

マーケットサーベイの募集

References: IO/MS/23/YLI.

“Supply of CHWS-1B Air Cooled Chillers”

(空冷チラーの供給)

IO 締め切り 2024 年 1 月 19 日(金)

○目的

CHWS-1 A/B システムは、安全関連の対象機器に 6° C の冷却水を提供します（付録 A を参照）。熱はその後対象機器から空冷冷凍ユニットを介して環境に転送されます。

CHWS-1 A/B 設計では、本質的に対象機器によって保証された機器の冗長性に準拠した 2 つの完全に独立して分離されたサブシステムを考慮します。

プラント通常運転(パッケージデザインの項を参照)では、冷却機能が継続的に要求されます。

事故時には、追加の安全関連対象機器はシステムによって冷却されます。

各トレインは、空冷式冷凍機 3 台、水平遠心ポンプ 2 台（作動中 1 台、待機中 1 台）、水研磨ユニット、加圧器、ストレーナ、バルブ、専用の配管分配器、および監視および運転目的のための計器から構成されます。

この技術概要は、システム CHWS-1 B に必要な SIC 認定冷凍ユニットの利用可能なソリューションに関する市場調査に使用されます。

○供給範囲

供給範囲は、完全冷蔵パッケージ 1 個を含むものとします。3 台の同一空冷チラーユニット(タグ:26 CH 1 B-CHI-1001&1002&1003)を並列に設置した構成（付録 A 参照）。

冷却水循環ポンプは他社から供給されたものであり、本文書の対象から除外します。

各ユニットには、必要なすべての機械的、電気的および計装制御装置が含まれるものとします。

第 4 項に定める義務条件の下での安全かつ信頼性の高い運転。

各ユニットには、必要なすべての機械的、電気的および計装制御装置が含まれるものとします。

第 4 項に定める義務条件の下での安全かつ信頼性の高い運転。

各ユニットは、必要な免震装置（ベンダーの範囲に含まれる）とともに、1 つの独立したスキッドに設置されるものとします。

ポンプが一定の速度で作動し、冷却水の流れが 3 つのユニット間で均等に分配されることを考慮して、供給者は、3 つのユニット間の義務の再分配を調整するために必要な追加設備をオプションとして提案する必要があります。(例えば、追加制御ユニット)。

詳細な供給範囲は付録 B を参照してください。

○機器の分類と適正

安全分類の観点から CHWS-1 B 冷凍ユニットは保護重要コンポーネント (PIC)SIC-2 に分類されます。適用可能な計装および制御安全分類は SIC-2 B です。システムの設計により都合が良い場合、供給者は、主制御システムが利用できない場合に基本機能のみをカバーするために使用される、ハードウェア

化された技術に基づく並列安全制御システムを提案しなければなりません。

供給範囲に含まれる装置は、それが設計されていることを証明するための十分な適正を有するものとし、メーカーは、該当する事象の発生前、発生中および発生後に故障が発生することなく、要求された機能を実行することができます。

認定計画書はベンダーからの発注後に発行されます。以下を含むものとしますが、これらに限定されません：

耐震基準：耐震基準は SC-1 (SF) 。供給された装置は、系統に影響のない安定性及び機能性（注 1 参照）SL-2 カテゴリーの地震（該当するフロア応答スペクトル、FRS については付録 D を参照）に耐えるものとします。

静磁場認定

電磁両立性認定

材料トレーサビリティ

加齢の影響の評価

電気および計装/制御の適正：安全運転のための装置は、RCC-E（カテゴリー K 3、該当する環境条件については 4 項参照）に従って認定されたものとします。

（以下詳細は英文技術仕様書を参照ください）

○パッケージデザイン

（詳細は英文技術仕様書を参照ください）

○規制の枠組み

（詳細は英文技術仕様書を参照ください）

○提案時に提出する文書

（詳細は英文技術仕様書を参照ください）

【※ 詳しくは添付の英語版技術仕様書「**Technical Summary for CHWS-1B Air Cooled Chillers**」をご参照ください。】

ITER 公式ウェブ <http://www.iter.org/org/team/adm/proc/overview> からアクセスが可能です。

「核融合エネルギー研究開発部門」の HP : <http://www.fusion.qst.go.jp/ITER/index.html>
では ITER 機構からの各募集（IO 職員募集、IO 外部委託、IO エキスパート募集）を逐次更新しています。ぜひご確認ください。

イーター国際核融合エネルギー機構からの外部委託 に関心ある企業及び研究機関の募集について

＜ITER 機構から参加極へのレター＞

以下に、外部委託の概要と要求事項が示されています。参加極には、提案された業務に要求される能力を有し、入札すべきと考える企業及び研究機関の連絡先の情報を ITER 機構へ伝えることが求められています。このため、本研究・業務に関心を持たれる企業及び研究機関におかれましては、応募書類の提出要領にしたがって連絡先情報をご提出下さい。



china eu india japan korea russia usa

Route de Vinon-sur-Verdon - CS 90 046 - 13067 St Paul Lez Durance Cedex - France

To: Potential Candidates

Ref: IO/MS/23/YLI

Subject: Letter of Invitation for the Market Survey on “Supply of CHWS-1B Air Cooled Chillers”

Dear Madam/Sir,

The ITER Organization (IO) launches a Market Survey and requests information from companies having the interest, knowledge and capacity related to: **CHWS-1B Air Cooled Chillers**.

The main purpose of this Market Survey is to evaluate the market situation and to identify candidate suppliers having the potential capabilities to respond to the IO solicitation.

Please note that this is not a Call for Nomination.

You will find enclosed the Technical Summary related to this Market Survey (Annex I).

With this letter, we invite all potential companies, institutions or entities from ITER Member States to participate to this Market Survey through the questionnaire (Annex II).

We kindly invite the Domestic Agencies to publish this Market Survey on their websites or through other advertising methods, which will help to retrieve the requested information from a maximum of potential candidates.

Interested parties can return the completed questionnaire, **no later than 19th January 2024**, to the following email address Ye.Li@iter.org and in copy Andrew.Brown@iter.org .

Thanks in advance for your co-operation.

Yours faithfully,

Andrew Brown
Group Leader
Construction, Assembly and Logistics Section

Technical Specifications (In-Cash Procurement)

Technical Summary for CHWS-1B Air Cooled Chillers

This Technical Summary collects the main technical requirement for SIC qualified Air Cooled Chillers for system CHWS-1B.

It will be used for a market survey on available solutions for this equipment.

Table of Contents

1 PURPOSE2

2 SCOPE OF SUPPLY2

3 EQUIPMENT CLASSIFICATION AND QUALIFICATION.....2

4 PACKAGE DESIGN3

4.1 DESIGN CONSTRAINTS3

4.2 ENVIRONMENTAL CONDITIONS4

5 REGULATORY FRAME4

6 DOCUMENTATION TO BE PROVIDED WITH THE PROPOSAL.....4

APPENDIX A – SIMPLIFIED SYSTEM DIAGRAM.....5

APPENDIX B – SCOPE OF SUPPLY AND BATTERY LIMITS6

APPENDIX C - PROCESS DATASHEET.....8

APPENDIX D – FLOOR RESPONSE SPECTRA9

APPENDIX E –INSTALLATION AREA ON B74 – R1.....10

1 Purpose

CHWS-1A/B systems provide cooling water at 6°C to safety related clients (see Appendix A). The heat is then transferred from clients to the environment via air-cooled refrigeration units.

CHWS-1 A/B design considers two completely independent and segregated subsystems which are inherently compliant with the equipment redundancy assured by the clients.

Cooling function is continuously required in plant normal operation operation (refer to section 4.1).

During Accidental Conditions, additional safety related clients will be cooled by the system.

Each train consists of three air cooled chillers, two horizontal centrifugal pumps (1 working and 1 in standby), a water polishing unit, a pressurizer, strainers, valves, together with a dedicated piping distribution as well as instrumentation for monitoring and operational purposes.

This Technical Summary will be used for a market survey on available solutions for the SIC qualified Refrigeration Units required for system CHWS-1B.

2 Scope of Supply

The scope of supply shall include one Complete Refrigeration Package. Composed by 3 Identical Air Cooled Chiller Units (Tags: 26CH1B-CHI-1001&1002&1003) installed in parallel (Refer to Appendix A).

The chilled water circulation pumps are supplied by others and excluded from this scope of this document.

Each Unit shall include all required Mechanical, Electrical and Instrumentation & Control equipment required for its safe and reliable operation under the duty conditions established in Section 4.

Each Unit shall be installed on one independent skid along with required seismic isolation devices (to be included in the scope of vendor).

Taking into account that pump run at fixed speed and that chilled water flow is equally divided among the 3 units, Supplier should propose as option any additional equipment required to coordinate the repartition of the duty among the 3 Units (e.g. additional control unit).

Refer to Appendix B for Detailed scope of supply.

3 Equipment Classification and Qualification

From Safety Classification point of view CHWS-1B Refrigeration Units are Protection Important Component (PIC) that falls in **SIC-2** category.

Applicable instrumentation and control Safety Classification is **SIC-2B**. If more convenient for the design of the system, supplier should propose a parallel safety control system based on hardwired technology, used to cover only basic functions when main control system is not available,

Equipment included in the scope of supply shall be **fully qualified** to demonstrate that it has been designed and manufacturer to perform the required function without experiencing failures before, during and after applicable events.

A qualification plan will be issued after order by vendor. It shall include but is not limited to:

<u>Seismic Qualification</u> : Seismic Qualification is SC-1 (SF) . The supplied equipment shall withstand a SL-2 category earthquake (Refer to Appendix D for applicable Floor Response Spectra, FRS) with no impact on system stability and functional capacity (see Note 1)
<u>Static Magnetic Field Qualification</u>
<u>Electromagnetic Compatibility Qualification</u>
<u>Material Traceability</u>
<u>Evaluation of the effects of Aging</u>
<u>Electrical and Instrumentation/Control Qualification</u> : equipment for safety operation shall be qualified as per RCC-E (category K3 , refer to section 4 for applicable environmental conditions)

Note 1: A Seismic Isolation Device has been included in the scope (refer to Appendix B) to reduce the accelerations to acceptable level for the equipment installed onskid. Taking into account applicable FRS, supplier to state in the proposal if this equipment is required. Qualification plan shall indicate how the seismic qualification of the assembly can be achieved (e.g. shaking table test of chiller unit installed on seismic isolation device).

4 Package Design

4.1 Design Constraints

Design Life	30 years	
Duty	Nominal Thermal Power for the Refrigeration package = 2500 kW. To be shared between the three Units. This is the maximum thermal power required in accidental conditions (with ~5% margin). Normal operation duty is lower. Refer Process Datasheet in Appendix C for all operating cases.	
Chilled Water Flow	346 m ³ /h constant flow, equally divided among the 3 units (115m ³ /h per unit).	
Regulation	In order to guarantee continuous availability of cooling function regulation range shall be 0-100%. The regulation target is to guarantee, in all operating conditions, a temperature of 6°C in the chilled water manifold downstream the refrigeration package (refer to Appendix A). If strictly required, slight deviation to the target temperature can be accepted and shall be indicated by supplier in the proposal. However, vendor could propose to reduce the number of continuously working units in normal operation, if this is considered the optimal configuration for the refrigeration units. In accidental case all units will be running. Vendor to indicate the methods of regulations required (e.g. hot gas bypass), taking into account that continuous start/stop regulation is not acceptable.	
Chilled Water Design Conditions	Pressure (MPa absolute)	0.9
	Temperature (°C)	50
Chilled Water Quality	Liquid Handled	Demineralized Water (no glycol allowed)
	Operating Water Temperature Inlet / Outlet °C	12 / 6
	Sp. Gr.	1.0
	Conductivity @ 25 °C, µS/cm	≤ 1.0
	pH @ 25 °C	6.5 - 7.5
	Dissolved Oxygen conc. max. (ppb)	≤ 20
	Chloride, max. (ppb)	≤ 10
	Iron, max. (ppb)	≤ 10
	Copper, max. (ppb)	≤ 10
	Sodium, max. (ppb)	≤ 10
	TOC, max. (ppb)	≤ 100
	Silica max. (ppb)	≤ 200
Refrigerant Gas	Global Warming Potential (GWP)	<10
	Minimum pressure in the refrigerating circuit in all operating conditions shall be higher than atmospheric pressure	
	Low Flammability gas are preferred	
Available Footprint	For Each unit: ~9150x2440 mm. with a clearance between chiller units of ~2050mm (refer to Appendix E)	
Materials Of Construction	<u>Evaporator:</u> Austenitic Stainless Steel is the preferred material for the parts of evaporators in contact with chilled water. Supplier can propose other construction material taking into account the chilled water parameters (refer to 4.2), the given design conditions and the required qualifications <u>Other Equipment:</u> Supplier can propose other construction material taking into account the chilled water parameters (refer to 4.2), the given design conditions and the required qualifications	
Required Unit Availability	Failure to Start < 9.21E-03/day Failure to Run < 6.93E-05/hour	
Allowable Sound Pressure Level	<85 dBA at 1 meter of the skid	

4.2 Environmental Conditions

Units will be installed **outdoor**, on the roof of Diagnostic Building (B74-R1, Tokamak Complex).

Equipment of each unit (except condensers) shall be installed inside a **container/cabinet**.

Ambient Conditions	Maximum	Minimum
Temperature, °C	+ 45	- 25
Relative Humidity, % at 40 °C	60	
Annual Rainfall, mm	965	289
Daily Rainfall, mm	180	
Hourly Rainfall, mm	120	
Daily Snowfall, mm	230	
Wind Speed, m/s	25.22	
Static Magnetic Field	12mT*	
ATEX Area Classification	Safe**	
Radiation dose	Not Applicable	
Seismic Loads	Refer to Appendix D	

*a safety coefficient of 1.4 has to be applied to this value for the qualification to static magnetic field

**Adequate ATEX certification shall be included in the scope if required by the chiller configuration (type of gas, installation in closed container/cabinet)

5 Regulatory Frame

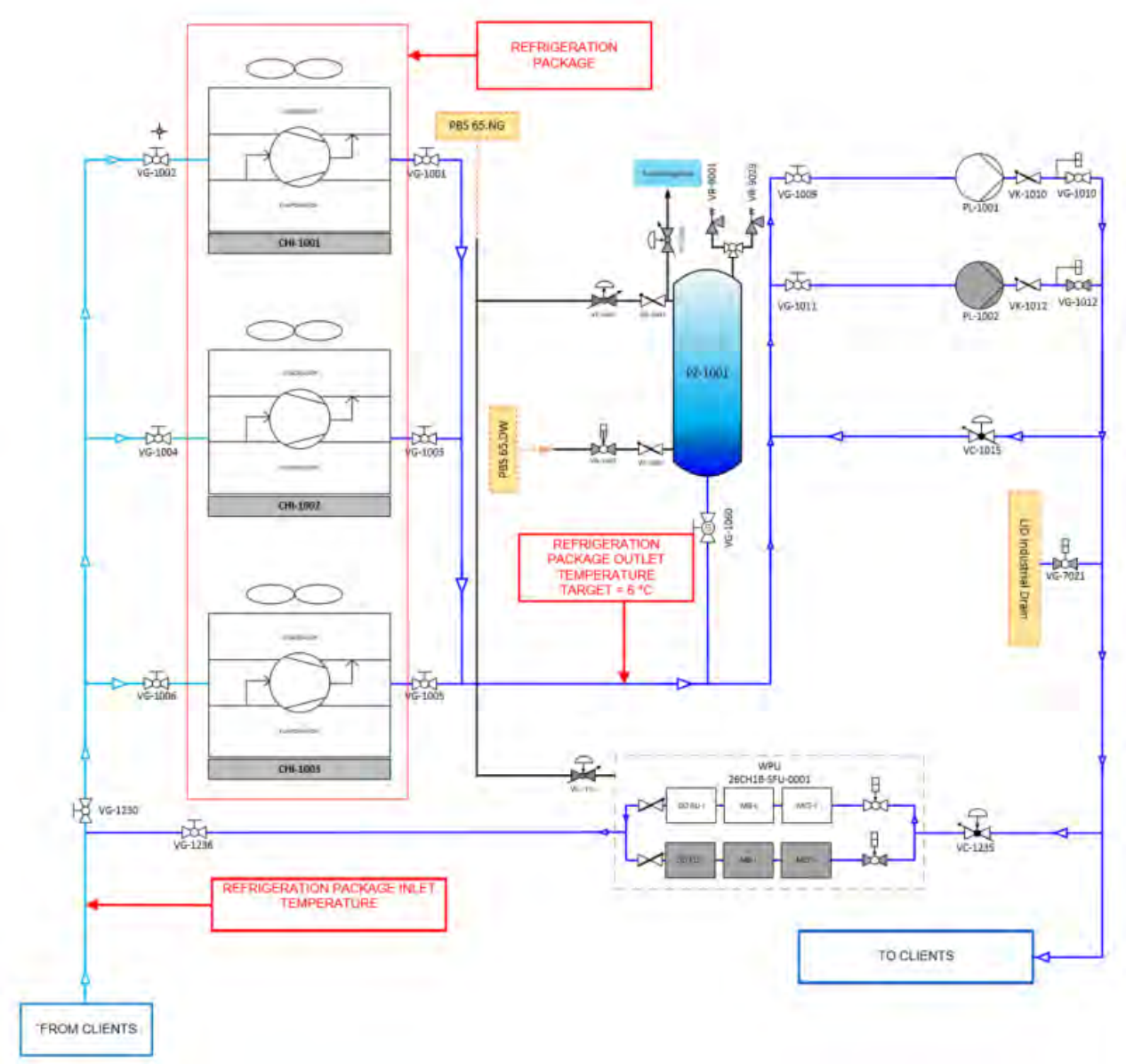
Offered package shall be in compliance with applicable French and European Regulation. This includes but is not limited to:

European Directive on machinery 2006/42/EC. Annex II, 1A to be applied for package certification
European Directive relative to pressure equipment 2014/68/UE
European Directive on Low Voltage Equipment 2014/35/UE
European Directive on Electromagnetic Compatibility 2014/30/UE
Cahier technique professionnel pour le suivi en service des systèmes frigorifiques sous pression” (CTP) du 23/07/2020
ASME Section VIII Division 1 (or equivalent)
RCC-E: Design and Construction rules for Electrical Equipment of Nuclear Island
AHRI Standard 551 591-2023 - Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle
IEC 60709 – 2018: Nuclear power plants - Instrumentation, control and electrical power systems important to safety - Separation
IEC/IEEE 60780 – 323 – 2016: Nuclear facilities - Electrical equipment important to safety - Qualification
IEC 60980 – Recommended Practices for Seismic Qualification of Electrical Equipment of the Safety System for nuclear generating stations
ASME-QME-1 2012-01-01 – Qualification of Active Mechanical Equipment Used in Nuclear Power Plants

6 Documentation to be provided with the Proposal

Minimum Set of Documentation
Technical Selection / Unit Datasheet
General arrangement drawing with overall dimensions (typical)
Technical Description of the package including Instrumentation and Control Arrangement
Unit/Package PID
Supplier Reference Lists for similar applications

Appendix A – Simplified System Diagram




Appendix B – Scope of Supply and Battery Limits

SCOPE OF SUPPLY OF EACH REFRIGERATION UNIT (Total Qty 3)	
1. Refrigeration gas compressor(s):	<ul style="list-style-type: none"> • Hermetic construction is preferred. • Semi-hermetic construction can be accepted or can be proposed by vendor as option, • Compressor electric motor(s) designed as per Manufacturer Standard, integral to compressors body, • Screw compressor technology has been considered as the base case. Other Technologies can be proposed by vendor based on his reference and his technical expertise. Reciprocating compressors are forbidden. • Compressors complete lube oil systems with oil separator and oil cooler (if required),
2. Evaporator, shell & tubes type,	
3. Forced Air Cooled condensers with AC type Fan motors,	
4. Economizer (Optional). To be included by vendor if required to cope with required operating conditions,	
5. Variable Frequency Drive (Optional). To be included by vendor to cope with required regulation range	
6. Hot gas bypass (Optional). To be included by vendor to cope with required regulation range	
7. On-skid set of safety and control instrumentations:	<ul style="list-style-type: none"> • High and Low Pressure switches/sensors for compressor inlet/discharge(1 set for each compressor), • Temperature Sensors for Evaporator Inlet And Outlet, • Flow transmitter on Evaporator Inlet to detect risk of freezing, • All other required safety and control instrumentation for safe and reliable operation of the package, • Instrumentation Junction Boxes, • Supplier to consider requirements on Separation for instrumentation important to safety.
8. All required pressure safety valves dual, fitted on three ways isolating valves	
9. Piping, Valves and fitting inside the skid	
10. Refrigerant gas receiver, flanged, valved, sized for complete refrigerant circuit drain	
11. First Charge of Refrigerant Gas	
12. Electrical Cabinet(s):	<ul style="list-style-type: none"> • Installed on skid to manage Electrical Motors and power distribution for any other equipment on skid (auxiliary equipment, PLC, HMI, valves...) • VFD (if required for regulation) or Softstarter for main AC motors shall be included in same cabinet or in a separated cabinet installed on skid • DOL start method for main motors is not accepted • One common entry for power supply in each refrigeration unit at the interface point along with required cable glands
13. PLC with local HMI panel installed in a dedicated control cubicle	<ul style="list-style-type: none"> • Preferred installation area is on skid • Supply to a centralized PLC able to control the duty and power repartition among the three chiller units is Optional, to be proposed by vendor • Units Control Parameters will be reported in control room. Required interface connections (hardwired and Modbus) to be provided by Vendor at battery limits • Units shall be designed to be operated either locally or remotely via control interface signals.
14. Cabinet/Container	<ul style="list-style-type: none"> • To protect from extreme environmental conditions all equipment included in the scope of supply, except condenser. Condenser will be installed on the top of the cabinet • Cabinet/Container configuration shall guarantee full accessibility and maintainability of components

<ul style="list-style-type: none">Required HVAC, fire protection, noise insulation and leakage detection devices shall be included in the scope
15. Metallic Cable Glands at battery limits
16. Anti-freezing system, heat insulation/tracing, if required by the design of the equipment
17. Baseplate, with its anchor bolts and stainless steel shimming,
18. Seismic isolation structure/devices to cope with applicable seismic Floor Response Spectra (Refer to Appendix D):
<ul style="list-style-type: none">It shall include all devices required to reduce accelerations to acceptable levels for the unit (e.g. dampers, springs)It shall include all structural elements required for the interface with unit baseplate and civil works. A secondary baseplate is required at the interface with foundation
19. All additional item to be supplied to cover the complete qualification of the chillers, including, if required, full scale test equipment
20. Testing (required quality class : QC-1):
<ul style="list-style-type: none">Full Scale Performance TestingAll Other Required Testing required by the applicable Quality Class as well as by Applicable Standards and Codes (3.1 Material Certificates, NDTs, etc.)All Testing Required in the Qualification plan, including full scale <u>shaking table test</u> for seismic qualification
21. All Required Surface protection and coating suitable for Outdoor installation
22. All Required Spares for Commissioning and Start-up
23. Quality documentation specific to material and components of each unit
24. All power and Instrumentation and Control cabling inside the skid battery limits.
25. UPS equipment (including accumulators) when required by Vendor to reach the safe state of the units after complete loss of main power supply
COMMON SCOPE OF SUPPLY FOR ALL REFRIGERATION UNITS
26. Additional centralized PLC (Optional) for the load repartition/regulation of the three chiller units, Including required interconnection cabling and communication with the individual PLCs of each refrigeration unit.
27. All Drawings, Calculation Notes, Common Qualification documentation as per agreed Vendor Document List (to be discussed later)

BATTERY LIMITS	
Process	Flanged Connection at Skid Edge for Evaporator Inlet and Outlet
Electrical	1 Single Electrical Connection at Skid Edge, 400 VAC 50 Hz, 3P+N+PE. The rest of voltage levels to be generated internally inside the electrical cabinet of each skid by the vendor.
Instrumentation	Junction Boxes at battery limits. Modbus (signal related to non-safety functions) and Hardwired (signals related to safety functions). Separation to be applied between safety and non-safety classified instrumentation
Civil/Structure	Chillers will be anchored on plinths equipped with embedded plates (Refer to Appendix E)

Appendix C - Process Datasheet

 REFRIGERATION PACKAGE DATASHEET PROCESS DATA											
REFRIGERATION PACKAGE CONFIGURATION											
Package vendor : _____ Package manufacturer : _____ N. of refrigeration Units included the package : <u>3</u> Unit model : _____ Units process sparing : <u>3x33%</u>						System : <u>CHWS-1B</u> Service : <u>Chilled Water</u> Units TAGs : <u>26CH1B-CHI-1001/1002/1003</u> Compressors items TAGs : _____ Evaporators items TAGs : _____ Condensers items TAGs : _____ Other : _____ Other : _____					
Quantity of elements per unit : Compressor : <input type="radio"/> Serial <input type="radio"/> Parallel Condenser : <input type="radio"/> Serial <input type="radio"/> Parallel Evaporator : <input type="radio"/> Serial <input type="radio"/> Parallel Other : <input type="radio"/> Serial <input type="radio"/> Parallel Other : <input type="radio"/> Serial <input type="radio"/> Parallel Other : <input type="radio"/> Serial <input type="radio"/> Parallel						Refrigeration Package Control: Control system of each package: <input checked="" type="radio"/> Local PLC <input type="radio"/> Centralized Control System Centralized Control System for the Refrigeration Unit (3) <input checked="" type="radio"/> Local PLC <input type="radio"/> Centralized Control System					
Package service description : Normal Operation: Package is continuously operated. Duty can vary from Minimal to Maximal Thermal Load Operation during accidents: Additional safety related clients will be cooled by the package. Duty can vary during the operation and can go down to low thermal power. In order to insure prompt availability of the cooling function, 0-100% regulation range has been considered. Start/stop regulation is forbidden Cooling water flowrate is constant et equally divided between the three units. No water flow regulation device is taken into account Inlet and Outlet temperature is referred to the mixing point downstream to chillers Target Temperature to clients is 6 °C. Vendor to indicate if this value can be guaranteed in all operating cases.											
PROCESS CONDITIONS IN OPERATING CASES											
	Design (Accidental Conditions)		Maximal Normal Operation		Minimal Normal Operation		Case 4		Case 5		
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	
Temperature (4) :	6	12.0	6	9.1	6	6.9					°C
Pressure :											bar a
Total process flowrate :	346		346		346						m³/h
Latent heat :											J/kg
Density :	1000		1000		1000						kg/m³
Viscosity :											cP
Thermal Conductivity :											W/mk
Solidification Temperature :											°C
Specific Heat	4186		4186		4186						J/kgK
Package Duty											
Total Duty Required :	2400		1230		350						kW
N. of Units in operation (7):	3		2		2						
Duty of each chiller unit :	800		615		175						kW
Electrical Power for each chiller :											kW
Total Electrical Power :											kW
Energy Efficiency Ratio :											
Duration :											days/year
Design Refrigeration Power <u>2400</u> kW Required Margin on Refrigeration power <u>4.5</u> % Total Refrigeration Power Required <u>2508</u> kW reached with <u>3</u> units in operation Refrigeration power required for each chiller unit : <u>836</u> kW (1) Refrigeration power provided for each chiller unit : <u>836</u> kW (5) Control / regulation : <input type="radio"/> By compressor slide control valve <input type="radio"/> By speed variation <input type="radio"/> By Hot gas by-pass (5) Regulation Range : from <u>0</u> % to <u>100</u> % (2)											
REMARKS											
(1) Refrigeration power required for each chiller unit shall cover power required in maximum case											
(2) Regulation Range takes into account the Refrigeration Margin.											
(3) Need for a centralized PLC to be discussed with Vendor taking into account the different load cases											
(4) Outlet temperature is calculated from required thermal load. Refer to table at page 3 for allowable process values											
(5) Method of regulation to be defined by vendor.											

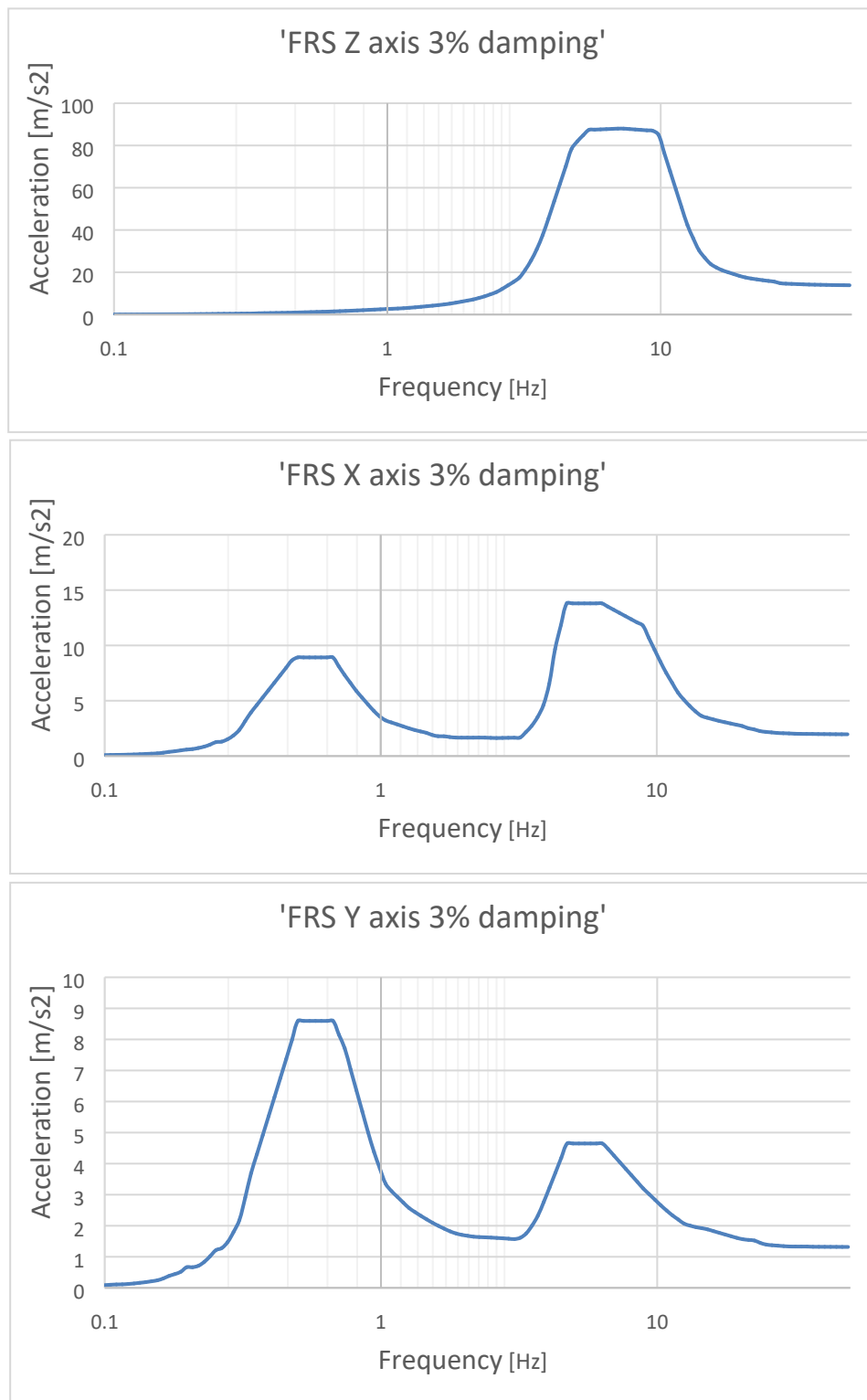
Appendix D – Floor Response Spectra

The values curves here below represent the SL-2 FRS in the installation area of the equipment.

Damping value considered for mechanical and electrical equipment in ITER standards is 3%.

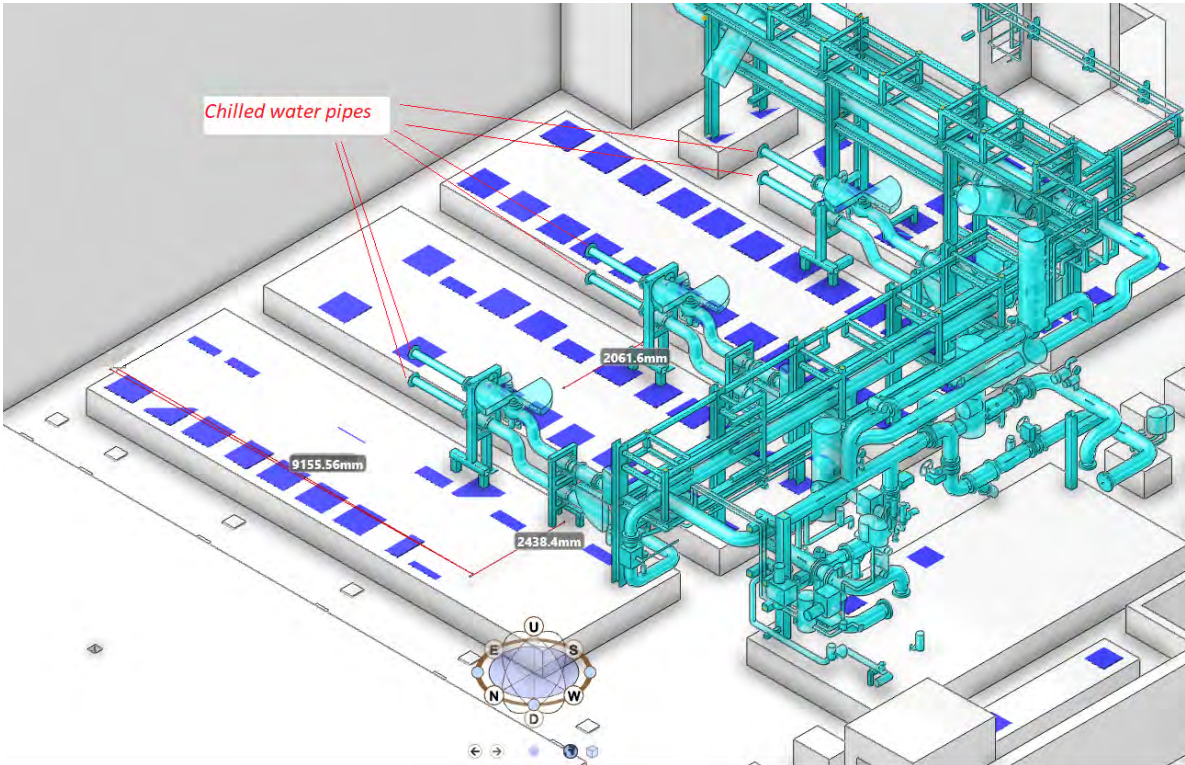
This is taken from U.S. Nuclear Regulatory Commission - REGULATORY GUIDE 1.61-DAMPING VALUES FOR SEISMIC DESIGN OF NUCLEAR POWER PLANTS - Washington, DC 20555-0001 - March 2007

Vendor to check and validate the damping factor to be applied.

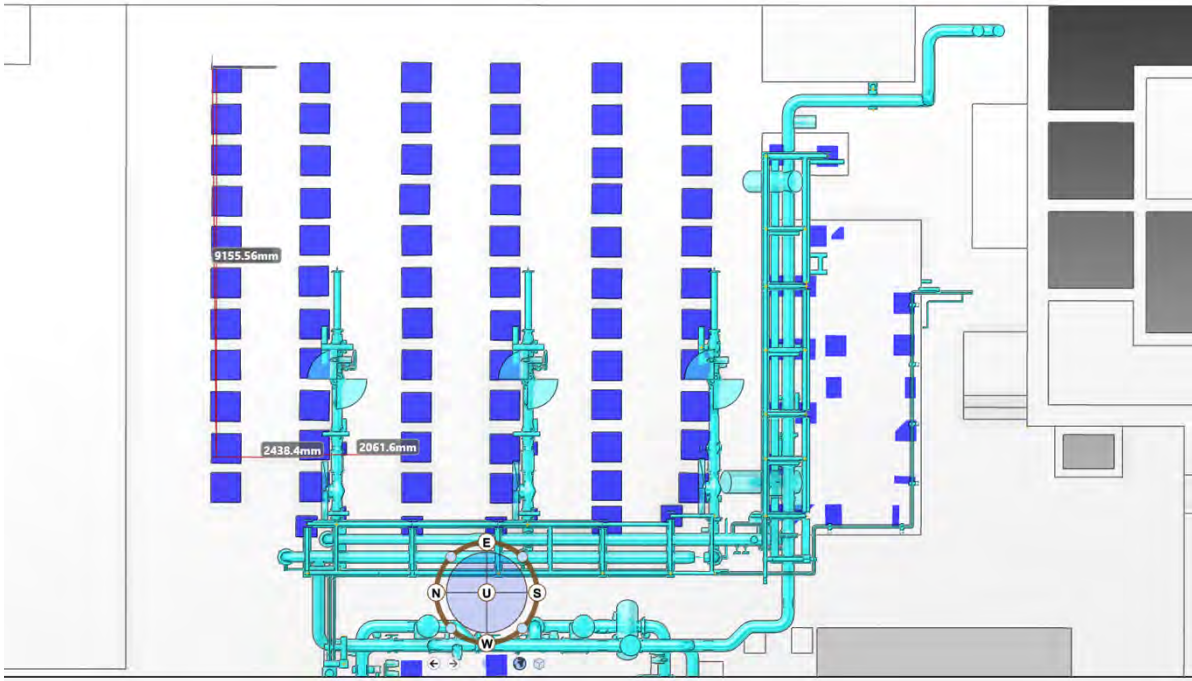


Appendix E –Installation Area on B74 – R1

Overall View of the installation Area (3 adjacent Plinths with embedded plates)



Location of embedded plates on chillers plinths



Technical Questionnaