	0.577	0.070	0.633	0.073	4.012	1.124
0.812	0.121	0.641	0.083	0.678	0.079	4.213	1.197
0.858	0.131	0.684	0.089	0.704	0.081	4.644	1.279
0.983	0.146	0.772	0.096	0.884	0.103	5.928	1.467
1.036	0.166	0.855	0.115	0.967	0.114	6.862	1.559
1.133	0.189	0.931	0.119	1.244	0.183	7.944	1.815
1.165	0.192	0.985	0.128	1.667	0.262	8.341	1.853
1.373	0.235	1.090	0.162	2.716	0.615	11.285	1.853
1.667	0.342	1.312	0.217	3.821	1.676	11.775	1.840
2.994	1.103	1.667	0.302	4.012	1.985	12.291	1.789
3.639	1.874	2.994	0.963	4.213	2.105	15.970	1.388
4.012	3.153	3.639	1.672	5.409	2.105	18.255	1.218
4.213	3.503	4.012	2.561	5.646	2.400	19.976	1.191
5.569	3.503	4.213	2.775	5.928	2.634	20.901	1.171
5.646	3.730	5.509	2.775	6.862	2.648	22.892	1.113
5.928	4.346	5.646	3.059	7.566	2.885	30.177	0.972
7.662	4.346	5.928	3.463	10.236	2.885	100.000	0.843
7.944	4.590	7.464	3.463	13.263	2.346		
8.341	4.863	7.944	3.799	15.833	1.749		
11.285	4.863	8.341	3.971	17.340	1.776		
11.775	4.375	11.285	3.971	23.460	1.776		
12.291	3.730	11.775	3.672	24.480	1.689		
13.996	2.839	12.291	3.139	29.096	1.184		
15.280	2.481	13.400	2.774	30.398	1.097		
16.515	2.698	15.327	2.093	31.917	0.992		
17.340	2.744	16.515	2.198	52.155	0.872		
23.460	2.744	17.340	2.253	100.000	0.840		
24.480	2.584	23.460	2.253				
26.676	1.875	24.480	2.105				
27.857	1.770	27.857	1.445				
30.230	1.355	30.398	1.184				
33.200	1.066	34.095	0.968				
34.707	1.047	43.451	0.903				
38.780	0.942	49.818	0.878				
49.818	0.878	100.000	0.840				
100.000	0.840						

TABLE NO : 4.1.2.10(a) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : SSE LOCATION : Floor - 116(PCB) (m)
DIRECTION : X (E-W) ZPA : 0.3692 (g)

0.5%		1.0%		2.0%		3.0%		4.0%	
Freq	Accl	Freq	Accl	Freq	Accl	Freq	Accl	Freq	Accl
0.100	0.014	0.100	0.014	0.100	0.013	0.100	0.012	0.100	0.010
0.225	0.067	0.237	0.063	0.288	0.072	0.303	0.069	0.288	0.061
0.249	0.069	0.249	0.066	0.333	0.074	0.426	0.098	0.333	0.067
0.291	0.089	0.288	0.083	0.367	0.096	0.492	0.121	0.386	0.084
0.340	0.089	0.333	0.083	0.405	0.102	0.570	0.135	0.469	0.101
0.367	0.118	0.367	0.110	0.492	0.137	0.728	0.180	0.530	0.118
0.446	0.151	0.409	0.119	0.549	0.155	0.802	0.212	0.628	0.140
0.497	0.180	0.517	0.190	0.604	0.159	0.884	0.233	0.928	0.233
0.519	0.213	0.628	0.190	0.699	0.188	0.928	0.271	1.244	0.335
0.728	0.254	0.761	0.265	0.737	0.204	0.975	0.271	1.667	0.622
0.802	0.322	0.842	0.329	0.802	0.241	1.074	0.325	1.838	0.771
0.881	0.367	0.928	0.407	0.884	0.272	1.185	0.331	2.346	1.509
0.887	0.376	1.074	0.430	0.928	0.324	1.306	0.394	3.174	1.509
1.023	0.477	1.244	0.516	1.244	0.422	1.667	0.696	3.312	1.497
1.244	0.606	1.512	0.805	1.334	0.457	2.234	1.610	3.457	1.367
1.440	0.795	2.026	1.647	1.440	0.557	2.346	1.740	3.926	0.822
1.588	0.984	2.234	2.657	1.588	0.703	3.174	1.740	4.423	0.828
1.667	1.263	2.346	2.797	2.026	1.302	3.312	1.684	5.120	1.188
1.838	1.459	3.174	2.797	2.234	1.998	3.457	1.535	5.928	1.958
2.234	3.360	3.924	1.307	2.346	2.072	3.918	0.917	8.020	1.958
2.346	3.400	4.423	1.512	3.174	2.072	4.877	1.086	8.368	1.939
3.174	3.400	4.843	1.512	3.312	1.956	5.120	1.363	9.119	1.669
3.609	2.288	5.646	2.967	3.901	1.059	5.689	1.872	10.392	0.958
3.771	1.521	5.928	3.836	4.877	1.238	5.928	2.309	12.013	0.650
4.423	1.950	6.224	3.882	5.120	1.602	8.020	2.309	14.464	0.573
4.862	1.950	8.420	3.882	5.661	2.171	8.368	2.287	15.879	0.573
5.120	2.613	9.999	1.778	5.928	2.817	9.119	1.911	18.207	0.512
5.646	4.181	12.363	0.794	8.020	2.817	10.392	1.030	19.117	0.522
5.928	5.352	15.879	0.794	8.368	2.806	10.859	0.950	22.186	0.522
8.020	5.352	17.983	0.658	8.735	2.377	12.231	0.655	23.237	0.562
8.368	4.927	19.117	0.834	9.119	2.245	12.974	0.629	31.439	0.562
9.119	3.756	25.865	0.834	9.947	1.414	15.879	0.614	32.806	0.544
9.523	2.603	29.620	0.765	11.349	0.913	17.292	0.524	35.065	0.506
10.842	1.576	31.439	0.765	12.974	0.657	19.117	0.564	38.215	0.506
11.349	1.570	37.331	0.705	14.196	0.637	22.421	0.564	52.065	0.387
12.398	0.925	38.992	0.612	16.400	0.547	23.237	0.597	100.000	0.372
15.879	0.925	50.208	0.392	18.207	0.593	31.439	0.597		
17.340	0.830	55.651	0.385	21.077	0.608	35.169	0.533		
19.117	1.156	100.000	0.371	23.237	0.652	38.215	0.533		
25.865	1.156			31.439	0.652	45.375	0.442		
28.171	1.070			34.791	0.585	51.872	0.388		
29.489	0.953			38.215	0.585	100.000	0.372		
34.661	0.953			45.375	0.464				
36.168	0.943			50.594	0.391				
37.751	0.897			100.000	0.372				
39.549	0.688								
41.157	0.658								
49.052	0.406								

61.355	0.380
100.000	0.371

TABLE NO : 4.1.2.10(a) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : SSE LOCATION : Floor - 116(PCB) (m)
DIRECTION : X (E-W) ZPA : 0.3692 (g)

5.0%		7.0%		10.0%		20.0%	
Freq	Accl	Freq	Accl	Freq	Accl	Freq	Accl
0.100	0.010	0.100	0.009	0.100	0.009	0.100	0.007
0.425	0.087	0.570	0.105	0.548	0.085	0.446	0.049
0.517	0.106	0.693	0.137	0.693	0.123	0.693	0.093
0.884	0.192	0.842	0.165	0.884	0.148	0.886	0.110
1.074	0.268	1.074	0.234	1.023	0.169	1.838	0.354
1.244	0.309	1.440	0.360	1.372	0.279	2.128	0.459
1.667	0.565	1.929	0.687	1.559	0.342	2.346	0.513
1.838	0.708	2.346	1.085	1.929	0.575	2.586	0.525
2.346	1.334	2.463	1.098	2.346	0.845	3.499	0.525
3.174	1.334	3.333	1.098	2.463	0.869	3.651	0.522
3.312	1.329	3.478	1.047	3.333	0.869	4.371	0.471
3.457	1.240	4.267	0.645	3.478	0.850	5.376	0.580
3.936	0.753	4.877	0.797	4.341	0.568	5.646	0.621
4.877	0.901	5.376	1.075	5.376	0.899	5.928	0.650
5.928	1.697	5.928	1.346	5.646	0.994	6.224	0.665
8.020	1.697	8.020	1.346	5.928	1.044	8.842	0.665
8.368	1.685	8.368	1.344	6.224	1.069	9.630	0.642
9.119	1.485	9.119	1.227	8.420	1.069	10.054	0.623
9.523	1.309	9.523	1.124	8.787	1.039	11.565	0.537
10.392	0.908	10.392	0.836	9.171	1.001	17.936	0.418
11.959	0.637	11.979	0.611	9.575	0.944	100.000	0.372
14.135	0.551	16.860	0.451	10.911	0.696		
15.123	0.551	19.117	0.459	11.401	0.639		
15.781	0.548	23.237	0.500	14.453	0.501		
18.207	0.487	31.439	0.500	17.365	0.436		
20.074	0.497	38.029	0.463	20.074	0.441		
23.237	0.537	39.851	0.458	23.237	0.465		
31.439	0.537	49.491	0.395	31.439	0.465		
34.152	0.488	100.000	0.370	38.937	0.437		
38.215	0.488			100.000	0.370		
49.515	0.394						
52.947	0.386						
100.000	0.371						

TABLE NO : 4.1.2.10(b) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : SSE LOCATION : Floor - 116(PCB) (m)
DIRECTION : Y (N-S) ZPA : 0.4877 (g)

0.5%		1.0%		2.0%		3.0%		4.0%	
Freq	Accl	Freq	Accl	Freq	Accl	Freq	Accl	Freq	Accl
0.100	0.014	0.100	0.013	0.100	0.013	0.100	0.012	0.100	0.010
0.288	0.089	0.261	0.070	0.261	0.064	0.229	0.051	0.512	0.117
0.367	0.118	0.288	0.083	0.303	0.074	0.288	0.066	0.585	0.127
0.396	0.123	0.367	0.109	0.367	0.095	0.327	0.068	0.604	0.133
0.475	0.152	0.401	0.115	0.475	0.121	0.372	0.086	0.628	0.144
0.764	0.297	0.425	0.123	0.517	0.159	0.409	0.095	0.683	0.155
0.928	0.476	0.469	0.140	0.609	0.160	0.517	0.134	0.770	0.177
1.244	0.613	0.497	0.167	0.685	0.181	0.602	0.144	0.906	0.221
1.440	0.829	0.543	0.193	0.736	0.207	0.628	0.156	0.982	0.248
1.667	1.263	0.729	0.233	0.764	0.224	0.728	0.186	1.018	0.266
2.128	2.208	0.842	0.332	0.928	0.317	0.842	0.239	1.157	0.296
2.234	2.918	0.880	0.333	0.996	0.323	0.915	0.255	1.306	0.379
2.657	4.121	0.928	0.406	1.074	0.364	1.074	0.326	1.512	0.497
2.716	4.794	1.185	0.438	1.244	0.431	1.185	0.341	1.667	0.582
2.994	6.281	1.306	0.559	1.383	0.475	1.512	0.560	2.463	1.549
3.143	6.712	1.588	0.869	1.512	0.649	2.463	1.722	2.872	2.221
4.253	6.712	1.667	1.023	1.667	0.761	2.994	3.244	2.994	2.744
4.632	3.799	1.838	1.166	2.346	1.871	4.050	3.244	4.050	2.744
4.836	3.490	2.234	2.279	2.947	3.572	4.226	3.095	4.226	2.650
5.217	3.322	2.586	2.899	2.994	3.959	4.809	1.868	4.809	1.697
5.928	3.072	2.716	3.743	4.050	3.959	5.660	1.232	5.692	1.137
8.020	3.072	2.994	5.202	4.226	3.747	5.928	1.498	5.928	1.312
8.272	3.005	4.050	5.202	4.809	2.177	8.020	1.498	8.020	1.312
8.758	4.003	4.226	5.005	5.248	1.560	8.758	1.565	8.758	1.331
11.849	4.003	4.605	3.202	5.648	1.420	11.849	1.565	11.849	1.331
12.365	2.561	5.412	1.805	5.928	1.774	13.383	1.029	13.474	0.931
12.750	2.189	5.928	2.411	8.020	1.774	14.403	1.029	14.069	0.931
14.403	2.189	8.020	2.411	8.758	1.974	15.029	1.003	14.695	0.912
15.029	1.893	8.758	2.857	11.849	1.974	16.782	0.684	16.565	0.643
16.424	1.178	11.849	2.857	12.905	1.257	19.117	0.772	19.117	0.715
19.117	1.456	12.365	1.985	14.069	1.204	25.865	0.772	25.865	0.715
25.865	1.456	13.072	1.627	14.695	1.136	26.990	0.756	26.990	0.711
28.171	1.300	14.403	1.627	16.502	0.759	28.171	0.720	28.171	0.675
29.410	0.874	16.591	0.916	19.117	0.872	31.042	0.582	31.296	0.561
38.215	0.841	19.117	1.093	25.865	0.872	33.011	0.582	33.011	0.561
40.619	0.629	25.865	1.093	26.990	0.839	38.215	0.551	37.536	0.528
49.083	0.507	26.990	1.037	28.171	0.790	54.079	0.497	48.837	0.505
100.000	0.491	28.171	0.962	29.410	0.657	100.000	0.489	100.000	0.490
		29.410	0.731	34.064	0.589				
		32.776	0.669	38.215	0.589				
		38.215	0.669	42.019	0.525				
		42.745	0.546	46.432	0.525				
		45.375	0.544	57.606	0.497				
		57.523	0.498	100.000	0.489				
		100.000	0.489						

TABLE NO : 4.1.2.10(b) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : SSE LOCATION : Floor - 116(PCR) (m)
DIRECTION : Y (N-S) ZPA : 0.4877 (g)

5.0%		7.0%		10.0%		20.0%	
Freq	Accl	Freq	Accl	Freq	Accl	Freq	Accl
0.100	0.010	0.100	0.009	0.100	0.009	0.100	0.007
0.377	0.076	0.408	0.075	0.409	0.066	0.405	0.049
0.463	0.093	0.450	0.080	0.478	0.073	0.438	0.049
0.552	0.115	0.502	0.089	0.628	0.110	0.583	0.076
0.600	0.124	0.708	0.138	0.728	0.123	0.761	0.098
0.660	0.139	0.774	0.141	0.802	0.127	1.372	0.226
0.728	0.160	1.112	0.241	0.882	0.148	2.346	0.603
0.828	0.181	1.127	0.241	1.023	0.193	2.852	0.816
0.910	0.202	1.306	0.311	1.205	0.242	3.143	0.896
0.995	0.233	1.454	0.361	1.838	0.491	3.300	0.904
1.023	0.249	2.463	1.189	2.026	0.680	4.465	0.904
1.145	0.274	2.994	1.892	2.994	1.452	4.660	0.896
1.512	0.447	3.143	1.897	3.143	1.496	5.077	0.840
1.667	0.534	4.253	1.897	4.253	1.496	6.276	0.667
2.852	1.934	4.438	1.803	4.438	1.450	8.420	0.667
2.994	2.385	5.511	1.067	5.275	1.044	10.444	0.614
4.050	2.385	6.536	1.022	5.959	0.857	11.889	0.609
4.226	2.323	8.842	1.022	6.536	0.867	13.026	0.593
4.411	2.127	9.226	1.013	8.842	0.867	15.940	0.523
5.023	1.412	9.650	0.971	9.226	0.861	17.340	0.529
5.728	1.063	11.849	0.971	9.630	0.844	19.117	0.532
5.928	1.175	12.365	0.942	10.165	0.803	25.865	0.532
6.536	1.185	14.069	0.786	11.849	0.803	40.010	0.500
8.842	1.185	16.680	0.588	12.365	0.798	100.000	0.489
11.849	1.171	19.117	0.632	16.663	0.562		
12.365	1.097	27.158	0.633	19.117	0.592		
13.474	0.877	28.339	0.615	25.865	0.592		
14.069	0.867	32.247	0.526	26.990	0.590		
14.695	0.841	36.772	0.509	33.514	0.509		
16.860	0.625	100.000	0.490	100.000	0.489		
19.117	0.675						
20.074	0.680						
27.158	0.680						
32.247	0.545						
36.585	0.515						
43.933	0.511						
52.637	0.497						
100.000	0.489						

TABLE NO : 4.1.2.10(c) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : SSE LOCATION : Floor - 116(PCB) (m)
DIRECTION : Z (VER) ZPA : 0.8363 (g)

0.5%		1.0%		2.0%		3.0%		4.0%	
Freq	Accl	Freq	Accl	Freq	Accl	Freq	Accl	Freq	Accl
0.100	0.009	0.100	0.009	0.100	0.008	0.100	0.007	0.100	0.007
0.288	0.059	0.288	0.055	0.254	0.041	0.367	0.056	0.472	0.066
0.350	0.062	0.350	0.059	0.303	0.049	0.628	0.098	0.500	0.073
0.378	0.077	0.409	0.077	0.367	0.063	0.671	0.099	0.602	0.084
0.424	0.086	0.446	0.091	0.400	0.065	0.735	0.116	0.635	0.090
0.517	0.139	0.517	0.124	0.446	0.079	0.785	0.126	0.671	0.093
0.738	0.168	0.736	0.149	0.517	0.102	0.842	0.145	0.734	0.107
0.764	0.186	0.764	0.168	0.645	0.107	0.878	0.147	0.797	0.116
0.797	0.197	0.801	0.176	0.690	0.111	0.962	0.160	0.854	0.127
0.842	0.230	0.842	0.206	0.842	0.171	0.982	0.161	1.031	0.152
0.928	0.289	0.928	0.245	0.928	0.189	1.074	0.183	1.156	0.165
1.244	0.349	1.074	0.247	0.992	0.193	1.202	0.191	1.208	0.177
1.372	0.367	1.244	0.294	1.074	0.210	1.254	0.214	1.306	0.207
1.565	0.477	1.358	0.314	1.191	0.213	1.394	0.232	1.404	0.216
1.838	0.639	1.440	0.368	1.395	0.266	1.464	0.262	1.432	0.225
2.234	1.293	1.546	0.417	1.454	0.303	1.511	0.278	1.648	0.266
2.586	1.472	1.596	0.433	1.508	0.326	1.588	0.297	1.686	0.269
3.499	1.472	1.754	0.498	1.588	0.350	1.662	0.303	2.463	0.600
4.423	1.615	2.234	0.971	1.667	0.367	1.685	0.304	3.300	0.640
5.808	3.982	2.586	1.121	1.838	0.419	2.346	0.632	4.423	0.805
5.928	4.690	2.716	1.156	2.346	0.760	2.716	0.707	5.928	1.929
6.862	7.956	3.674	1.156	2.716	0.862	4.423	0.882	6.862	3.750
7.206	8.377	4.423	1.287	4.423	1.003	5.928	2.189	7.206	4.402
7.566	13.316	5.822	3.126	5.928	2.656	6.862	4.171	7.944	5.166
7.944	14.335	5.928	3.583	6.862	4.727	7.206	4.972	8.341	5.502
8.758	14.755	6.862	6.154	7.566	6.666	7.944	5.917	11.285	5.502
11.849	14.755	7.206	6.916	8.341	7.825	8.341	6.388	11.775	4.874
12.365	8.489	7.566	9.619	11.285	7.825	11.285	6.388	12.114	4.243
12.581	7.883	8.341	10.830	11.775	7.050	11.775	5.612	13.400	3.371
13.717	7.883	11.285	10.830	12.291	5.429	12.291	4.596	14.622	2.866
14.313	7.504	11.775	10.428	13.170	4.375	13.992	3.276	15.356	2.518
14.939	6.864	12.291	6.886	13.717	4.375	15.123	3.276	16.515	3.053
15.728	7.666	12.929	5.984	14.939	3.918	15.728	3.106	17.340	3.074
16.515	8.355	13.717	5.984	15.476	3.474	16.515	3.495	23.460	3.074
22.343	8.355	14.939	5.185	15.728	3.852	17.340	3.500	24.480	2.928
23.314	8.215	15.419	4.668	16.515	4.096	23.460	3.500	25.551	2.384
24.334	7.895	15.728	5.545	17.340	4.152	24.480	3.403	26.676	2.028
25.405	6.879	16.515	5.620	23.460	4.152	25.551	2.675	27.857	1.626
27.711	2.999	22.343	5.620	24.480	4.085	26.676	2.260	32.990	1.000
30.252	2.158	24.334	5.393	25.551	3.224	27.857	1.762	43.451	0.904
34.561	1.400	25.405	4.491	26.676	2.618	33.200	1.012	49.818	0.877
37.805	0.994	27.711	2.346	27.857	1.964	43.451	0.905	100.000	0.840
47.445	0.898	28.950	1.841	29.096	1.805	52.155	0.875		
75.450	0.846	30.252	1.773	30.398	1.508	100.000	0.840		
100.000	0.838	33.054	1.249	33.200	1.062				
		37.805	0.965	36.290	0.961				
		52.009	0.882	52.155	0.877				
		75.450	0.845	62.736	0.858				

100.000 0.838 100.000 0.839

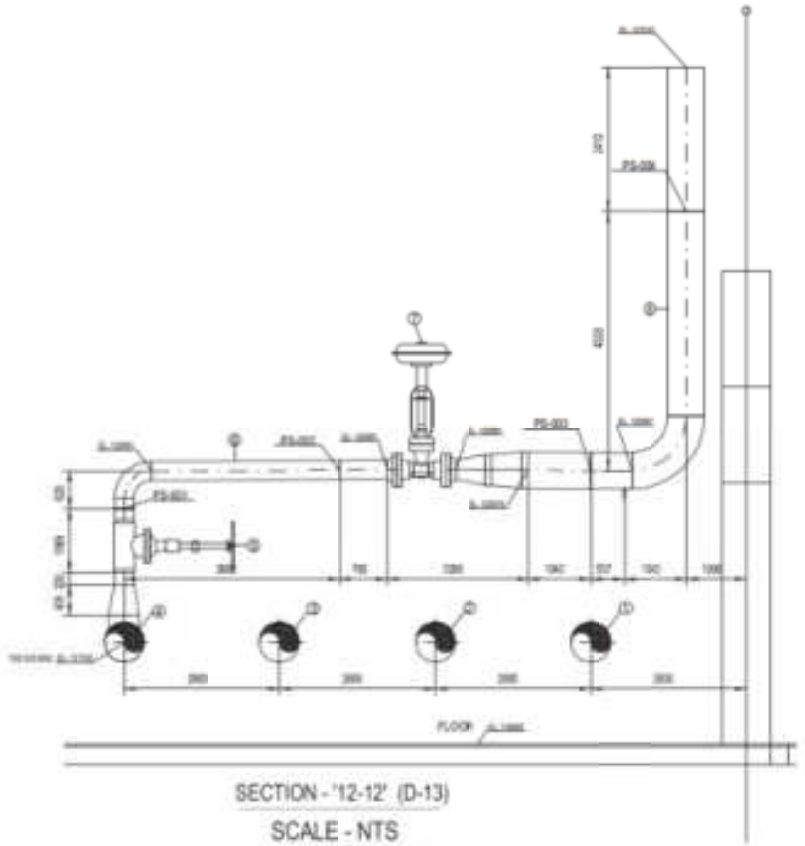
TABLE NO : 4.1.2.10(c) ACCELERATION RESPONSE SPECTRA (ELASTIC)

PROJECT : KAIGA-5&6 BUILDING : CB
INTENSITY : SSE LOCATION : Floor - 116(PCB) (m)
DIRECTION : Z (VER) ZPA : 0.8363 (g)

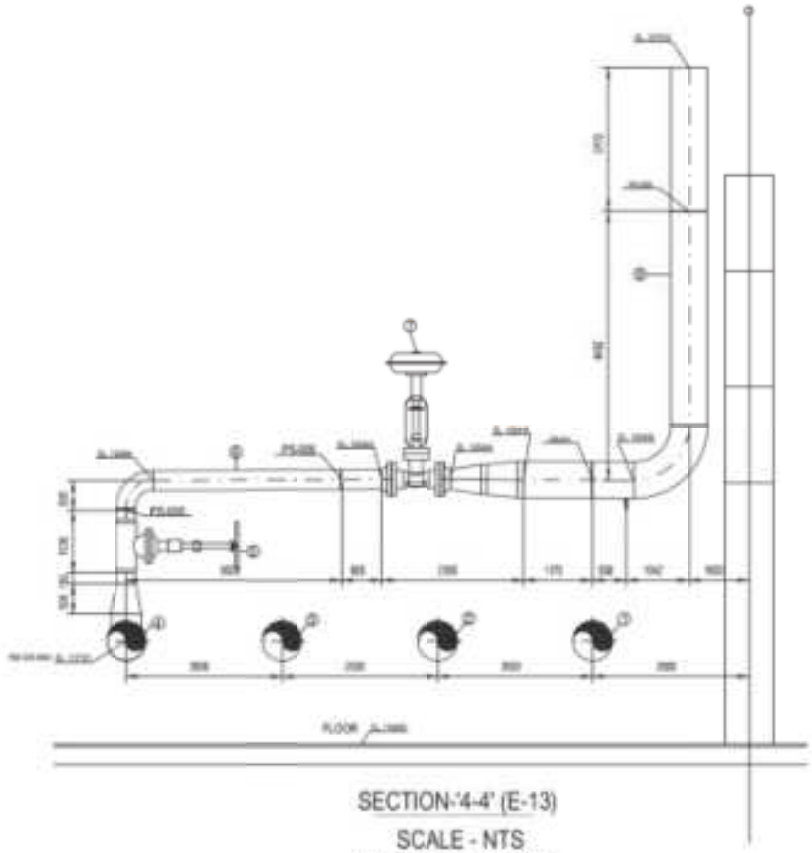
5.0%		7.0%		10.0%		20.0%	
Freq	Accl	Freq	Accl	Freq	Accl	Freq	Accl
0.100	0.007	0.100	0.006	0.100	0.006	0.100	0.005
0.430	0.056	0.432	0.050	0.377	0.041	0.386	0.032
0.476	0.062	0.503	0.057	0.712	0.075	0.458	0.032
0.515	0.069	0.728	0.086	0.781	0.076	1.017	0.074
0.846	0.112	0.770	0.087	0.884	0.089	1.488	0.126
0.928	0.126	1.300	0.166	0.934	0.092	1.667	0.133
1.074	0.151	1.414	0.182	1.130	0.116	2.346	0.227
1.206	0.164	1.553	0.193	1.390	0.159	3.821	0.360
1.339	0.192	2.346	0.426	1.516	0.167	5.376	0.787
1.369	0.194	2.716	0.469	1.598	0.169	6.862	1.454
1.440	0.209	3.710	0.469	2.128	0.303	7.206	1.599
1.632	0.238	5.120	1.001	2.463	0.362	7.566	1.721
2.463	0.534	5.928	1.583	2.840	0.391	7.944	1.815
2.586	0.552	6.862	2.871	3.466	0.399	8.341	1.853
3.516	0.572	7.206	3.283	4.644	0.672	11.285	1.853
4.644	0.806	7.566	3.550	5.928	1.401	11.775	1.840
5.928	1.772	7.944	3.799	6.862	2.331	12.291	1.789
6.862	3.407	8.341	3.971	7.206	2.637	15.970	1.388
7.206	3.953	11.285	3.971	7.566	2.885	19.094	1.157
7.944	4.590	11.775	3.672	7.944	3.063	20.901	1.140
8.341	4.863	12.291	3.139	8.341	3.144	22.892	1.113
11.285	4.863	13.400	2.774	11.285	3.144	30.177	0.972
11.775	4.375	15.609	1.965	11.775	2.954	33.119	0.943
12.291	3.730	16.515	2.198	12.832	2.446	100.000	0.842
13.996	2.839	17.340	2.253	13.400	2.346		
14.622	2.638	23.460	2.253	16.180	1.678		
15.728	2.372	25.551	1.875	16.515	1.739		
16.515	2.698	27.857	1.431	22.343	1.739		
17.340	2.744	32.412	0.996	24.334	1.689		
23.460	2.744	36.290	0.951	28.950	1.184		
24.480	2.584	49.818	0.878	31.772	0.992		
27.857	1.544	100.000	0.840	36.144	0.947		
32.731	1.000			47.445	0.883		
43.451	0.904			100.000	0.841		
49.818	0.878						
100.000	0.840						

ATTACHMENT - 17

PIPING LAYOUT AND 3D MODEL SCREEN SHOTS OF ASDV



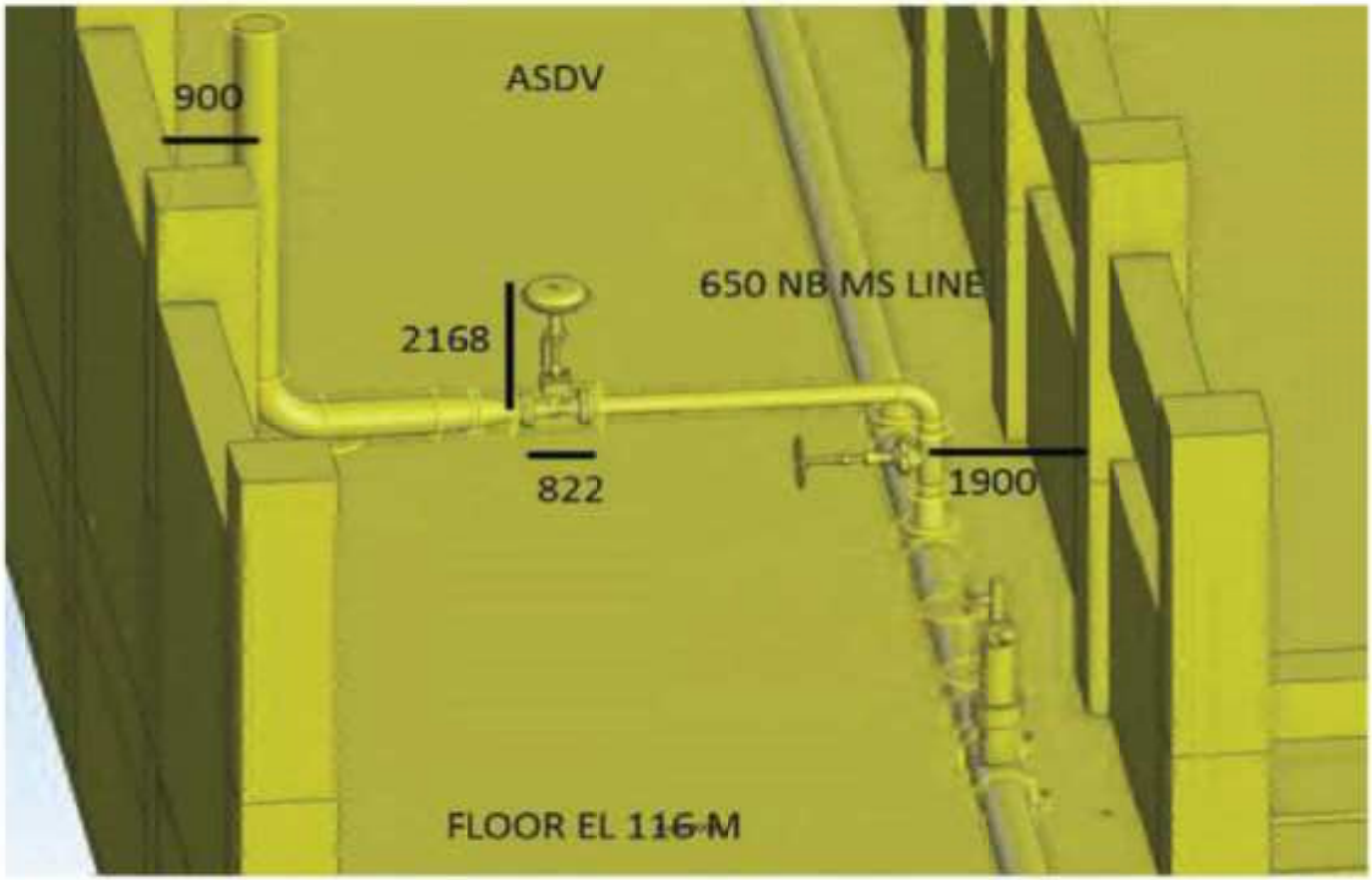
SECTION - '12-12' (D-13)
SCALE - NTS
(REFER TABLE NO.4)

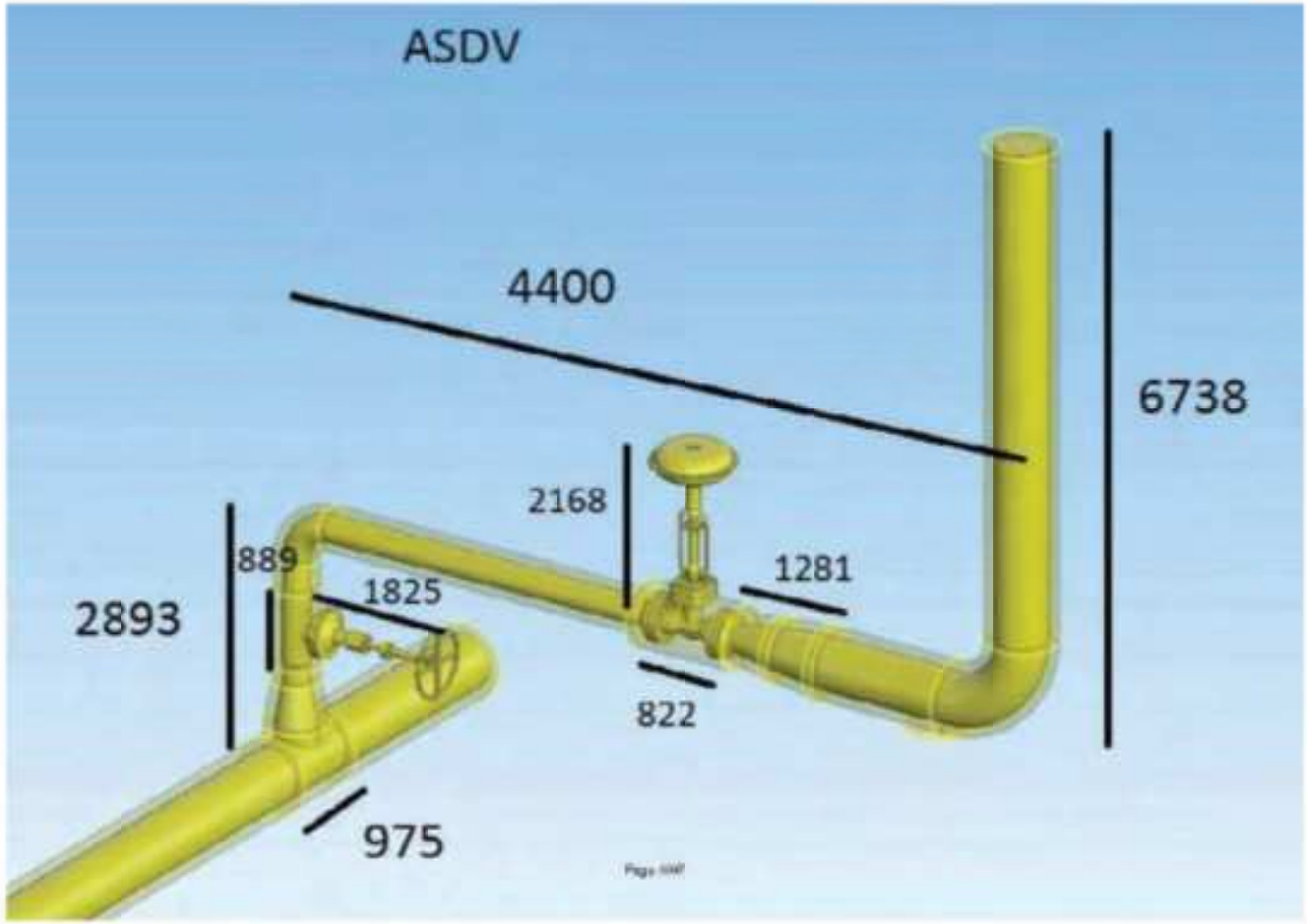


SECTION-'4-4' (E-13)
SCALE - NTS
(REFER TABLE NO.4)

TABLE NO.4

SECTION	LINE NO. ①	LINE NO. ②	LINE NO. ③	LINE NO. ④	VALVE ⑤	LINE NO. ⑥	VALVE ⑦	LINE NO. ⑧
SECTION - 4-4	1-650-S-3811-1002	1-650-S-3811-1001	1-650-S-3811-1003	1-650-S-3811-1004	1-3812-V-1007	1-500-S-3812-1013	1-3812-CV-1232	1-600-S-3812-1014
SECTION - 12-12	1-650-S-3811-1002	1-650-S-3811-1001	1-650-S-3811-1003	1-650-S-3811-1004	1-3812-V-1006	1-300-S-3812-1015	1-3812-CV-1233	1-600-S-3812-1016





ATTACHMENT - 18

SPECIFICATION FOR ELECTRO-PNEUMATIC CONVERTERS

1.0 SCOPE

This specification covers general technical requirements for design, inspection, testing manufacture and supply of Electronic and Pneumatic feedback type Electro pneumatic transducers and auxiliary equipment required for Nuclear Power Stations. The general characteristics of the transducers shall conform to this specification. Particular requirements of the transducers are covered by instrument specification sheet and which will form part of this specification. In case of conflict between this specification and the instrument specification sheet, the instrument specification sheet shall govern. Any difference between this specification and the specification of the instrument offered by the bidder must be clearly indicated in the bid.

2.0 APPLICABLE STANDARDS AND SPECIFICATIONS

IS: 13947	Degrees of protection provided by enclosures for low voltage switch gear and control gear.
ISA-S26	Dynamic response testing of process control instrumentation
IS-13122	Transmitters for use in Industrial Process Control Systems - Specification
ANSI-B1.20.1	Pipe threads (except dry seal)
SAMA-RC20-11	Measurement and control terminology
IEEE-323	Standard for qualifying class 1E equipment of nuclear power generating stations
KAPP-3&4/65530/2001/ES	Engineering standard for electromagnetic compatibility qualification for C&I.
IS 9000-1994 (Part–III and V) / IEC-68.2	Basic environmental testing procedure for electrical and electronic items.
KAPP-3&4/65540/2001/ES	Engineering standard for instrumentation and control system Grounding

3.0 REQUIREMENTS

3.1 General:

- The general philosophy for instrumentation in Nuclear Power Plants is based on the use of instruments, which are capable of continuous satisfactory operation over a long period of time, with minimum attention. Long term reliability under varying service conditions is of prime importance and the use of high quality components for all applications in the instruments is therefore required.
- The design, manufacture and performance assessment of the equipment shall conform to well established practices or codes. The bidder shall stipulate as part of the bid, the codes and standards to which the design, fabrication and performance of the equipment conforms.
- The design of the transducers shall be such that inspection and calibration can be carried out easily. No periodical maintenance is envisaged. If any is required the bidder shall specify in the bid.
- Transducers having identical specifications shall give uniform performance from one to another and shall preferably have interchangeable component part
- The bidder shall specify information regarding the physical dimensions and weight of the transducers along with the bid. Also, since the space available in the plant is limited, a design which reduces the overall size of the transducer is preferred.

3.2 Mounting

Each transducer along with the accessories shall be suitable for mounting on either control valve yoke at the accessory mounting pad or pipe stand mounting or wall mounting and shall be supplied with the necessary hardware such as mounting brackets.

3.3 Ambient conditions

The ambient temperature will be varying from 15 °C to 65°C with the relative humidity ranging from 0 to 95%.

3.4 Input signals and Input Impedance

The input signal to the transducer shall be 4-20 mA dc. A design is preferred where the input range can be changed readily by replacement of a range card situated preferably in the rear of the transducer. The extent and method of split ranging if available shall be specified by the bidder. Input resistance shall not exceed 265 ohms. Actual value shall be specified by bidder.

3.5 **Output specifications**

Unless otherwise specified in instrument specification sheet, all transducers shall be direct acting, with an output signal of 0.21 to 1.06 kg/cm^2 (g) or 3 to 15 psi (g). A design will be preferred, wherein reverse action is secured by simple tubing interchange and/or reversal of signal polarity, which can be easily carried out in the field.

3.6 The design shall be such that the performance is not affected by adjacent runs of power lines and other common mode interference sources when unshielded two conductor cable is used to connect the various individual units of a system together.

3.7 **Grounding**

- Signal grounding

  The design of the instrument shall be such that either of the input signal leads may be grounded. The insulation resistance between either of input terminals and the body of the transducer shall be better than 10 mega ohms at 100 VDC at 27°C±2°C and 65% ±5% RH.

- Safety grounding

  A separate terminal insulated from signal terminals shall be provided to facilitate grounding of the instrument casing.

3.8 **Air Supply Input**

Air supply at 7 kg/cm^2 (g) with ±20% variation. Each transducer shall be supplied with an input filter regulator. It is preferable that these units shall be mounted integrally with the transducer. The regulator transducer assembly shall be designed to operate satisfactorily with the above air supply as input. Supplier shall specify the maximum and normal steady state air consumption of the transducer.

3.9 **Load variation**

The terminal volume can vary from 130 cc to 160 cc.

3.10 **Split Ranging**

A design is preferred, wherein the same transducer with suitable jumpers, can be used to operate two or more valves in sequence.

3.11 **End Connections**

¼" NPT Female (as per ANSI-B1.20.1) connections are preferred for pneumatic input (air supply) and output. Electrical connections should be brought out to suitable terminal blocks. The terminal block shall be an integral part of the transducer. Cable connection shall be suitable for passing 9 mm /10.5 mm O.D., 1 pair LHLS cable through ½" NPT female conduit having double compression cable gland of tapered grommet (material EPDM). This cable gland shall be supplied along with the transducers.

3.12 **Adjustments**

The transducer shall be provided with the following adjustments:

- Zero adjustment up to about ±2% of span
- Span adjustment up to about ±2% of span
- Direct to reverse acting and vice-versa.

It will be preferable, if the transducer is provided with external span and zero adjustments.

3.13 **Enclosures**

The transducer enclosure shall be of IP-65 type as per IS-13947.

3.14 **Tropicalization**

It is desirable that the design, materials used for construction and methods of fabrication are such that the transducers are inherently moisture and fungus resistant. As an alternative, the transducer shall be rendered moisture and fungus resistant by suitable treatment. The manufacturer shall state as part of the tender, the method of treatment and this shall be subject to approval by the purchaser.

3.15 **Materials, Components and parts**

The materials used for the various parts of the transducer shall be proposed by the bidder and approved by the purchaser.

3.16 **Performance**

- The definitions for the performance of the equipment shall conform to SAMA RC-20-11-1964. The performance of the transducer shall be as per IS 13122.

- Accuracy
  The accuracy of the transducer shall be ±0.5 % of span or better under normal operating conditions.

Note: The accuracy as specified above shall be met under normal operating conditions. The subsequent sections specify the upper limits for different types of errors such as hysteresis, dead band, etc. These shall not be interpreted to mean that the overall accuracy of the transducer is the sum of these upper limits of errors. The errors of the transducer shall be within the limits specified by each of the sections mentioned below and further the overall accuracy shall be within the limits specified in this section.

- Dead Band

The dead band shall not be more than 0.1% of span for the transducers under normal operating conditions.

- Hysteresis

The Hysteresis shall not be more than 0.5% of span under normal operating conditions.

- Repeatability

The maximum non-repeatability shall be within 0.25% of span.

- Linearity

Non-linearity shall be within ±0.5% of span between 10% to 100% of scale.

- Air supply pressure effect

The change in the p pressure due to variation in the air supply pressure shall not be greater than 0.05% of output span per percent change in input air supply pressure.

- Ambient temperature effect

The change in the output pressure due to variation in the ambient temperature shall not be greater than $\pm$ 0.02% of output span per $^{\circ}C$ change in ambient temperature.

- Frequency Response

The response shall be constant within 3 dB and shall have a phase shift of not more than 45 degrees up to at least a frequency of 1 cycle per second (F_c, corner frequency). The response shall have no undesirable peaks in the range up to 10 cps, and shall roll off after the corner frequency with no point after the corner frequency having an amplitude ratio higher than the value at F_c. The sinusoidal input variation for assessing the dynamic performance shall have peak to peak amplitude of 10% centered at 50% of input span. The output shall be terminated with a load consisting of air chamber of ≈ 20 cc volume and 10 m length of 4 mm ID connecting tubing. The procedural recommendations of ISA-S26 shall be followed. The manufacturer shall submit complete magnitude and phase response curves of the transducers.

- Vibration effect (non-seismic and seismic)

All transducers should withstand and perform within the specified accuracy limits during and after non-seismic vibration at peak acceleration of lg, over a frequency range of 1-200 Hz in each of the three orthogonal axes.

In addition to above, the transducers shall be seismically qualified for intended functional performance, by a shake table test for the required response spectra (RRS) at the base of the transducer. If specified in ISS, one sample assembly of each type from the production lot shall be subjected to shake table test (seismic vibration test), such that the Test Response Spectrum (TRS) envelopes the Required Response Spectrum (RRS). The RRS required for the testing will be enclosed with the tender documents.
The test set up, mounting arrangement and procedure shall be proposed by the supplier and subject to the approval of the purchaser. After completion of the above tests, calibration test for assemblies shall be done. If any one out of these samples is found defective or fails, balance assemblies ordered in the lot shall be modified and retested at manufacturer's cost.

- Mounting inclination effect

The bidder shall specify the change in performance of transducer caused by $\pm 10^{\circ}$ Inclination in each plane, from any of the mounting positions.

3.17 **Environmental Requirements**

Electro-pneumatic converter shall meet the dry heat and damp heat requirements to the conditions specified in IS 9000-Part III and section 2 of Part-V respectively.

3.18 **EMI/RFI Requirements**

The instrument shall be suitable to meet the EMI/RFI requirements as specified in "Engineering standard for electromagnetic compatibility qualification for C&I" (KAPP-3&4/65530/2001/ES).

3.19 **Calibration Statement**

Each transducer along with filter regulator assembly shall be supplied with three copies of certified calibration statements, listing results of five point (at least) accuracy calibration. The transducer assembly shall be terminated with normal load and the normal inlet pressure.

4.0 **Quality Assurance Plan**

The supplier shall submit Quality Assurance (QA) Plan to describe the standard quality assurance, control & test activities that are carried out during the manufacture of transducers. The QA Plan shall describe the incoming material quality control in sequence. The QA Plan shall be in conformance with the QA plan stipulated in the Annexure-I of this specification and shall be submitted for purchaser's review and approval.

5.0 Tests

5.1 Routine Tests

- Visual & Dimensional Check
- Performance test
- Insulation Resistance Test
- Calibration Test
- Air Supply Effect Test
- Linearity Test
- Hysteresis Test
- Dead bad Test
- Repeatability Test
- Supply pressure variation effect

5.2 Type Tests

- Vibration (Non-Seismic and Seismic) Test
- Ambient temperature effect and mounting inclination effect
- Steam Bound Test
- Climatic test

One unit from the lot shall be subjected to the following climatic tests:

a) DRY HEAT TEST: The unit shall be tested as per IS-9000 Part III

Temperature	:	55°C ± 2°C
Relative Humidity	:	≤50%
Duration	:	4 hrs.

b) DAMP HEAT TEST
The unit shall be tested as per IS-9000 Part V

Two cycles over a range of 40°C±2°C, 90% RH

25°C±5°C, 98% RH

Environmental test for Dry heat cycle (4 hours duration) and Damp heat cycle (2 cycles of 12 + 12 hours each) shall be carried out as per IS 9000-Part III and section 2 of Part-V respectively or equivalent national/international standards to qualify the instrument for the above operating and storage conditions. After completion of each of the above tests, the sample instrument shall be checked for insulation resistance and calibration accuracy. *(Any changes in parameters of these tests if exists will be conveyed before commencement of these tests).*

- EMI/RFI Test

One assembly of electro-pneumatic converter shall be subjected to EMI/RFI test as per the Engineering standard for electromagnetic compatibility qualification for C&I. If approved test reports complying to above requirements are available for the offered model, these reports are acceptable in lieu of actual test.

- Drift Test (Long Term)

One sample electro-pneumatic converter shall be subjected to long term (30 days) drift test. After drift test, the calibration test shall be repeated. Drift shall not exceed ±0.2% of FS.

- Frequency Response Test

One sample transducer of each type shall be tested to verify compliance with respect to frequency response requirement.

- Tests on Enclosure

One sample of each type transducer assembly (with filter regulator) shall be tested to demonstrate conformity of the enclosure with the requirements as per IS-13947.

6.0 DOCUMENTATION

Schedules of submission of various documents by the contractor are given below. All the documents shall be signed by the contractor.

6.1 Documents to be furnished by the Bidder Along With the Offer

All the documents listed below shall be furnished in triplicate along with the offer.

- Detailed technical literature on the offered electro-pneumatic transducers indicating dimensions, material of construction, service conditions, tests carried out, installation procedures, applicable standards etc.
- List of in-house manufacturing facilities.
- List of in-house inspection and test facilities.
- Standard QA plan for manufacturing of E/A converters indicating incoming, in-process and final inspection and testing.
- QA manual of the company.
- Reference list of customers to whom similar products have been supplied, indicating quantities supplied, purchase order reference, order value, scheduled delivery dates, and actual dates of supply.
- List of suppliers/sub-vendors of raw material and inspection/testing agencies for execution of this order.
- Point wise confirmation on each clause of this specification explaining how the requirements are being met.

- Copies of the test reports, if the offered electro-pneumatic transducers have earlier undergone various tests mentioned in this specification.

6.2 **Documents Required to be Furnished Immediately After Placement of Purchase Order**

Immediately after placement of purchase order, 3 copies of following documents shall be submitted for the purchaser's review and approval. Contractor shall commence manufacturing/testing of the electro-pneumatic transducers only after specific approval of the relevant documents by the purchaser.

- General arrangement drawing (with the detailed bill of material) of electro- pneumatic transducers indicating overall dimensions, component/sub- assembly dimensions and tolerances, material of construction of each component, finish etc.
- A detailed QA plan indicating incoming, in-process and final inspection and tests.
- Detailed procedure for all the inspection and tests to be carried out on the E/A converters.

6.3 **Documents required to be furnished along with the supply**

- Five copies of all as-built drawings along with their re-producible.
- 6 copies of operation and maintenance manual giving functional description, descriptive and illustrative literatures of all the components/ sub-assemblies, installation procedure etc. Six numbers of soft copies of the same shall also be supplied in the form of CD/DVD/Pen drive.
- Six copies of history Dockets including all test reports/certificates. It also preferred to provide these documents in soft form along with the hard copies.

In addition to the above, the manufacturer shall supply in triplicate, certificate of compliance stating that the material supplied is in accordance with all the provisions of this specification

7.0 GUARANTEE

All the electro-pneumatic transducers shall be guaranteed by the Supplier for the period mentioned in general conditions of the contract. During this period, any preventive & breakdown maintenance required/necessary shall be done by the Supplier. All faulty items shall be replaced free of cost at site by the Supplier.

FORMAT FOR SUBMISSION OF DATA (in MS Access format):

SL.NO.	E/A Converter Tag No. Control Valve Ref.	Loc. (Bldg. Floor, Grid)	Mtg. Action: Direct/ Rev.	Input Signal Output Signal Split Range	Seismic Test	P.O. No. Mfr Model no.	Rev. No.: Date Ref. Dwg. No. Remarks	Pkg.	NPCIL Engr	REMARKS

ANNEXURE-I: SAMPLE QUALITY ASSURANCE PLAN

SL. NO. 1	COMPONENT/ OPERATION 2	CHARACT-ERISTIC 3	TYPE OF CHECK 4	CLASSIF-ICATION 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENT 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	AGENCY (P)(W)(V) 10	REMARKS 11
1.0	**COMPONENTS** (Active and Passive)	Physical check, part nos., rating etc.	Visual	MA	100%	Mfr's drgs./ data sheets	As per mfr's drgs./data sheets	IQC Records	3 2 1	
2.0	**IN PROCESS INSPECTION**									
	i) Visual inspection of sub-assemblies/assemblies	Physical damage, workmanship, soldering, threads, clearances (movement of Plunger coil etc.), cleanliness etc	Visual, NPT gauge	MA	100%	Mfr's drgs. and approved spec.	Mfr's drgs. and approved spec.	IQC Records	3 2 1	
	ii) Completeness of Instrument	Conformity to assembly drawing	Visual	MA	100%	Approved mfr's drgs.	As per approved mfr's drgs.	IQC Records	3 2 1	

SL. NO. 1	COMPONENT/ OPERATION 2	CHARACT-ERISTIC 3	TYPE OF CHECK 4	CLASSIF-ICATION 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENT 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	AGENCY (P)(W)(V) 10	REMARKS 11
3.0	**FINAL INSPECTION OF ASSEMBLED TRANSDUCERS**									
3.1	**ROUTINE TESTS**									
		i)Visual	Physical damage, over all finish, threads, process connections, etc.	MA	100%	Specs. and approved mfr's drawings	As per specs. and approved mfr's drawings	IQC Records	3 2 1	
		ii)Completeness	Model, Tag nos. as per P.O., Accessries etc.	MA	100%	Specs. and approved mfr's drawings	As per specs. and approved mfr's drawings	IQC Records	3 2 1	
		iii) Functional	Insulation resistance	MA	100%	App'd. test procedure	As per app'd test procedure	Test Report	3 2 1	10% random check by NPC QA
			Input resistance	MA	100%			Test Report	3 2 1	---do---

SL. NO. 1	COMPONENT/ OPERATION 2	CHARACT-ERISTIC 3	TYPE OF CHECK 4	CLASSIF-ICATION 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENT 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	AGENCY (P)(W)(V) 10	REMARKS 11
		iv) Performance	5 point calibration, Repeatability, Linearity, Hysteresis, & Dead Band Measurement	MA	As per 5.3.3	App'd. test procedure	As per app'd test procedure	Test Report	3 2 1	10% random check by NPC QA
		v) Air supply pressure effect	Measurement	MA	100%	App'd. test procedure	As per app'd test procedure	Test Report	3 2 1	---do---
3.2	**TYPE TESTS**									
		i)Degree of Protection	Protection class	MA	One sample	Test procedure	As per app'd test procedure	Test Reports	3 2 1	
		ii) Vibration test a) Non-seismic b) Seismic	Shake table Shake table	MA MA	One sample ----do---	App'd. test procedure ----do----	As per app'd test procedure ----do---	Test Reports ----do---	3 2/1 1 3 2/1 1	
		iii) Ambient temp. effect	Measurement	MA	One sample	----do----	----do----	----do----	3 2 1	

SL. NO. 1	COMPONENT/ OPERATION 2	CHARACT-ERISTIC 3	TYPE OF CHECK 4	CLASSIF-ICATION 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENT 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	AGENCY (P)(W)(V) 10	REMARKS 11
		iv) Mounting inclinatio n effect	Measurement	MA	One Sample	App'd. test procedure	App'd. test procedure	Test Reports	3 2 1	
		v) Dry Heat Test	Measurement	MA	One Sample	IS-9000 or equivalent	App'd. test procedure	Test Reports	3 2/1 1	
		vi) Damp Heat Test	Measurement	MA	One Sample	----do-----	---do-----	Test Reports	---do-----	
		vii) Drift test (30 days)	Measurement	MA	One Sample	App'd test procedure	± 0.2% of FS beyond calibration Accuracy	Test Reports	2 2 1	
		viii) Frequency response test	Measurement	MA	One Sample	-----do-----	App'd. test procedure	Test Reports	3 2 1	

SL. NO. 1	COMPONENT/ OPERATION 2	CHARACT-ERISTIC 3	TYPE OF CHECK 4	CLASSIF-ICATION 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENT 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	AGENCY (P)(W)(V) 10	REMARKS 11
		ix) EMI/RFI	Measurement	MA	One Sample	App'd test procedure	App'd test procedure	Test Report	3 2 1	
4.0	**PACKING**		Visual	MA	100%	App'd procedure	App'd procedure	IQC Records	3 2 1	
5.0	**DOCUMENTATION**		Visual	MA	100%	App'd procedure	App'd procedure	IQC Records	3 2 1	

LEGEND :

P - Performed by
W - Witnessed by
V - Verified by
MA - Major

1. NPCIL
2. Prime Vendor
3. Sub-vendor/External Agency

NOTE

1. Test reports on the bought out components for all the NPCIL specified tests shall be obtained from the manufacturers and submitted for the verification of NPCIL.
2. All test reports, the certificates and inspection reports shall be reviewed by Prime Supplier/Sub-Vender/Manufacturer, before submitting the same to verification by purchaser.
3. History docket/End documents prepared by Prime Supplier/Sub-vendor shall be submitted to Purchaser's Representative for verification and checking for its completeness.
4. Calibrated instruments shall be used during inspection, examination & testing.
5. Quality surveillance carried out by purchaser's representative at any stage of manufacturing of product shall not absolve manufacturer of their responsibility to ensure quality neither shall it preclude subsequent rejection by purchaser.
6. Prime supplier/Sub-vendor shall establish and maintain documented quality system/documented procedures. They should address the following as a minimum in their documented Quality system/documented procedures.
   Control of manufacturing process, control of non-conforming product, corrective and preventive action, document control, control on purchasing, control on calibration of instruments, control on inspection & test and test status.
7. To verify the establishment and correct implementation of quality system of Prime supplier/Sub-vendor, NPCIL reserves the right to audit Prime supplier/Sub-vendor's quality system before or after execution of NPCIL jobs and carry out follow-up audit if any non-conformance observed during the audit.

ATTACHMENT - 19
INSTRUMENT SPECIFICATION FOR COPPER TUBES

INSTRUMENT SPECIFICATION FOR COPPER TUBES

1. Manufacturer : Bidder to Specify
2. Type : 80Ft., Annealed Copper, Seamless as per ASTM B 68M
3. Size (Mm) (1.2 mm Thk) :

Out Side Dia. In mm	Tolerance On OD In mm	Wall Thickness[In mm] And Tolerance
6	+0.1 -0	1.2 + 0.16 -0
10	+0.1 -0	1.2 + 0.16 -0
12	+0.1 -0	1.2+ 0.16 -0
20	+0.12 -0	1.5+ 0.20 -0
25	+012 -0	1.5+ 0.20 -0

4. Quantity (Meters) Bidders to specify
5. Fluid : Air /oil / water kg/ cm^2 (g]
6. Max. Pressure : 10 kg/cm^2 (g)
7. MAX. Temperature : up to 100°C
8. Hardness : ≤ Rockwell F50
9. Ovality Variation : < 0.7% of O.D.
10. Surface Finish : Better than 3.5 Microns for outer and inner surfaces
11. Mechanical Properties
    - 11.1 Tensile Strength : ≥ 2200 kg/Cm^2 (g)
    - 11.2 Yield Point : ≥ 650 kg/Cm^2 (g)
    - 11.3 Elongation % In 50 mm Gauge Length : ≥ 40%

12. Tests

12.1 Type Test

12.1.1	Hardness Test	:	On one test piece of each size and each batch as per ASTM-E-18
12.1.2	Expansion Test	:	On one sample piece of each size and each batch as per ASTM-B-153
12.1.3	Tensile Test	:	On one sample piece Of Each Size And Each Batch As Per ASTM-E-8M
12.1.4	Flattening And Doubling Over Test	:	On One sample piece Of Each Size And Each Batch As Per BS-2871 ASTM-E-255
12.1.5	Chemical Analysis	:	one sample of each batch as per ASTM-E-53 & ASTM-B-55M

12.2 Routine Test

12.2.1	Dimensional Test	:	Required to be done on 10% of the lot
12.2.2	Hydrostatic Test	:	at pressure of 60 kg/cm^2(g); for 10 min. Required to be done on each size each batch
12.2.3	Pneumatic Test	:	at a pressure 10 kg/cm^2 (g); for 10 min. Required to be done on each size each batch
12.2.4	Eddy Current Test	:	on 100% tube.

Note:* Bidder to State

1. Vendor shall submit detailed Quality Assurance Plan and test procedures for purchaser's approval. Manufacturing to start only after approval of these documents.

2. Vendor to provide all material test reports and other test certificates for purchaser's approval..

II **Format for Copper Tubing Inventory Data** (in MS Access format)

SL No.	Type And Size Of Tube	Quantity	Remarks
*	*	*	*
*	*	*	*
*	*	*	*

III Applicable Code & Standards

ASTM-E-8M		Standard test Method for tension testing of metallic materials[metric]
ASTM-E-18	-	Standard test method for Rockwell hardness and Rockwell Superficial hardness of metallic materials
ASTM-E-53	-	Method for chemical analysis of copper
ASTM-B-68M	-	Standard specification for seamless copper tube, bright Annealed [metric]
ASTM-B-153	-	Standard test method for expansion [pin test] Of copper and copper alloy pipe and tubing
ASTM-E-243	-	Standard practice for electro-magnetic [eddy current] examination Of copper and copper alloy tubes.
ASTM-B-251M	-	Standard specification for general requirement for wrought seamless Copper and alloy tubes [metric]
ASTM-E-255	-	Practice for sampling copper and copper alloy for determination of Chemical composition.
BS-2871	-	Copper and copper alloys tubes
EN-1057	-	Copper and copper alloy tubes

IV Sample Quality Assurance Plan.

Sl. No.	Component & Operation	Characteristic	Type of Check	Classification	Quantum of Check	Ref. Of Documents	Acceptance Norm	Format of Record	Agency			Remarks
									P	W	V	
1	2	3	4	5	6	7	8	9		10		11
1.0	RAW MATERIAL											
1.1	Material for body, nut & ferrules	Chemical Composition	Chemical Analysis	MA	Sample from each heat	Applicable Standards	Applicable Standards	Test Report	3, 4	2	1	To be done in NPC Approved Lab
2.0	IN PROCESS											
2.1	Inspection prior to every cold drawing/stage and after intermediate annealing	Visual, dimensional surface quality hardness etc.	In process inspection	MA	Sample from each heat	Plant standard	Plant standard	IQC Records	3	2	1	
3	Final inspection											
3.1	Chemical properties	Chemical composition	Chemical analysis	MA	Sample from each lot	As per NPCIL approved procedure	As per NPCIL approved procedure	Test report	3, 4	2	1	

Sl. No.	Component & Operation	Characteristic	Type of Check	Classification	Quantum of Check	Ref. Of Documents	Acceptance Norm	Format of Record	Agency			Remarks
									P	W	V	
1	2	3	4	5	6	7	8	9		10		11
3.2	Dimension check & surface finish	physical	dimensional	MA	10%	As per NPCIL approved procedure	As per NPCIL approved procedure	Test report	3	2	1	
3.3	Tensile test	Tensile strength	Mech. test	MA	Sample from each lot	As per NPCIL approved procedure	As per NPCIL approved procedure	Test report	3	2	1	
3.4	Expansion test	malleability	Mech. test	MA	Sample from each lot	As per NPCIL approved procedure	As per NPCIL approved procedure	Test report	3	2	1	
3.5	Flattening and doubling over test	mallenbility	Mech. test	MA	Sample from each lot	As per NPCIL approved procedure	As per NPCIL approved procedure	Test report	3	2	1	
3.6	Hardness test	Hardness	Hardness check	MA	Sample from each lot	As per NPCIL approved procedure	As per NPCIL approved procedure	Test report	4, 3	2	1	
3.7	Hydrostatic test	Mechanical integrity & strength	Pressure test	MA	100%	As per NPCIL approved procedure	As per NPCIL approved procedure	Test Report	4, 3	2	1	
3.8	Pneumatic test	Material integrity	Leak test	MA	100%[4 tubes sup			Test Report	4, 3	2	1	
3.9	Eddy current test	Material integrity	Non Destructive test	MA	100%	As per NPCIL approved procedure	As per NPCIL approved procedure		3	2	1	
3.10	Cleaning of tubes	cleanliness	physical	MA	100%	As per NPCIL approved procedure	As per NPCIL approved procedure		3	2	1	
3.11	Identification and packing	————	visual	minor	100%	As per NPCIL approved procedure	As per NPCIL approved procedure	Test Report	3	2	1	

Legend:

P - Performed by
W - Witnessed by
V - Verified by
MA - Major

1. NPC
2. Manufacturer
3. Third party
4. External Lab

ATTACHMENT -20

POSITION TRANSMITTER SPECIFICATION

Sr. No.	PROPERTIES		REQUIREMENTS
	GENERAL:		
1	Type	:	Position sensing magnetic (non contact type)
2	External Zero/Span Adj.	:	Required
3	Digital Display	:	Required in engineering units/%
4	ENVIRONMENTAL CONDITIONS:	:	As per Section C-1-1 (Project Requirements) of this tender document.
	PERFORMANCE RELATED PARAMETERS:		
5	Accuracy	:	Less than ± 0.5% of full scale
6	Hysteresis	:	Less than 0.2% of full span
7	Repeatability	:	Less than 0.5% of full span
8	Insulation resistance	:	More than 100 Meg Ohms at 100 V Dc after 1 minute
9	RFI effect	:	Not more than 0.1% of span from 20 to 1000 MHz and for field strength up to 30 V/m.
10	Total Response time (Time constant + Dead Time)	:	Not more than 200 milli-seconds
11	Ambient Temperature Effects	:	+/- 0.01%/ deg C of full span
12	Turn On time	:	Not more than 5 seconds after power is applied to the transmitter
13	Supply Voltage Effect	:	For ± 1V variation from reference supply
13a	Zero Shift	:	Les than ± 0.005% of calibrated span
13b	Span Shift	:	Les than ± 0.005% of calibrated span
14	Over Range Effect	:	Bidder to Specify
	OUTPUT:		
15	Output Signal	:	a) 4-20 mA DC output @ 600 Ohm Load
16	Output Load	:	Bidder to Specify
	ENCLOSURE:		
17	Enclosure	:	Flame proof IP:65 compliant
18	Transmitter Housing	:	Bidder to Specify
19	Mounting Arrangement	:	Bidder to Specify
	MATERIAL:		

20	Sensor assembly, accessory and fitment	:	SS 316
21	Mounting bracket	:	SS 316
22	Identification plate	:	SS 316

POWER SUPPLY:

23	Power Supply	:	Bidder to specify
24	Power Consumption	:	Bidder to Specify

DISPLAY REQUIREMENTS:

25	Display	:	Minimum Five Digit LCD Display+ Engineering unit Display
26	Failure mode alarm	:	If self-diagnostics detect a gross transmitter failure, the analog signal will be driven either below 3.2 mA or to 21.8 mA to alert the user.

TESTS

27 **ROUTINE TESTS**

A. Five Point Calibration Test
B. Insulation Resistance Test
C. Burn-In Test
D. Visual, Function and Performance Test

28 **TYPE TESTS**

A. Environment Test
B. EMI Test
C. Seismic Test (As applicable)
D. Enclosure test
E. Over Range Test
F. Non Seismic vibration test
E. Drift Test
F. Frequency response Test

29. DOCUMENTATION

Schedules of submission of various documents by the contractor are given below. All the documents shall be signed by the contractor.

Documents to be furnished by the Bidder Along With the Offer

All the documents listed below shall be furnished in triplicate along with the offer.

- Detailed technical literature on the offered transmitters indicating dimensions, material of construction, service conditions, tests carried out, installation procedures, applicable standards etc.
- List of in-house manufacturing facilities.
- List of in-house inspection and test facilities.
- Standard QA plan for manufacturing of transmitter indicating incoming, in-process and final inspection and testing.
- QA manual of the company
- Reference list of customers to whom similar products have been supplied, indicating quantities supplied, purchase order reference, order value, scheduled delivery dates, and actual dates of supply.
- List of suppliers/sub-vendors of raw material and inspection/testing agencies for execution of this order.
- Point wise confirmation on each clause of this specification explaining how the requirements are being met.
- Copies of the test reports, if the offered electro-pneumatic transducers have earlier undergone various tests mentioned in this specification.

Documents required to be Furnished Immediately after Placement of Purchase Order

Immediately after placement of purchase order, 3 copies of following documents shall be submitted for the purchaser's review and approval. Contractor shall commence manufacturing/testing of the electro-pneumatic transducers only after specific approval of the relevant documents by the purchaser.

- General arrangement drawing (with the detailed bill of material) of transmitter indicating overall dimensions, component/sub- assembly dimensions and tolerances, material of construction of each component, finish etc.
- A detailed QA plan indicating incoming, in-process and final inspection and tests.
- Detailed procedure for all the inspection and tests to be carried out on the transmitter

Documents required to be furnished along with the supply

- Five copies of all as-built drawings along with their re-producible.
- 6 copies of operation and maintenance manual giving functional description, descriptive and illustrative literatures of all the components/ sub-assemblies, installation procedure etc. Six numbers of soft copies of the same shall also be supplied in the form of CD/DVD/Pen drive.
- Six copies of history Dockets including all test reports/certificates. It also preferred to provide these documents in soft form along with the hard copies.

In addition to the above, the manufacturer shall supply in triplicate, certificate of compliance stating that the material supplied is in accordance with all the provisions of this specification

30 GUARANTEE

All the electro-pneumatic transducers shall be guaranteed by the Supplier for the period mentioned in general conditions of the contract. During this period, any preventive & breakdown maintenance required/necessary shall be done by the Supplier. All faulty items shall be replaced free of cost at site by the Supplier.

NOTES:

1. * - Bidder to specify, subjected to NPCIL's approval.
2. Bidder to submit detailed fabrication drawing, quality assurance plan and test procedure for purchaser's approval.
3. Contractor to provide all material & test certificates for purchser's/consultant's review & records.
4. All required hardware and mounting accessories shall be supplied by the bidder.

FORMAT FOR SUBMITTING TRANSMITTER INVENTORY DATA (in MS Access format)

Sr. No:	Tag No:	Process Fluid	Element Material	Body material	Calibration Range	Instrument Range	Accuracy	Repeatability	Cable Entry	Seismic Test	Mounting Accessories	Manufacturer	Model No.	P.O. NO:	Remarks
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

NUCLEAR POWER CORPORATION OF INDIA LIMITED	
700 MWe KAIGA ATOMIC POWER PROJECT -UNIT 5&6 TECHNICAL SPECIFICATION FOR ASDV	PAGE NO.: PAGE 120 OF 141 REV NO.: 00 DATE : 15/05/2024

SL. NO. 1	COMPONENT/ OPERATION 2	CHARACTERISTIC 3	TYPE OF CHECK 4	CLASSIFICATION 5	QUANTM OF CHECK 6	REFERENE DOCUMENT 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	AGENCY (P)(W)(V) 10	REMARKS 11
1.0	**COMPONENTS**									
1.1	Indigenous components like transistors, resistors, capacitors, inductors, potentiometers, fuses, switches, Terminal blocks, PCBs and connectors etc.	i) Acceptance tests	Physical and Electrical	major	Sample as per relevant JS Specs.	Relevant JSS	As per relevant JSS	Internal quality control (IQC) Record	3 2 1	Where appropriate JSS is not available equivalent standard to be used.
		ii)Marking & rating	Visual	major	100%	Mfr's drgs./ data sheet	As per Mfr's dwgs./data sheets	IQC Record	3 2 1	
1.2	Imported components like IC, and other semiconductor devices.	i)Acceptance tests	Physical and Electrical	major	As per relevant MIL/BS or equivalent Standards	Relevant Standards	As per relevant standards	IQC Records	3 2 1	
		ii)Marking & rating	Visual	major	100%	Mfr's drgs./ data sheet	As per Mfr's dwgs./data sheets	IQC Records	3 2 1	
1.3	Pressure Die-cast Items	i)Visual	Physical damage	major	100%	Approved manufacturer's drgs.	As per approved manufacturer's drgs.	IQC Records	3 2 1	
		ii) Dimensional	Measurement	major	IL:S3/ AQL:1			IQC Records	3 2 1	
		iii) Material	Physical & Chemical Composition	major	Sample (one per lot)			Lab. report	3 2 1	

1.4	Forged items	i)Visual	Physical damage	major	100%	Approved manufacturer's drgs	As per approved manufacturer's drgs	IQC Records	3 2 1	
		ii)Dimensional	Measurement	major	IL:S3/ AQL:1	---do--	---do---	---do---	3 2 1	
		iii) Material	Physical & Chemical Composition	major	Sample (one per lot)	---do---	---do---	Lab report	3/2 2 1	
		iv) NDT	Radiograph	major	10%	ASTM-E-446	As per approved procedure	Lab report	3/2 2 1	
		v) DP Test	Surface defects	major	100%	ASTM-E-165	---do---	Test report	3 2 1	
1.5	Sensor Assembly	Visual	Physical damage	major	100%	Approved manufacturer's drgs.	As per approved manufacturer's drgs	IQC Records	3 2 1	
1.6	Hardware and Accessories- U Bolt, 'O' ring, HT Bolt, HT Nut etc.	i)Visual	Physical damage	major	100%	Approved manufacturer's drgs.	As per approved manufacturer's drgs	IQC Records	3 2 1	
		ii)Dimensional	Measurement	major	IL:S2/ AQL:1	Approved manufacturer's drgs.	As per approved manufacturer's drgs	IQC Records	3 2 1	
		iii) Material	Physical & Chemical composition (for SS hardware only)	major	Sample (one per lot)	---do---	---do---	---do---	3 2 1	
2.0	**IN-PROCESS INSPECTION**									
2.1	PCB assembly/ sub-assembly	i)Visual	Correctness of	major	100%	Approved manufacturer's	As per approved	IQC Records	3 2 1	

			components, mounting, orientation, quality of soldering etc.			drgs.	manufacturer's drgs			
		ii)functional	Electrical parameters & functional checks	major	100%	As per relevant Mfrs. Drgs./ specs.		IQC Records	3 2 1	
2.2	Connector assembly	i)Visual	Physical damage	major	100%	As per approved drawings. ---do---	As per approved drawings ---do---	IQC Records ---do---	3 2 1	
		ii)Dimensional	Measurement	major	100%				3 2 1	
3.0	**FINAL INSPECTION OF ASSEMBLED TRANSMITTERS**									
3.1	ROUTINE AND ACCEPTANCE TESTS									
		i)Visual	Physical damage, over -all finish, threads, adaptors, process connections etc.	major	100%	Specs. & approved mfr's' drawings	As per specs. & approved mfr's drawings	IQC Records	3 1 1	
		ii)Completeness	Model, Tag nos. as per P.O., accessories etc.	major	100%	---do---	---do---	---do---	3 1 1	

		iii)Functional	Insulation resistance	major	100%	As per approved test procedure	As per approved procedure	Test Reports	3 1 1	10% check by NPC QA
			Repeatability	major	100%	As per approved test procedure	---do---	---do---	3 1 1	---do---
			Linearity, Hysteresis, 5 point calibration	major	100%	As per approved test procedure	---do---	Test Reports	3 1 1	10% check by NPC QA.
3.2	TYPE TESTS									
		i)Seismic test	Seismic with stand capability	major	One Tx	PB-P-541 & Approved test Procedure	Approved test Procedure	Test Report	3 2/1 1	
		ii) EMI/RFI	Measurement	major	One Tx.	Approved test procedure & IEC-801-3	Within ± 0.05% of URL	---do---	3/2 2 1	
		iii)Environmental effect a)Dry heat b)Damp heat	Measurement	major	Two Tx.	PC-E-144 & approved test procedure	PC-E-144 & Approved test procedure	Test Report	3/2 2/1 1	
		iv)Over-range test	Measurement	major	One Tx.	Approved test procedure	PC-E-144 & approved test procedure	Test Report	3 1 1	
3.3	PACKING		Visual	major	100%	Approved procedure	As per approved procedure	IQC Records	3 2 1	

ATTACHMENT - 21
TECHNICAL SPECIFICATION FOR FILTER PRESSURE REGULATOR

TECHNICAL SPECIFICATION FOR FILTER PRESSURE REGULATOR

1.	Type	:	Diaphragm relieving
2.	Leakage	:	Up to 5 cc/min
3.	Filter integral with regulator unit	:	≤5 Microns
4.	Bowl capacity	:	min 75 cc
5.	Bowl material	:	Die cast aluminum, IP-65
6.	Fluid	:	Instrument Air
7.	Adjusting Screw	:	Required
8.	Drain	:	Manual
9.	Regulation & Flow characteristics (Performance)	:	Refer Note given below
10.	Over Range Protection	:	150 % of Inlet Pressure
11.	Colour	:	Manufacturer std., Epoxy Finish
12.	Mounting Brackets	:	Required, suitable for wall/instrument rack/valve body/ 50 NB pipe mounting.
13.	Regulating Valve Body	:	Brass bar stock as per IS-319/Die cast Aluminum
14	End Connection	:	Bidder to specify
15.	a) Diaphragm Material	:	Metal/EPDM (metallic diaphragm preferred)
15	b) O-ring material	:	EPDM if any other material is used, it is subject to approval of NPCIL
15	c) Gasket	:	EPDM/PEEK
16	Instrument Valve	:	SS 316
17.	Spring Material	:	SS 316/ Spring steel

18.	Inner Valve Material	:	SS 316
19.	Trim Material	:	SS 316
20.	Maximum Temperature	:	65° C
21.	Design Pressure	:	11 kg/cm^2(g)
22.	Max. Pressure	:	8.3 kg/cm^2(g)
23.	Normal Pressure	:	7.0 kg/cm^2(g)
24	Output Pressure Range	:	Bidder to specify
25	Test on Filter Pressure Regulator	:	
25.1	Routine Test	:	a) Dimensional & Material Test b) Air Leak test c) End Connection test d) Functional test e) Flow Characteristic test f) Regulation Characteristic Test
25.2	Type tests	:	a) Seismic Qualification Test b) Steam Bound Test

Note:

1 **Flow Characteristics**

1.1 Regulators with outlet pressure range of 0.5 - 2.5 kg/cm^2 (g).
For an inlet pressure of 7 kg/cm^2(g), with the outlet pressure set at 2.1 kg/cm^2(g) for zero flow, the actual outlet pressure shall not drop by more than 10% of the set point when the air flow increases to 180 standard liter per minute (slpm).

1.2 Regulators with outlet pressure range of 2.0-4.5 kg/cm2 (g).
For an inlet pressure of 7 kg/cm^2(g), with the outlet pressure set at 4.2 kg/cm^2(g) for zero flow, the actual outlet pressure shall not drop by more than 10% of the set point when the air flow increases to 200 slpm.

1.3 Regulators with outlet pressure range of 4.0-6.5 kg/cm2 (g).
For an inlet pressure of 7 kg/cm^2 (g) with the outlet pressure set at 6 kg/cm^2 (g) for a zero flow, the actual outlet pressure shall not drop by more than 10% of the set point when air flow increases to 280 slpm in the case of 1/4" size regulators and 1120 slpm in the case of 1/2" size regulators.

2 **Regulation Characteristics**

2.1 Regulation Characteristics for outlet pressure 0.5 to 6.5 Kg/cm^2:
For an air flow of 14 slpm and an inlet pressure of 7 kg/cm^2 (g), the outlet pressure shall not vary more than $\pm$ 1% from the set point for an inlet pressure variation of $\pm$ 10%.

II PRESSURE GAUGE OF PRV

26.	Type	:	Direct Sensing
27.	Pressure Element	:	Bourdon
28.	Gauge Pressure Element	:	SS 316L
29.	Gauge Accuracy	:	± 2% of span or better
30.	Gauge Repeatability	:	0.5% of span
31.	Gauge Dial Size	:	63 mm
32.	Scale Length	:	270°
33.	Scale Range	:	As Required
34.	Gauge Colour Dial/Numerals	:	White / Black
35.	Pointer assembly	:	Bidder to be specify
36.	Over rang protection	:	130% of max. pressure
37.	Blow out disc	:	Required
38.	Zero adjustment	:	Bidder to be specify
39.	Gauge Movement Material	:	SS 304/Brass as per IS : 319
40.	Case	:	SS 304, IP-65
41.	Connection	:	¼" NPT (M), Back entry
42.	Packing material	:	EPDM / PEEK
43.	Gauge Glass	:	Shatter Proof borosilicate
44.	Bezel ring	:	Pressed steel, screwed with weather proof gasket
45.	Paint finish	:	Weather proof stove enameled

46.	Test on Pressure gauge	:	
46.1	Routine Tests:	:	a) End connection, Dimension check and material test b) Five point calibration test before & after over range test c) Accuracy & repeatability d) Over range performance test e) Air leak test f) Hydrostatic Test
46.2	Type Tests:	:	a) Enclosure class b) Seismic Test c) Pressure cycling Test

Notes:

1. Bidder shall submit Detailed Quality assurance plan, drawing etc. for NPCIL's review/approval and manufacturing of PRVs can be started only after the approval of all these documents.
2. Packing for all these PRVs shall be suitable for long term storage.

FORMAT FOR SUBMISSION OF DATA:

Vendor has to submitted Instrument data as per the below given format (in MS Access format)

Sr. No.	Unit	Util	Instrument Type	Tag Serial No.	Associated Equipment no.	Building	Floor	Grid/Room No.	Outlet Press. Range (kg/cm2(g))	Pressure Gauge scale Range (kg/cm2(g))	Mounting Type (2" pipe/ Panel/Plate)	Mounting ISS/Panel No.	Process End connection	Seismic Test (YES/NO)	Radiation Qualification Test (YES/NO)	DBE Qualification Test (OBE/NO)#	Purchase Order No.	Manufacturer	Model No.	Reference P&ID /PID No.	Package	Revision No.	NPCIL Engineer	Remarks

* Refer to specify
# OBE- test is applicable for MSLB Accessible Area

SAMPLE QUALITY ASSURANCE PLAN

Sr. No	Component & Operation	Characteristic	Type of Check	Classification	Quantum of Check	Ref. of Documents	Acceptance Norm	Format of Record	Agency			Remarks
									P	W	V	
1	2	3	4	5	6	7	8	9		10		11
A	RAW MATERIAL											
	Casting & Forging	(a)Chem. Comp.	Chemical Analysis	Major	1 no. Per Heat	Applicable Standard		Test Certificates	3	2	1	NOTE -9
		(b)Physical Properties	Tensile Strength	Major	1 no. Per Heat	--do--		Test Report	3	2,1	1	NOTE -9
	Bar Stocks	(a)Chem. Comp.	Chemical Analysis	Major	1 no. Per Heat.	Applicable Standard		Test Certificates	3	2	1	NOTE -9
		(b)Physical Test	Tensile Strength	Major	1 no. Per Heat	--do--		Test Report	3	2,1	1	NOTE -9
	Spring	(a)Chem. Comp.	Chemical Analysis	Major	1 no. Per Heat.	Applicable Standard		Test Certificates	3	2	1	
		(b)Physical Test	Tensile Strength	Major	1 no. Per Heat	-do-		Test Report	3	2,1	1	
	Diaphragm	Chem. Comp.	Chemical Analysis	Major	1 no. Per Heat.	As per Approved Drg. and relevant standards		Report	3	2	1	
	Filter	Porosity		Major	100%	As per Approved Drg. and relevant standards		Test Report	3	2,1	1	10% Witness by 2,1 & 100% Verified by 1
B	Finished Product	Dimension & thread check	Measurement & thread gauge	Major	100 %	As per Approved Drg.		Test Report	3	2,1	1	10% Witness by 2,1 & 100% Verified by 1
		Air Leak Test	Leakage	Major	100%	As per Approved Drg. and relevant standards.		Test Report	3	2,1	1	10% Witness by 2,1 & 100% Verified by 1
		Functional Test	Regulation Test	Major	100%	As per Approved Drg. and relevant standards		Test Report	3	2,1	1	10% Witness by 2,1 & 100% Verified by 1
		Seismic Test	Measurement Test	Major	One Sample of each type	As per Approved Drg. and relevant standards		Test Report	3	2,1	1	
C	Finished Product	Painting & Finish	Visual	Major	100%	Approved Procedure		Report	3	2	1	
		Name plate & packing	Visual	Major	100%	Visual		Report	3	2	1	

D	Documentation	Records, Reports, History Docket, CD/ DVD containing soft copy	Visual	Major	100%	As per Approved Drg. and relevant standards	Documentation and CD/DVD	3	2	1	

LEGEND:

P- Performed by
W- Witnessed by
V- Verified by

1. Purchaser
2. Prime Supplier
3. Sub-Vender/External laboratory

MI-Minor
MA-Major

*: Random Check by NPCIL QA

NOTE:

1. Test reports on the bought out components for all the NPCIL specified tests shall be obtained from the manufacturers and submitted for the verification of NPCIL.
2. The purpose of QAP is to streamline NPCIL Quality Surveillance activities and identifying CHP on un-ambiguous terms.
3. All test reports, the certificates and inspection reports shall be reviewed by Prime Supplier/Sub-Vender/Manufacturer, before submitting the same to verification by purchaser.
4. History docket/End documents prepared by Prime Supplier/Sub-vendor shall be submitted to Purchaser's Representative for verification and checking for its completeness.
5. Calibrated instruments shall be used during inspection, examination & testing.
6. Quality surveillance carried out by purchaser's representative at any stage of manufacturing of product shall not absolve manufacturer of their responsibility to ensure quality neither shall it preclude subsequent rejection by purchaser.
7. Prime supplier/Sub-vendor shall establish and maintain documented quality system/documented procedures. They should address the following as a minimum in their documented Quality system/documented procedures. Control of manufacturing process, control of non-conforming product, corrective and preventive action, document control, control on purchasing, control on calibration of instruments, control on inspection & test and test status.
8. To verify the establishment and correct implementation of quality system of Prime supplier/Sub-vendor, NPCIL reserves the right to audit Prime supplier/Sub-vendor's quality system before or after execution of NPCIL jobs and carry out follow-up audit if any non-conformance observed during the audit.
9. Chemical and Physical tests shall be performed in NPCIL approved laboratories.

ATTACHMENT - 22
SPECIFICATION FOR BRASS SOLENOID VALVE

SPECIFICATION FOR BRASS SOLENOID VALVE

I. SOLENOID VALVES

1.	Type:	:Internal pilot operated, Single coil
2.	Service	: Compressed air/ Any other gas used in the plant
3.	Operating Pressure	: As per requirement
4.	Operating Temperature	: 15 to 65 Deg C
5.	Electric Supply	: 24 V DC with variation +15% and -20%
6.	Solenoid rating	: Continuous
7.	Insulation Class	: Class H as per IS:1271 /IEC:60317
8.	Insulation Resistance	: Greater than or equal to 100 mega ohms at 500 V DC
9.	Pickup Voltage	: Not more than 70% of nominal supply voltage
10.	Dropout Voltage	: 10 to 50 % of nominal supply voltage
11.	Hold in current	: Bidder to specify
12.	Guiding	: Top
13.	Bonnet Type	: Bidder to specify
14.	No. of Ports	: 2 way/3 way/4 way
15.	Orifice size	: Bidder to specify
16.	Operating Speed	: < 0.1 second
17.	Coil Temperature rise	: < 70 Degrees C
18.	Power rating	: Bidder to specify
19.	Power consumption	: Preferably 8W (not to exceed 11W)
20.	Operating Speed	: < 0.1 second
21.	Coil Enclosure	: IP 67 as per IS-12063/IEC-60529
22.	Enclosure colour	: Bidder to specify
23.	Terminal box	: IP 67 as per IS-12063/IEC-60529
24.	Coil Material	: Enameled Copper wire with epoxy moulded
25.	Seat Material	: EPDM / PEEK
26.	Stem Material	: Sandvik SA1802 or equivalent
27.	Plug Material	: Sandvik SA1802 or equivalent
28.	Body Material	: Brass ASTM B16
29.	Gasket / O Ring material	: Viton
30.	Conduit Size	: $^1/_2$" NPT(F)
31.	Process Connection	: Bidder to specify
32.	Reset Action	: Automatic
33.	Gland	: $^1/_2$"

34. Test : Routine Test

a. End connection check
b. Dimensional & Material Check
c. Hydrostatic body leak check
d. Air seat leak test
e. Insulation resistance test
f. High voltage test
g. Power consumption test
h. Coil pickup & dropout test
i. Coil temperature rise test
j. Speed of Response Test

Type Test

a. Life test
b. Environmental test
c. Gland leak test
d. Seismic Qualification Test (wherever required. Mandatory for class-2 and safety related systems)
e. Radiation Qualification Test
f. Accelerated Aging Test

Notes:

1. Bidder shall submit detailed quality assurance plan, drawing etc. for NPCIL's review/approval and manufacturing of solenoid valves can be started only after the approval of all these documents.
2. Bidder shall submit detailed test procedure, for the above mention tests, for NPCIL's approval. Test shall be conducted only after written approval of test procedure by NPCIL.
3. Packing for all these solenoid valve shall be suitable for long term storage.
4. Solenoid coils shall be terminated in a terminal box with screwless terminals. Terminal box shall be rigidly connected to the solenoid coil enclosure with nipple.

II. APPLICABLE STANDARDS

1. IS – 12063: Classification of degree of protection provided by enclosure of electrical equipment.
2. IS – 8935: Specification of electrical solenoid operated actuator.
3. IS – 2071: Section 5.5 for High voltage test.
4. IS – 9000: Basic environment testing procedure for electronic and electrical equipments. (Part III Sec. 5, Part V Sec 2).
5. IEC – 60529: Applies to the classification of degree of protection provided against intrusion, dust, accidental contact and water by mechanical casings and electrical enclosures.
6. IS – 13730 / IEC – 60317: Specifies requirement of enameled round copper winding wire of class 200 with dual coating.
7. ASTM B16: Specification for free-cutting brass rod, bar and shapes.

FORMAT FOR SUBMISSION OF DATA:

Vendor has to submitted Instrument data as per the below given format (in MS Access format)

Sr. No.	Unit	[illegible]	Instrument Type	Tag Serial No.	Associated Equipment	Building	Floor	[illegible] No.	[illegible] Type	Mounting Type	Mounting [illegible] Panel No.	Process End Connection	[illegible]	[illegible]	[illegible]	[illegible]	Seismic Test	[illegible] Qualification Test	Purchase Order No.	Manufacturer	Model No.	Reference [illegible] No.	Package	Revision No.	[illegible] Engineer	Remarks

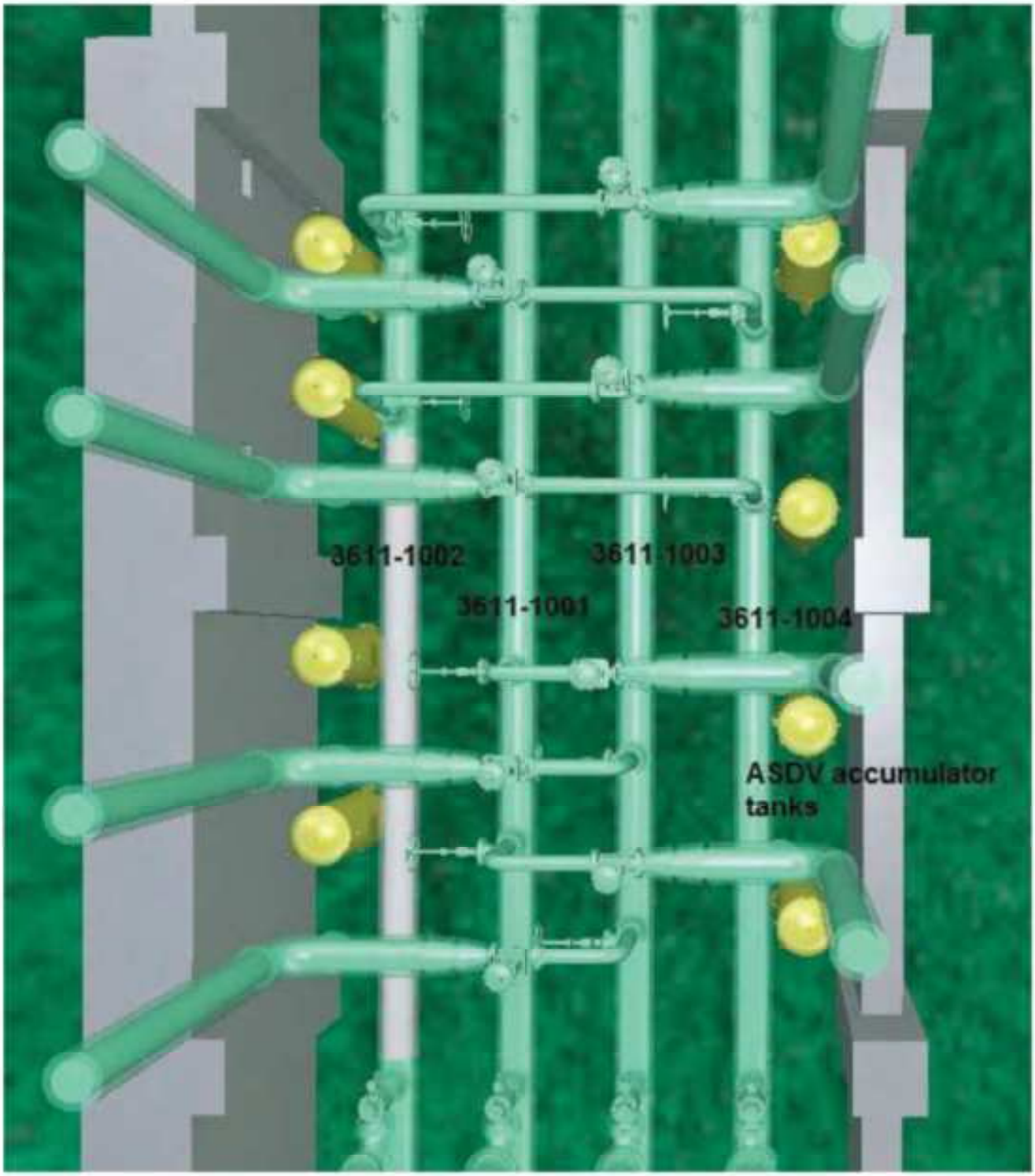
SAMPLE QUALITY ASSURANCE PLAN

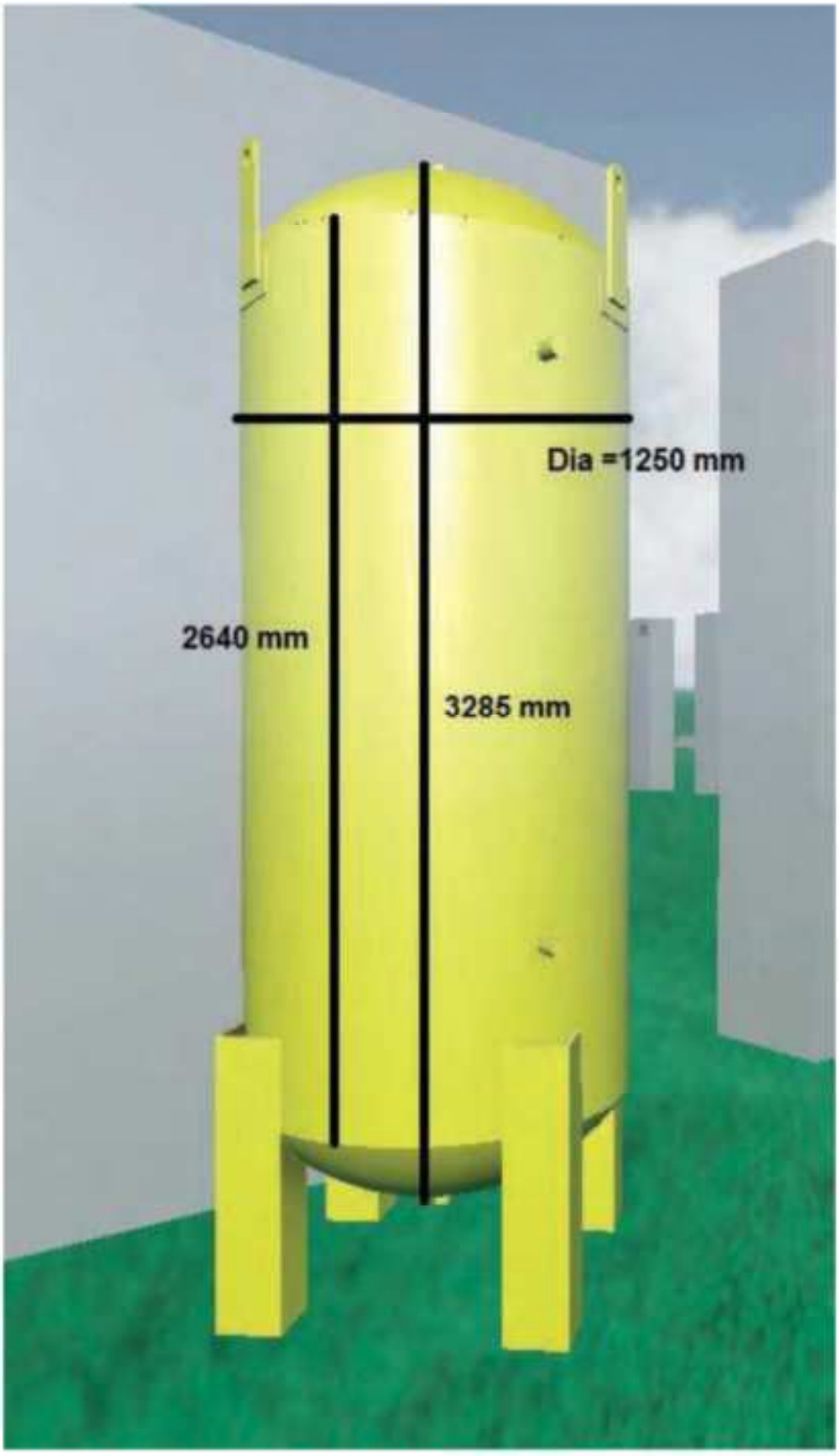
SI NO.	COMPONENT	CHARACTERISTIC		TYPE OF CHECK	CLASSIFICATION	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORM OF RECORDS	AGENCY			REMARKS
										P	W	V	
1.	BODY PARTS & RAW MATERIAL	1	Chemical composition	Analysis/ Test	Major	One sample per heat	RELEVANT ASTM STD		Product analysis report	3	2	1	To be done in NPCIL approved Lab
		2	Physical Properties	Mechanical testing	Major	One sample per heat	RELEVANT ASTM STD		Test certificate	3	2/1	1	
		3	Visual examination	Visual for any visible defects	Major	100%	RELEVANT ASTM STD		Internal Quality control Report	3	2/1	1	
2	Finished Mechanical Parts	1	Dimension and end connection	Dimension inspection	Critical	100%	NPCIL approved drawings		Inspection report	3	2/1	1	Random check by NPCIL
3	COIL	1	Wire Size	Size test	Major	Sample as per IS 8935	Manufacturer data sheet		Test Report	3	2/3	1	
		2	Coil insulation	Coil insulation test	Critical	100%	NPCIL Spec (test as per IS 8935)		Test Report	3	2/1	1	Random check by NPCIL QA
		3	Coil material	Mill testing	Major	One sample per heat	RELEVANT ASTM STD		Test certificate	3	2/1	1	-
		4	Heat dissipation capability	Coil temperature rise test	Major	Sample as per IS 8935	Approved test procedure		Test Report	3	2/1	1	-
		5	Coil pick up & drop out voltage	-	Major	Sample as per IS 8935	Approved test procedure		Test Report	3	2/1	1	Random check by NPCIL QA
4	Finished Product	1	Body Leakage	Shell hydrostatic test	Critical	Sample as per IS 8935	Approved test procedure		Test Report	3	2/1	1	Random check by NPCIL QA
		2	Seat Leakage test	Valve closure test	Critical	Sample as per IS 8935	Approved test procedure		Test Report	3	2/1	1	Random check by

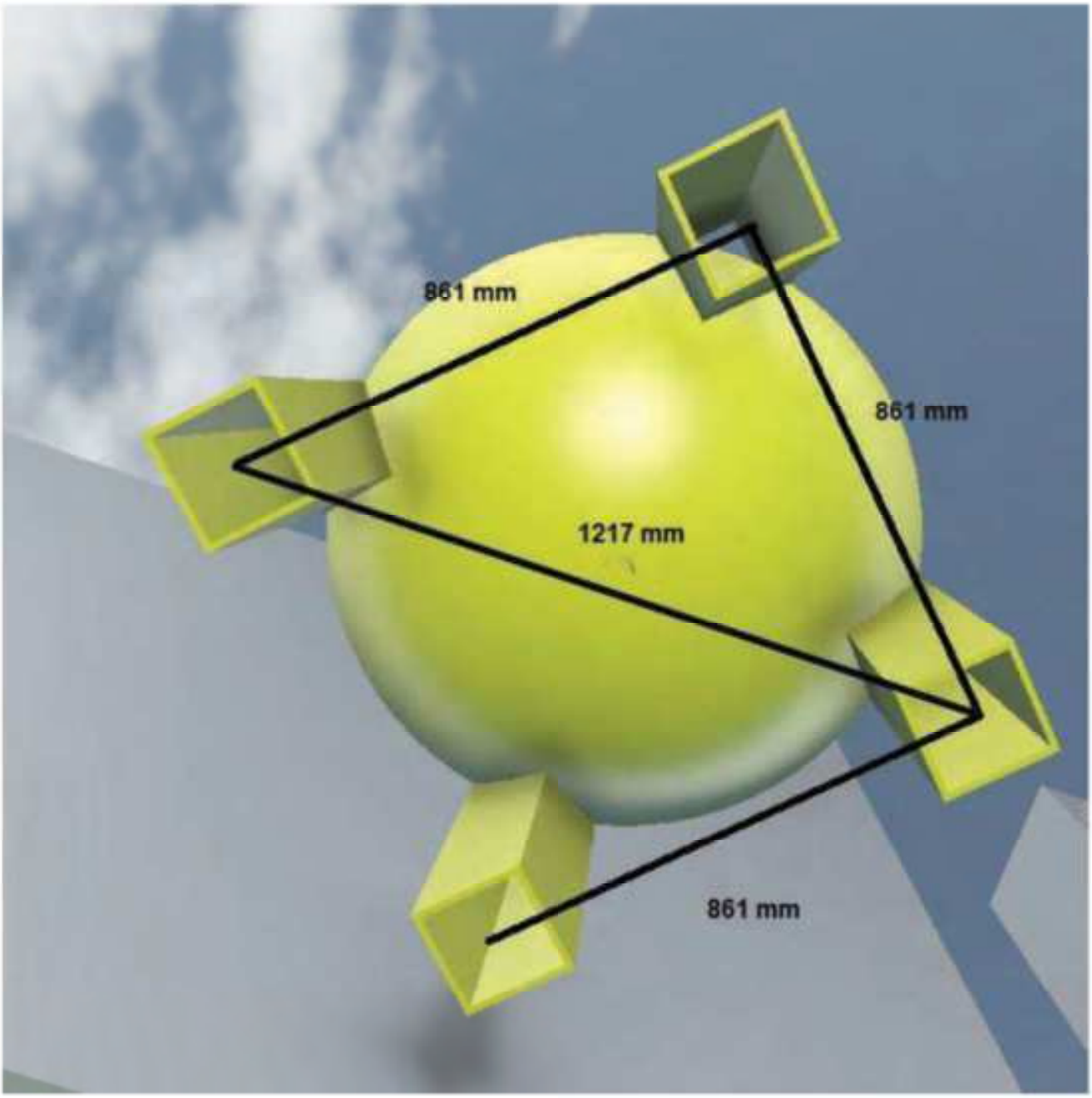
												NPCIL QA
		3	Stem material certificate	Major	100%	RELEVANT ASTM STD	-	Test certificate	3	2	1	-
		4	Power Consumption	D.C. Resistance & steady state current	Major	Sample as per IS 8935	Approved test procedure	Test Report	3	2/1	1	
		5	Normal Operation of Valve	Major	100%	NPCIL Spec.& approved test procedure	Approved test procedure	Test Report	3	2/1	1	
		6	Flow capacity of Valve	Major	Sample as per IS:8935	NPCIL Spec.& approved test procedure	Approved test procedure	Test Report	3	2/1	1	
		7	Insulation Resistance Test	Critical	Sample as per IS:8935	NPCIL Spec.& approved test procedure	Approved test procedure	Test Report	3	2/1	1	
		8	High Voltage Test (Insulation Integrity)	Major	Sample as per IS:8935	NPCIL Spec.& approved test procedure	Approved test procedure	Test Report	3	2/1	1	
		9	Coil Temperature Rise Test (Heat dissipation capability)	Major	Sample as per IS:8935	NPCIL Spec.& approved test procedure	Approved test procedure	Test Report	3	2/1	1	
		10	Speed of response	Major	Sample as per IS:8935	NPCIL Spec.& approved test procedure	Approved test procedure	Test Report	3	2/1	1	
		11	D.C. resistance and steady state current	Major	Sample as per IS:8935	NPCIL Spec.& approved test procedure	Approved test procedure	Test Report	3	2/1	1	
5	Type test											
		1	Life test	Mechanical testing	Major	One sample	Approved test procedure	Test Report	3	1	1	Random check by NPCIL QA
		2	Environmental Test	Measurement	Major	One sample	Approved test procedure	Test Report	3	1	1	
6	Final packing	1	Final packing	Visual	Major	100%	Approved test procedure	Test Report	3	1	1	
7	Documentation	1	Documentation	Visual	Major	100%	NPCIL specification	-			1	

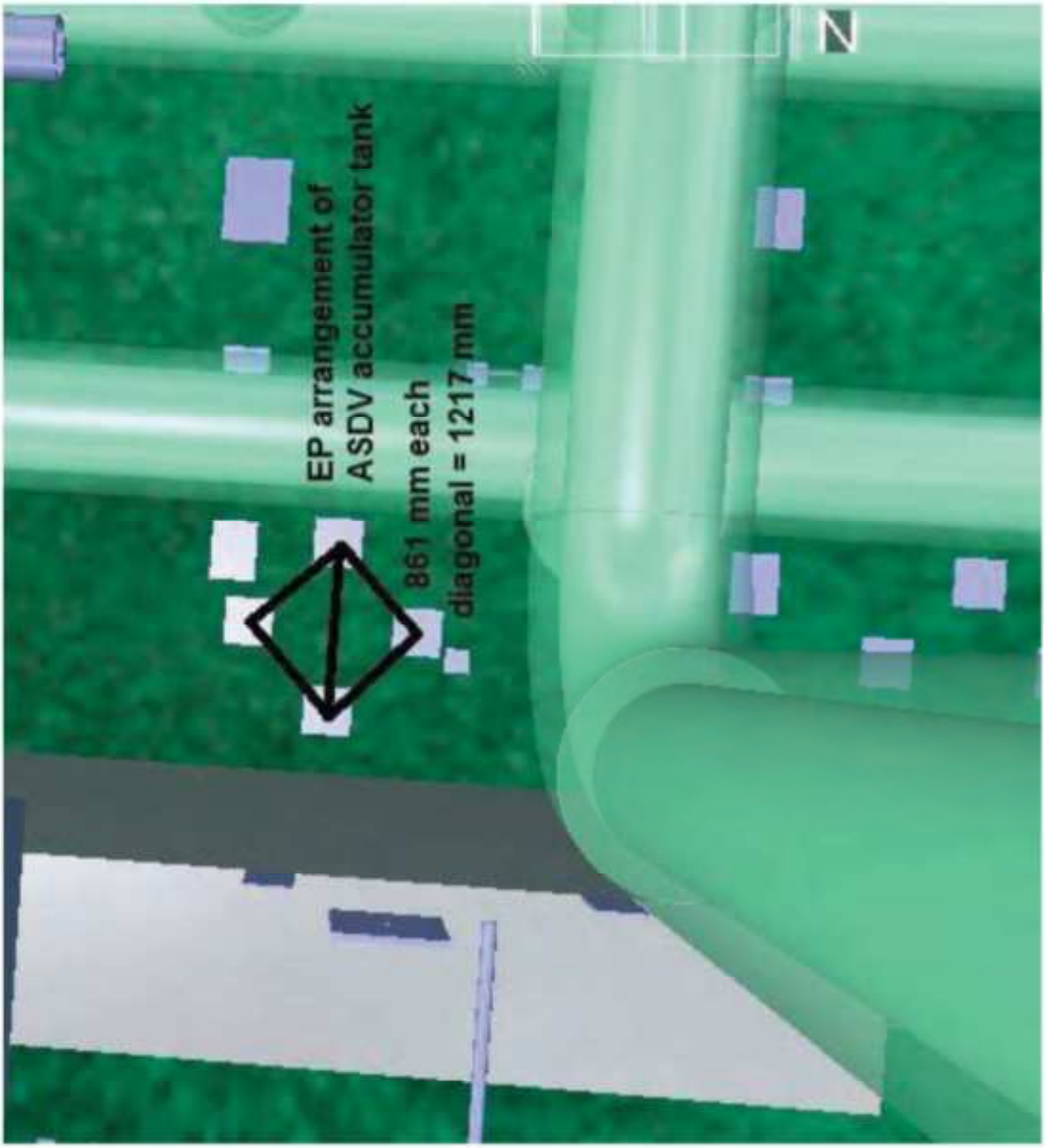
Legend:	
P	Performed by
W	Witnessed By
C	Certified By
1	NPCIL
2	Bidder
3	Sub Bidder /NPCIL approved Test Lab

ATTACHMENT - 23









NUCLEAR POWER CORPORATION OF INDIA LTD.
(A Government of India Enterprise)
CHECKLIST & RECOMMENDATION FOR EVALUATION OF VENDORS

Tender No	:	CMM/ETM/00/40/11/0005
Item/Package	:	ATMOSPHERIC STEAM DISCHARGE VALVE (ASDV) ALONG WITH SPARES & MANDATORY SPARES
Name of Main Contractor	:	BHEL
Address and contact details of Main Contractor	:	Heavy Electrical Plant, BHEL Bhopal, MP-462022,
Name of Sub-contractor/Vendor	:	To be filled by vendor
Address of Sub-contractor	:	To be filled by vendor
Items for which approval is sought	:	To be filled by vendor

1.0 General:

1.1)	Key Personnel contacted	:	To be filled by vendor
	a) Senior Management	:	To be filled by vendor
	b) Quality Co-ordinator	:	To be filled by vendor
	c) Others (Production, Planning etc.)	:	To be filled by vendor

FOLLOWING ARE TO BE COMMENTED

1.2)	Recognition details if any code Stamps like U1, U2, ASME N, NPI or certification Like ISO 9001, 14000 etc. (Verify the records)	:	To be filled by vendor
1.3)	Floor space availability for present Activities/for future expansion	:	To be filled by vendor
	a) Indoor	:	To be filled by vendor
	b) Outdoor	:	To be filled by vendor
1.4)	Level of House keeping	:	To be filled by vendor

1.5)	Whether NPCIL jobs executed earlier	:	To be filled by vendor along with credentials
1.6)	Delivery Performance (Schedule vs Actual) (Verify records)	:	To be filled by vendor
2.0	**Technical**		
2.1)	Quality Control		
	(a) Incoming Material Inspection	:	Yes/No
	(b) Process Inspection	:	Yes/No
	(c) Final Inspection	:	Yes/No
2.2)	Plant & Machinery	:	To be filled by vendor with credentials
	(a) General condition & Age	:	
	(b)Confirms to the details submitted in application	:	
2.3)	Calibration facilities	:	To be filled by vendor with credentials
2.4)	Calibration records	:	To be filled by vendor with credentials
2.5)	NDE Qualification records	:	To be filled by vendor with credentials
2.6)	Is there a system of selecting/ short listing Sub-vendors?	:	To be filled by vendor
2.7)	Availability of Testing facilities	:	To be filled by vendor with credentials)
2.8)	Whether working of following are satisfactory?		
	(a) Production	:	To be filled by vendor
	(b) Quality control :	:	To be filled by vendor
2.9)	Understanding of scope of work	:	To be filled by vendor
2.9.1)	Understanding of technical requirement of Job	:	To be filled by vendor

2.10)	Availability and understanding of related standards.	:	To be filled by vendor
2.11)	Capacity of the Vendor to fabricate and inspect	:	To be filled by vendor
2.12)	Understanding of special Examination/ Testing (like ultrasonic Examination/ Helium Leak testing, Optical alignment testing etc.)	:	To be filled by vendor
2.13)	Availability of special facilities	:	To be filled by vendor with credentials
2.14)	Facilities/Machineries/testing equipment available in the shop floor to meet technical requirement of the job	:	To be filled by vendor with credentials
2.15)	Qualified and experience Manpower in the shop floor to execute the specified job	:	To be filled by vendor with credentials

3.0 <u>Quality System :</u>

3.1)	If ISO certified, check the availability and accessibility of Quality system manual	:	To be filled by vendor
3.2)	Validity of ISO certification	:	To be filled by vendor
3.3)	Whether Quality Control plan and Procedures are prepared?	:	To be filled by vendor
3.4)	Whether organisation chart is available?	:	To be filled by vendor with credentials
3.5)	What is the level of Quality Control in the organisation?	:	To be filled by vendor with credentials
3.6)	Whether working of following are Satisfactory?		
	(a) Document control	:	Yes/NO
	(b) Process Control	:	Yes/NO

(c) Non-conformances control : Yes/NO

3.7) Whether Internal Quality Audits are carried out? : Yes/NO

3.8) Whether non-conformities during Internal Audits are recorded and disposed off following laid down procedure? : Yes/NO

4.0 Assessment: To be filled by BHEL

4.1 Understanding and interpretation by vendor

Sl No	Area of Assessment	Observation	Remark
1	Scope of work	Good/Satisfactory/Unsatisfactory	
2	Related standard	Good/Satisfactory/Unsatisfactory	
3	Construction features	Good/Satisfactory/Unsatisfactory	
4	Functional Requirement	Good/Satisfactory/Unsatisfactory	

4.2 Capability of Vendor

Sl No	Area of Assessment	Observation	Remark
1	To design/develop	Good/Satisfactory/Unsatisfactory	
2	To fabricate	Good/Satisfactory/Unsatisfactory	
3	To inspect	Good/Satisfactory/Unsatisfactory	
4	Specify remark on the capability of vendor to execute the job	Good/Satisfactory/Unsatisfactory	

4.3 Comments if any w.r.t. delivery schedules: NA

4.4 Comments if any on quality of product: NA

5.0 Conclusion:

Signature of Team Members

Sl. No.	Name	Designation	Sign & Date
1	BHEL Employee	BHEL Employee	BHEL Employee
2	BHEL Employee	BHEL Employee	BHEL Employee
3	BHEL Employee	BHEL Employee	BHEL Employee

ANNEXURE-B (COMMERCIAL FOR INDEGENOUS VENDORS)
(Submit *the document with company's seal and authorized signature*)
Enquiry No – E1643089

S.No.	BHEL TERMS	Vendors Remarks
1.	**Prices shall be firm till delivery**	
2.	**INSPECTION**: BHEL QC / BHEL APPOINTED TPI AND NPCIL. Please confirm.	
3.	**Delivery Destination**: - The material is required to be **supplied** to Site. To consignee address: Chief Construction Engineer, Kaiga Atomic Power Project-5&6 (KAIGA-5&6) Kaiga Site, Via - Karwar, Dist- Uttar Kannada, Karnataka- 581400.	
4.	Price to be furnished on **F.O.R. site basis**, duly insured basis inclusive of P&F charges.	
5.	Minimum delivery period to be Quoted in no. of weeks from the date of receipt of Purchase Order. If any document approval is required then the delivery period shall start from the date of document approval however, required delivery is 365 days (tentative). DELIVERY PERIOD SHALL START FROM THE DATE OF MANUFACTURING CLEARANCE FROM BHEL BHOPAL. vendor shall submit all documents within 15 days of issue of PO and subsequent submission shall be within 7 days in case any revision required.	
6.	**Payment terms**: 100% payment within 90 days of receipt (45 days for MSE and 60 days for Medium enterprises/ NSIC registered suppliers under as per relevant act in force) subject to acceptance of material at BHEL, on direct presentation of the documents. Any deviation from the above payment terms, if accepted (by BHEL), shall be loaded @ SBI base rate + 6% for the purpose of bid evaluation.	
7.	Confirm whether bidder is **Manufacturer or Trader or Dealer** of items under enquiry. In case of Trader or Dealer, please furnish authorization certificate from OEM.	
8.	**Penalty: -** LD shall be 0.5% of the total order value per week of delay or part thereof, subject a maximum of 10% of the total order value (Please refer clause 9 of GCC).	
9.	**Specify** HSN code OF MATERIAL item wise in the offer.	
10.	GST TYPE & ITS PERCENTAGE APPLICBALE item wise mentioned in the offer (IGST/CGST+SGST/UGST)	
11.	The offer must be valid for 120 days from the date of technical bid opening.	
12.	Submitted duly seal & signed on all pages – BHEL GTC (BP200102)	
13.	Confirm **UDYAM Certificate** is Submitted, In Case Bidder is an MSE Vendor. (As Per Order F. No. 1(2)(1)/ 2016-MA Dated 09/02/2017 From Min. Of MSME Traders/Agents Are Not Allowed For Benefits/Relaxations Extended to MSES.)	
14.	**Final price bid shall be opened only for those vendors who will be approved by the end customer (NPCIL) on the basis of credentials.**	
15.	Supplier to Furnish All Inspection Reports, Material TC & GC to PO Issuing Authority After Supply / Along with Supply.	
16.	Guarantee / Warranty required and periods: 18 Months from supply or 12 months from the commissioning whichever is earlier. Please confirm.	
17.	Submitted duly seal & signed – Annexure C	
18.	Submitted duly seal & signed – Annexure B (Techno commercial Bid)	
19.	Submitted duly seal & signed - on each page of BHEL GTC	
20.	Submitted duly seal & signed – Annexure D	

21.	Submitted duly seal & signed – on each page of Integrity pact	
22.	**All the credentials submitted by the vendors shall be reviewed & approved by BHEL & NPCIL and if any additional document required by NPCIL/BHEL, BIDDER shall furnish the same.**	
23.	PBG of 05 % shall be applicable.	
24.	Vendor to submit financial documents.	

NOTE-

1) DEVIATION IN ANY COMMERCIAL CONDITION SHALL BE SUITABLY LOADED IN THE OFFERED PRICE.

2) IN CASE OF ANY CONFLICT, CONFIRMATION BY VENDOR PROVIDED HERE WILL SUPERCEDE.

3) IN CASE BIDDER IS NOT MAKING AN OFFER AGAINST THIS ENQUIRY, WE REQUEST THE BIDDER TO POST THE REGRET LETTER.

ANNEXURE - B (COMMERCIAL FOR FOREIGN VENDORS)

(Submit *the document with company's seal and authorized signature*)

Enquiry No. :- E1643089

S.No	BHEL TERMS	Vendors Remarks
1.	**INSPECTION**: BHEL QC / BHEL APPOINTED TPI AND NPCIL. Please confirm. Prices shall be FIRM till execution of order inclusive of all testing & Inspection charges. Inspection charges shall be mentioned separately also.	
2.	Prices to be furnished on FCA basis inclusive of packing & forwarding charges.	
3.	Please also quote air freight charges i.e. C&F Charges from FCA port to Mumbai Air Port (Indian Port).	
4.	Agency commission if any to be included in FCA price and indicated separately as a percentage of quoted FCA value.	
5.	100% against irrevocable, unconfirmed LC, payable within 90 days of the bill of lading (BL) date. In case BHEL considers any deviation in payment terms i.e. early payment based on vendor's request, then bids shall be evaluated with loading of State bank of India Base rate plus 6%, for the credit period short of 90 days. The LC shall be established 2month prior to shipment date, valid for period of 90 days, unless agreed otherwise. Payment terms of CAD payable on 90th day of BL / HAWB date shall be preferred as the tender value is less.	
6.	L/C charges in India to BHEL A/C and outside India to vendor's account. In case of delay in supply by the vendor, charges for extension of L/C (Inside & Outside) will have to be borne by vendor.	
7.	Minimum delivery period to be Quoted in no. of weeks from the date of receipt of Purchase Order. If any document approval is required then the delivery period shall start from the date of document approval however, required delivery is 365 days (tentative). DELIVERY PERIOD SHALL START FROM THE DATE OF MANUFACTURING CLEARANCE FROM BHEL BHOPAL. vendor shall submit all documents within 15 days of issue of PO and subsequent submission shall be within 7 days in case any revision required.	
8.	Early delivery is acceptable subject to prior approval from BHEL.	
9.	Penalty: -LD shall be 0.5% of the total order value per week of delay or part thereof, subject a maximum of 10% of the total order value (Please refer clause 9 of GCC).	
10.	The offer must be valid for 120 days from the date of technical bid opening.	

11.	Exchange rate of technical bid opening date or latest available prior to technical bid opening date will be considered for evaluation of bids.	
12.	Please indicate the shipping weight of the unit quantity of the item	
13.	Please indicate the name of currency of the offer	
14.	Submitted duly seal & signed on all pages – BHEL GTC (BP200102)	
15.	Submitted duly seal & signed Annexure C	
16.	Submitted duly seal & signed Annexure B (Techno-commercial bid)	
17.	Submitted duly seal & signed on all pages Integrity Pact	
18.	PBG of 05 % shall be applicable.	
19.	**All the credentials submitted by the vendors shall be reviewed & approved by BHEL & NPCIL and if any additional document required by NPCIL/BHEL, BIDDER shall furnish the same.**	
20.	Vendor to submit financial documents.	
21.	**Final price bid shall be opened only for those vendors who will be approved by the end customer (NPCIL) on the basis of credentials.**	
22.	**Delivery Destination**: - The material is required to be **supplied** to Site. To consignee address: Chief Construction Engineer, Kaiga Atomic Power Project-5&6 (KAIGA-5&6) Kaiga Site, Via - Karwar, Dist- Uttar Kannada, Karnataka- 581400.	

NOTE- 1) DEVIATION IN ANY COMMERCIAL CONDITION SHALL BE SUITABLY LOADED IN THE OFFERED PRICE.

2) IN CASE OF ANY CONFLICT, CONFIRMATION BY VENDOR PROVIDED HERE WILL SUPERCEDE.

Techno-Commercial Bid

(To be filled by supplier and submit with offer)

Tender No.		E1643089
SL No	quantity	Item description
1	16 No.	ATMOSPHERIC STEAM DISCHARGE VALVE (ASDV) ALONG WITH ITS PNEUMATIC ACTUATOR AS PER TECHNICAL SPEC NO. KAIGA5&6/PC/E/08003 AND ANNEXURE-T
2	4 No.	ATMOSPHERIC STEAM DISCHARGE VALVE (ASDV) ALONG WITH ITS PNEUMATIC ACTUATOR AS PER TECHNICAL SPEC NO. KAIGA5&6/PC/E/08003 AND ANNEXURE-T FOR SPARES
3	1 ST	MANDATORY SPARES (1 SET CONSIST OF REMOVABLE SEAT RINGS -04 NOS. & GLAND PACKINGS -04 SETS) AS PER TECHNICAL SPEC NO. KAIGA-5&6/PC/E/08003 AND ANNEXURE-T
Remarks :		(1) OFFER TO BE SUBMITTED IN TWO PART BID I.E. `TECHNICAL BID' & `PRICE BID' THROUGH NIC PORTAL (HTTPS://EPROCUREBHEL.CO.IN/NICGEP/APP). (2) REFER GTC &`ANNEXURES' FOR COMMERCIAL TERMS AND TECHNICAL TERMS. (3) PLEASE FURNISH DULY FILLED AND ENDORSED COPY OF BHEL GTC (BP 200102), ANNEXURE B AND ANNEXURE C, ANNEXURE , VENDOR CREDENTIAL FORM DULLY FILLED AND STAMPED ALONG WITH THE OFFER. (4) PLEASE ACCEPT OUR TECHNO COMMERCIAL OFFER IN TOTO. (5) ENQUIRY TECHNICAL TERM : AS PER DESCRIPTION. (6) INSPECTION TERMS : BHEL QC / BHEL APPOINTED TPI AND NPCIL. (7) ORIGINAL TC & GC IS REQUIRED ALONG WITH MATERIAL AT THE TIME OF SUPPLY TO BHEL. (8) BIDDER OTHER THAN OEM TO SUBMIT AUTHORIZATION CERTIFICATE FROM OEM ALONG WITH OFFER. (9) ANY DEVIATION FROM OUR COMMERCIAL CONDITION SHALL BE SUITABLY LOADED IN THE OFFERED PRICE. (10) SUPPLIER TECHNICAL TERM : TO BE PACKED PROPERLY WITH PHYSICAL PROTECTION. (11) All the credentials submitted by the vendors shall be reviewed & approved by BHEL & NPCIL and if any additional document required by NPCIL/BHEL, BIDDER shall furnish the same. (12) Final price bid shall be opened only for those vendors who will be approved by the end customer (NPCIL) on the basis of credentials. (14) Integrity Pact shall be furnished by vendor(duly signed and sealed). (15) Purchase Preference shall be given to MSE bidder i.e. 100% quantity shall be offered to MSE Vendors subject to matching of L-1 Rate if L2 rate is L1+15%. (16) Financial Turnover criteria proposed to be kept as Rs.2.5 Crores. vendor to submit financial documents. (17) Required delivery is 365 days(tentative) from DELIVERY PERIOD SHALL START FROM THE DATE OF MANUFACTURING CLEARANCE FROM BHEL BHOPAL. (18) Item is directly dispatched to the site. To consignee address: Chief Construction Engineer, Kaiga Atomic Power Project-5&6 (KAIGA-5&6),Kaiga Site, Via - Karwar, Dist-Uttar Kannada, Karnataka-581400. (19) ALL THE ITEMS SHALL BE PROCURED FROM THE SAME VENDOR. HENCE, EVALUATION TO BE DONE ON OVERALL BASIS.

Sr. No.	ELEMENTS	Standards	To be offered/confirmed by supplier	Remarks, if any
1	Quotation Reference & date	As per supplier		
2	HSN / SAC code	As per supplier		
2A	GST TYPE & ITS PERCENTAGE APPLICBALE item wise mentioned in the offer (IGST/CGST+SGST/UGST)	As per supplier		
3	Quotation Currency	In INR		
4	E-Mail	As per supplier		
5	Phone/Mobile	As per supplier		
6	Contact Person	As per supplier		
7	Order to be placed on	As per supplier		
8	Address	As per supplier		
9	Minimum delivery period to be quoted in no of weeks from the date of receipt of Purchase Order. If any document approval is required then the delivery period shall start from the date of document approval however vendor shall submit all documents with in 10 days of issue of PO. And subsequent submission shall be within 7 days in case any revision required.	As per supplier		
10	Prices shall be firm till delivery	Yes		
11	party appointed by BHEL shall do Inspection at your works. Third party inspection charges shall be borne by BHEL. Any other inspection/ testing charges if any are to be included in the quoted prices. Minimum 10 days' notice to be given for inspection. Please confirm.	Yes		

Techno-Commercial Bid

(To be filled by supplier and submit with offer)

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Remarks :		(1) OFFER TO BE SUBMITTED IN TWO PART BID I.E. `TECHNICAL BID' & `PRICE BID' THROUGH NIC PORTAL (HTTPS://EPROCUREBHEL.CO.IN/NICGEP/APP). (2) REFER GTC &`ANNEXURES' FOR COMMERCIAL TERMS AND TECHNICAL TERMS. (3) PLEASE FURNISH DULY FILLED AND ENDORSED COPY OF BHEL GTC (BP 200102), ANNEXURE B AND ANNEXURE C, ANNEXURE , VENDOR CREDENTIAL FORM DULLY FILLED AND STAMPED ALONG WITH THE OFFER. (4) PLEASE ACCEPT OUR TECHNO COMMERCIAL OFFER IN TOTO. (5) ENQUIRY TECHNICAL TERM : AS PER DESCRIPTION. (6) INSPECTION TERMS : BHEL QC / BHEL APPOINTED TPI AND NPCIL. (7) ORIGINAL TC & GC IS REQUIRED ALONG WITH MATERIAL AT THE TIME OF SUPPLY TO BHEL. (8) BIDDER OTHER THAN OEM TO SUBMIT AUTHORIZATION CERTIFICATE FROM OEM ALONG WITH OFFER. (9) ANY DEVIATION FROM OUR COMMERCIAL CONDITION SHALL BE SUITABLY LOADED IN THE OFFERED PRICE. (10) SUPPLIER TECHNICAL TERM : TO BE PACKED PROPERLY WITH PHYSICAL PROTECTION. (11) All the credentials submitted by the vendors shall be reviewed & approved by BHEL & NPCIL and if any additional document required by NPCIL/BHEL, BIDDER shall furnish the same. (12) Final price bid shall be opened only for those vendors who will be approved by the end customer (NPCIL) on the basis of credentials. (14) Integrity Pact shall be furnished by vendor(duly signed and sealed). (15) Purchase Preference shall be given to MSE bidder i.e. 100% quantity shall be offered to MSE Vendors subject to matching of L-1 Rate if L2 rate is L1+15%. (16) Financial Turnover criteria proposed to be kept as Rs.2.5 Crores. vendor to submit financial documents. (17) Required delivery is 365 days(tentative) from DELIVERY PERIOD SHALL START FROM THE DATE OF MANUFACTURING CLEARANCE FROM BHEL BHOPAL. (18) Item is directly dispatched to the site. To consignee address: Chief Construction Engineer, Kaiga Atomic Power Project-5&6 (KAIGA-5&6),Kaiga Site, Via - Karwar, Dist-Uttar Kannada, Karnataka-581400. (19) ALL THE ITEMS SHALL BE PROCURED FROM THE SAME VENDOR. HENCE, EVALUATION TO BE DONE ON OVERALL BASIS.

Sr. No.	ELEMENTS	Standards	To be offered/confirmed by supplier	Remarks, if any
12	**Delivery Destination** : - The material is required to be **supplied** to Site. Consignee address: Chief Construction Engineer, Kaiga Atomic Power Project-5&6 (KAIGA-5&6),Kaiga Site, Via - Karwar, Dist-Uttar Kannada, Karnataka-581400.	Yes		

Techno-Commercial Bid

(To be filled by supplier and submit with offer)

Tender No.		E1643089
SL No	quantity	Item description
1	16 No.	ATMOSPHERIC STEAM DISCHARGE VALVE (ASDV) ALONG WITH ITS PNEUMATIC ACTUATOR AS PER TECHNICAL SPEC NO. KAIGA5&6/PC/E/08003 AND ANNEXURE-T
2	4 No.	ATMOSPHERIC STEAM DISCHARGE VALVE (ASDV) ALONG WITH ITS PNEUMATIC ACTUATOR AS PER TECHNICAL SPEC NO. KAIGA5&6/PC/E/08003 AND ANNEXURE-T FOR SPARES
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Remarks :		(1) OFFER TO BE SUBMITTED IN TWO PART BID I.E. `TECHNICAL BID' & `PRICE BID' THROUGH NIC PORTAL (HTTPS://EPROCUREBHEL.CO.IN/NICGEP/APP). (2) REFER GTC &`ANNEXURES' FOR COMMERCIAL TERMS AND TECHNICAL TERMS. (3) PLEASE FURNISH DULY FILLED AND ENDORSED COPY OF BHEL GTC (BP 200102), ANNEXURE B AND ANNEXURE C, ANNEXURE , VENDOR CREDENTIAL FORM DULLY FILLED AND STAMPED ALONG WITH THE OFFER. (4) PLEASE ACCEPT OUR TECHNO COMMERCIAL OFFER IN TOTO. (5) ENQUIRY TECHNICAL TERM : AS PER DESCRIPTION. (6) INSPECTION TERMS : BHEL QC / BHEL APPOINTED TPI AND NPCIL. (7) ORIGINAL TC & GC IS REQUIRED ALONG WITH MATERIAL AT THE TIME OF SUPPLY TO BHEL. (8) BIDDER OTHER THAN OEM TO SUBMIT AUTHORIZATION CERTIFICATE FROM OEM ALONG WITH OFFER. (9) ANY DEVIATION FROM OUR COMMERCIAL CONDITION SHALL BE SUITABLY LOADED IN THE OFFERED PRICE. (10) SUPPLIER TECHNICAL TERM : TO BE PACKED PROPERLY WITH PHYSICAL PROTECTION. (11) All the credentials submitted by the vendors shall be reviewed & approved by BHEL & NPCIL and if any additional document required by NPCIL/BHEL, BIDDER shall furnish the same. (12) Final price bid shall be opened only for those vendors who will be approved by the end customer (NPCIL) on the basis of credentials. (14) Integrity Pact shall be furnished by vendor(duly signed and sealed). (15) Purchase Preference shall be given to MSE bidder i.e. 100% quantity shall be offered to MSE Vendors subject to matching of L-1 Rate if L2 rate is L1+15%. (16) Financial Turnover criteria proposed to be kept as Rs.2.5 Crores. vendor to submit financial documents. (17) Required delivery is 365 days(tentative) from DELIVERY PERIOD SHALL START FROM THE DATE OF MANUFACTURING CLEARANCE FROM BHEL BHOPAL. (18) Item is directly dispatched to the site. To consignee address: Chief Construction Engineer, Kaiga Atomic Power Project-5&6 (KAIGA-5&6),Kaiga Site, Via - Karwar, Dist-Uttar Kannada, Karnataka-581400. (19) ALL THE ITEMS SHALL BE PROCURED FROM THE SAME VENDOR. HENCE, EVALUATION TO BE DONE ON OVERALL BASIS.

Sr. No.	ELEMENTS	Standards	To be offered/confirmed by supplier	Remarks, if any
13	Price to be furnished on **FOR destination Site**, duly insured basis inclusive of P&F charges.	Yes		
14	Quoted for all the items of tender enquiry	Yes / No. (If "No" please mention item number of regreted items)		
15	Technical Specifications	Accepted as per enquiry / Accepted with deviation (If select Accepted with deviation, please mention the deviation)		
16	TC , GC and ALL Inspection report as per tender enquiry and specification will be submitted along with each consignment.	Yes (In case of "No" your offer may be rejected).		
17	Brand Name, If any.	As per supplier		
18	Supply from	As per supplier		
19	Quotation Validity will be 120 days from the date of techno-commercial bid opening.	Yes		
20	Are you registered under MSMED ACT 2006 as small or micro.	Yes / No (If select Yes, please enclosed valid MSE/UAM/UDYAM certificate)		
21	Payment terms: 100% payment within 90 days of receipt (45 days for MSE / NSIC registered suppliers under as per relevant act in force) subject to acceptance of material at BHEL, on direct presentation of the documents. Any deviation from the above payment terms, if accepted (by BHEL), shall be loaded @ SBI base rate + 6% for the purpose of bid evaluation.	90 days / 45 Days (If supplier is MSE, please select 45 days)		

Techno-Commercial Bid

(To be filled by supplier and submit with offer)

Tender No.		E1643089
SL No	quantity	Item description
1	16 No.	ATMOSPHERIC STEAM DISCHARGE VALVE (ASDV) ALONG WITH ITS PNEUMATIC ACTUATOR AS PER TECHNICAL SPEC NO. KAIGA5&6/PC/E/08003 AND ANNEXURE-T
2	4 No.	ATMOSPHERIC STEAM DISCHARGE VALVE (ASDV) ALONG WITH ITS PNEUMATIC ACTUATOR AS PER TECHNICAL SPEC NO. KAIGA5&6/PC/E/08003 AND ANNEXURE-T FOR SPARES
3	1 ST	MANDATORY SPARES (1 SET CONSIST OF REMOVABLE SEAT RINGS -04 NOS. & GLAND PACKINGS -04 SETS) AS PER TECHNICAL SPEC NO. KAIGA-5&6/PC/E/08003 AND ANNEXURE-T
Remarks :		(1) OFFER TO BE SUBMITTED IN TWO PART BID I.E. `TECHNICAL BID' & `PRICE BID' THROUGH NIC PORTAL (HTTPS://EPROCUREBHEL.CO.IN/NICGEP/APP). (2) REFER GTC &`ANNEXURES' FOR COMMERCIAL TERMS AND TECHNICAL TERMS. (3) PLEASE FURNISH DULY FILLED AND ENDORSED COPY OF BHEL GTC (BP 200102), ANNEXURE B AND ANNEXURE C, ANNEXURE , VENDOR CREDENTIAL FORM DULLY FILLED AND STAMPED ALONG WITH THE OFFER. (4) PLEASE ACCEPT OUR TECHNO COMMERCIAL OFFER IN TOTO. (5) ENQUIRY TECHNICAL TERM : AS PER DESCRIPTION. (6) INSPECTION TERMS : BHEL QC / BHEL APPOINTED TPI AND NPCIL. (7) ORIGINAL TC & GC IS REQUIRED ALONG WITH MATERIAL AT THE TIME OF SUPPLY TO BHEL. (8) BIDDER OTHER THAN OEM TO SUBMIT AUTHORIZATION CERTIFICATE FROM OEM ALONG WITH OFFER. (9) ANY DEVIATION FROM OUR COMMERCIAL CONDITION SHALL BE SUITABLY LOADED IN THE OFFERED PRICE. (10) SUPPLIER TECHNICAL TERM : TO BE PACKED PROPERLY WITH PHYSICAL PROTECTION. (11) All the credentials submitted by the vendors shall be reviewed & approved by BHEL & NPCIL and if any additional document required by NPCIL/BHEL, BIDDER shall furnish the same. (12) Final price bid shall be opened only for those vendors who will be approved by the end customer (NPCIL) on the basis of credentials. (14) Integrity Pact shall be furnished by vendor(duly signed and sealed). (15) Purchase Preference shall be given to MSE bidder i.e. 100% quantity shall be offered to MSE Vendors subject to matching of L-1 Rate if L2 rate is L1+15%. (16) Financial Turnover criteria proposed to be kept as Rs.2.5 Crores. vendor to submit financial documents. (17) Required delivery is 365 days(tentative) from DELIVERY PERIOD SHALL START FROM THE DATE OF MANUFACTURING CLEARANCE FROM BHEL BHOPAL. (18) Item is directly dispatched to the site. To consignee address: Chief Construction Engineer, Kaiga Atomic Power Project-5&6 (KAIGA-5&6),Kaiga Site, Via - Karwar, Dist-Uttar Kannada, Karnataka-581400. (19) ALL THE ITEMS SHALL BE PROCURED FROM THE SAME VENDOR. HENCE, EVALUATION TO BE DONE ON OVERALL BASIS.

Sr. No.	ELEMENTS	Standards	To be offered/confirmed by supplier	Remarks, if any
22	Other Charges (If any)	Applicable / Not Applicable. (If applicable please mention percentage (%) / Value (along with type of charges).		
23	Transit Insurance will be in supplier scope	Yes		
24	Penalty: - LD shall be 0.5% of the total order value per week of delay or part thereof, subject a maximum of 10% of the total order value (Please refer clause 9 of GCC - BP-200102).	Yes / No (In case of "No", your offer will be loaded suitably)		
25	General terms and conditions of enquiry (Form No. BP-200102) is Acceptable.	Yes (In case of "No" your offer may be rejected).		
26	Special Terms and conditions of enquiry (Annexure B) is acceptable.	Yes (In case of "No" your offer may be rejected).		
27	Confirm whether bidder is Manufacturer or Trader or Dealer of items under enquiry. In case of Trader or Dealer, please furnish authorization certificate from OEM.	As per supplier		
28	Submitted duly seal & signed Annexure C	Yes (In case of "No" your offer may be rejected).		
29	Submitted duly seal & signed on all pages – BHEL GTC (BP200102)	Yes (In case of "No" your offer may be rejected).		

ANNEXURE- C

DECLARATION BY BIDDERS REGARDING CONFLICT OF INTEREST

"A bidder shall not have conflict of interest with other bidders. Such conflict of interest can lead to anti-competitive practices to the detriment of Procuring Entity's interests. **The bidder found to have a conflict of interest shall be disqualified**. A bidder may be considered to have a conflict of interest with one or more parties in this bidding process, if:

a) they have controlling partner (s) in common;· or

b) they receive or have received any direct or indirect subsidy/ financial stake from any of them; or

c) they have the same legal representative/agent for purposes of this bid; or

d) they have relationship with each other, directly or through common third parties, that puts them in a position to have access to information about or influence on the bid of another Bidder,· or

e) Bidder participates in more than one bid in this bidding process. Participation by a Bidder in more than one Bid will result in the disqualification of all bids in which the parties are involved. However, this does not limit the inclusion of the components/ sub-assembly/ Assemblies from one bidding manufacturer in more than one bid; or

f) In cases of agents quoting in offshore procurements, on behalf of their principal manufacturers, one agent cannot represent two manufacturers or quote on their behalf in a particular tender enquiry. One manufacturer can also authorise only one agent/dealer.

There can be only one bid from the following:

1. The principal manufacturer directly or through one Indian agent on his behalf; and

2. Indian/foreign agent on behalf of only one principal, or

g) A Bidder or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the contract that is the subject of the Bid, or

h) In case of a holding company having more than one independently manufacturing units, or more than one unit having common business ownership/management, only one unit should quote. Similar restrictions would apply to closely related sister companies. Bidders must proactively declare such sister/ common business/ management units in same/ similar line of business. "

We confirm to above conditions of NIT against **enquiry no**/ **GeM bid no- ……**

Sign/seal of bidder

(……)

For M/s. ……

BHARAT HEAVY ELECTRICALS LIMITED, BHOPAL

MATERIAL MANAGEMENT – THERMAL DIVISION

ANNEXURE-D

For this Procurement, Government of India Public Procurement (Preference to Make in India), Order 2017 with its amendments and subsequent Orders issued by the respective nodal ministries shall be applicable even if issued after issue of this NIT but before finalization of contract/PO/WO against this NIT.

*As per the Provisions of this order, please submit **a self-certification complying with the conditions below on company letterhead duly signed by competent authority**.*

Format:

I ……., hereby declare on behalf of M/s. ……. that we are participating in the Enquiry No. …… floated by BHEL, Bhopal (MP), India and shall comply with following:

1. Public Procurement (Preference to Make in India), Order 2017 *with its amendments* and subsequent Orders issued by the respective nodal ministries shall be applicable even if issued after issue of this NIT but before finalization of contract/PO/WO against this NIT.

2. As per the Provisions of this order, **only "Class-I Local Suppliers"** are eligible to bid for the tender.

(a) A supplier will be treated as **"Class-I Local Suppliers",** if the items quoted by bidder have local content equal to or more than 50%.

(b) '**Local Content'** means the amount of value added in India, which shall be total value of item quoted (excluding net domestic indirect taxes) minus the value of imported content in the item (including all custom duties) as a proportion of the total value, **in percent**.

3. I hereby declare that our firm qualifies as **"Class-I Local Suppliers"**.

a. The Local Content in the items quoted under this Enquiry is ……. Percent

b. Details of location(s) in India where this value addition shall be done, is/are as follows:

(a) ……..

(b) ……..

(c) ……..

(……)

For M/s. ……

(Seal & Sign)

Annexure-1

INTEGRITY PACT

Between

Bharat Heavy Electricals Ltd. (BHEL), a company registered under the Companies Act 1956 and having its registered office at "BHEL House", Siri Fort, New Delhi - 110049 (India) hereinafter referred to as "The Principal", which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the ONE PART

and

_____, (description of the party along with address), hereinafter referred to as "The Bidder/ Contractor" which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the OTHER PART

Preamble

The Principal intends to award, under laid-down organizational procedures, contract/s for Atmospheric Steam discharge valve (ASDV) along with its Pneumetic Actuator _____ (hereinafter referred to as "Contract"). The Principal values full compliance with all relevant laws of the land, rules and regulations, and the principles of economic use of resources, and of fairness and transparency in its relations with its Bidder(s)/ Contractor(s).

In order to achieve these goals, the Principal will appoint panel of Independent External Monitor(s) (IEMs), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

Section 1- Commitments of the Principal

1.1 The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles: -

1.1.1 No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

1.1.2 The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/ additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.

1.1.3 The Principal will exclude from the process all known prejudiced persons.

1.2 If the Principal obtains information on the conduct of any of its employees which is a penal offence under the Indian Penal Code 1860 and Prevention of Corruption Act 1988 or any other statutory penal enactment, or if there be a substantive suspicion in this regard, the Principal will inform its Vigilance Office and in addition can initiate disciplinary actions.

Section 2 - Commitments of the Bidder(s)/ Contractor(s)

2.1 The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. The Bidder(s)/ Contractor(s) commits himself to observe the following principles during participation in the tender process and during the contract execution.

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2.1.1 The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to the Principal or to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material, immaterial or any other benefit which he/ she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

2.1.2 The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any illegal or undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

2.1.3 The Bidder(s)/ Contractor(s) will not commit any penal offence under the relevant Indian Penal Code (IPC) and Prevention of Corruption Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

2.1.4 Foreign Bidder(s)/ Contractor(s) shall disclose the name and address of agents and representatives in India and Indian Bidder(s)/ Contractor(s) to disclose their foreign principals or associates. The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

2.2 The Bidder(s)/ Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

2.3 The Bidder(s)/ Contractor(s) shall not approach the Courts while representing the matters to IEMs and shall await their decision in the matter.

Section 3 - Disqualification from tender process and exclusion from future contracts

If the Bidder(s)/ Contractor(s), before award or during execution has committed a transgression through a violation of Section 2 above, or acts in any other manner such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s)/ Contractor(s) from the tender process , terminate the contract, if already awarded, exclude from future business dealings and/ or take action as per the separate "Guidelines on Banning of Business dealings with Suppliers/ Contractors", framed by the Principal.

Section 4 - Compensation for Damages

4.1 If the Principal has disqualified the Bidder (s) from the tender process before award / order acceptance according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/ Bid Security.

4.2 If the Principal is entitled to terminate the Contract according to Section 3, or terminates the Contract in application of Section 3 above , the Bidder(s)/ Cotractor (s) transgression through a violation of Section 2 above shall be construed breach of contract and the Principal shall be-entitled to demand and recover from the Contractor an amount equal to 5% of the contract value or the amount equivalent to Security Deposit/ Performance Bank Guarantee , whichever is higher, as damages, in addition to and without prejudice to its right to demand and recover compensation for any other loss or damages specified elsewhere in the contract.

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Section 5 - Previous Transgression

5.1 The Bidder declares that no previous transgressions occurred in the last 3 (three) years with any other company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.

5.2 If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason or action can be taken as per the separate "Guidelines on Banning of Business dealings with Suppliers/ Contractors", framed by the Principal.

Section 6 - Equal treatment of all Bidder (s)/ Contractor (s) / Sub-contractor (s)

6.1 The Principal will enter into Integrity Pacts with identical conditions as this Integrity Pact with all Bidders and Contractors.

6.2 In case of Sub-contracting, the Principal Contractor shall take the responsibility of the adoption of Integrity Pact by the Sub-contractor(s) and ensure that all Sub-contractors also sign the Integrity Pact.

6.3 The Principal will disqualify from the tender process all Bidders who do not sign this Integrity Pact or violate its provisions.

Section 7 - Criminal Charges against violating Bidders/ Contractors /Subcontractors

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the Vigilance Office.

Section 8 -Independent External Monitor(s)

8.1 The Principal appoints competent and credible panel of Independent External Monitor (s) (IEMs) for this Integrity Pact. The task of the IEMs is to review independently and objectively, whether and to what extent the parties comply with the obligations under this Integrity Pact.

8.2 The IEMs are not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the CMD, BHEL.

8.3 The IEMs shall be provided access to all documents/ records pertaining to the Contract, for which a complaint or issue is raised before them as and when warranted. However, the documents/records/information having National Security implications and those documents which have been classified as Secret/Top Secret are not to be disclosed.

8.4 The Principal will provide to the IEMs sufficient information about all meetings among the parties related to the Contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the IEMs the option to participate in such meetings.

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8.5 The advisory role of IEMs is envisaged as that of a friend, philosopher and guide. The advice of IEMs would not be legally binding and it is restricted to resolving issues raised by a Bidder regarding any aspect of the tender which allegedly restricts competition or bias towards some Bidders. At the same time, it must be understood that IEMs are not consultants to the Management. Their role is independent in nature and the advice once tendered would not be subject to review at the request of the organization.

8.6 For ensuring the desired transparency and objectivity in dealing with the complaints arising out of any tendering process or during execution of Contract, the matter should be examined by the full panel of IEMs jointly, who would look into the records, conduct an investigation, and submit their joint recommendations to the Management.

8.7 The IEMs would examine all complaints received by them and give their recommendations/ views to the CMD, BHEL at the earliest. They may also send their report directly to the CVO, in case of suspicion of serious irregularities requiring legal/ administrative action. Only in case of very serious issue having a specific, verifiable Vigilance angle, the matter should be reported directly to the Commission. IEMs will tender their advice on the complaints within 30 days.

8.8 The CMD, BHEL shall decide the compensation to be paid to the IEMs and its terms and conditions.

8.9 IEMs should examine the process integrity, they are not expected to concern themselves with fixing of responsibility of officers. Complaints alleging mala fide on the part of any officer of the Prinicpal should be looked into by the CVO of the Principal.

8.10 If the IEMs have reported to the CMD, BHEL, a substantiated suspicion of an offence under relevant Indian Penal Code / Prevention of Corruption Act, and the CMD, BHEL has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Office, the IEMs may also transmit this information directly to the Central Vigilance Commissioner, Government of India.

8.11 After award of work, the IEMs shall look into any issue relating to execution of Contract, if specifically raised before them. As an illustrative example, if a Contractor who has been awarded the Contract, during the execution of Contract, raises issue of delayed payment etc. before the IEMs, the same shall be examined by the panel of IEMs. Issues like warranty/ guarantee etc. shall be outside the purview of IEMs.

8.12 However, the IEMs may suggest systemic improvements to the management of the Principal, if considered necessary, to bring about transparency, equity and fairness in the system of procurement.

8.13 The word 'Monitor' would include both singular and plural.

Section 9 - Pact Duration

9.1 This Integrity Pact shall be operative from the date this Integrity Pact is signed by both the parties till the final completion of contract for successful Bidder, and for all other Bidders 6 months after the Contract has been awarded. Any violation of the same would entail disqualification of the bidders and exclusion from future business dealings.

9.2 If any claim is made/ lodged during currency of this Integrity Pact, the same shall be binding and continue to be valid despite the lapse of this Pact as specified above, unless it is discharged/ determined by the CMD, BHEL.

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Section 10 - Other Provisions

10.1 This Integrity Pact is subject to Indian Laws and exclusive jurisdiction shall be of the competent Courts as indicated in the Tender or Contract, as the case may be.

10.2 Changes and supplements as well as termination notices need to be made in writing.

10.3 If the Bidder(s)/ Contractor(s) is a partnership or a consortium or a joint venture, this Integrity Pact shall be signed by all partners of the partnership or joint venture or all consortium members.

10.4 Should one or several provisions of this Integrity Pact turn out to be invalid, the remainder of this Integrity Pact remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

10.5 Only those bidders / contractors who have entered into this Integrity Pact with the Principal would be competent to participate in the bidding. In other words, entering into this Integrity Pact would be a preliminary qualification.

10.6 In the event of any dispute between the Principal and Bidder(s)/ Contractor(s) relating to the Contract, in case, both the parties are agreeable, they may try to settle dispute through Mediation before the panel of IEMs in a time bound manner. In case, the dispute remains unresolved even after mediation by the panel of IEMs, either party may take further action as the terms & conditions of the Contract. The fees/expenses on dispute resolution through mediation shall be shared by both the parties. Further, the mediation proceedings shall be confidential in nature and the parties shall keep confidential all matters relating to the mediation proceedings including any settlement agreement arrived at between the parties as outcome of mediation. Any views expressed, suggestions, admissions or proposals etc. made by either party in the course of mediation shall not be relied upon or introduced as evidence in any further arbitral or judicial proceedings, whether or not such proceedings relate to the dispute that is the subject of mediation proceedings. Neither of the parties shall present IEMs as witness in any Alternative Dispute Resolution or judicial proceedings in respect of the dispute that was subject of mediation.

For & On behalf of the Principal
(Office Seal)

Place BHOPAL
Date 21/09/2024

Witness:
(Name & Address)
राजेश कुमार सिंह/Rajesh Kumar Singh
अपर महाप्रबंधक/Addl. General Manager
एम टी-थर्मल विभाग / MM-Thermal
बी एच ई एल, भोपाल/B H E L, BHOPAL

For & On behalf of the Bidder/ Contractor
(Office Seal)

Witness:
(Name & Address)

Clause on IP in the tender

Integrity Pact (IP)

(a) IP is a tool to ensure that activities and transactions between the Company and its Bidders/ Contractors are handled in a fair, transparent and corruption free manner. Following Independent External Monitors (IEMs) on the present panel have been appointed by BHEL with the approval of CVC to oversee implementation of IP in BHEL.

SI	IEM	Email
1.	Shri Otem Dai, IAS (Retd.)	iem1@bhel.in
2.	Shri Bishwamitra Pandey, IRAS (Retd.)	iem2@bhel.in
3.	Shri Mukesh Mittal, IRS (Retd.)	iem3@bhel.in

(b) The IP as enclosed with the tender is to be submitted (duly signed by authorized signatory) along with techno-commercial bid (Part-I, in case of two/ three part bid). Only those bidders who have entered into such an IP with BHEL would be competent to participate in the bidding. In other words, entering into this Pact would be a preliminary qualification.

(c) Please refer Section-8 of IP for Role and Responsibilities of IEMs. In case of any complaint arising out of the tendering process, the matter may be referred to any of the above IEM(s). All correspondence with the IEMs shall be done through email only.

Note:

No routine correspondence shall be addressed to the IEM (phone/ post/ email) regarding the clarifications, time extensions or any other administrative queries, etc on the tender issued. All such clarification/ issues shall be addressed directly to the tender issuing (procurement) department's officials whose contact details are provided below:

Details of contact person(s):

(1)
Name: Rashmi Fatima Kujur
Deptt: MTX
Address: Bhopal (BHEL)
Phone: (Landline/ Mobile)
0755-250-2401
Email: rashminiz@bhel.in
Fax:

(2)
Name: Ajay Kumar
Deptt: MTX
Address: Bhopal (BHEL)
Phone: (Landline/ Mobile)
0755-250-3207
Email: ajay-singh@bhel.in
Fax: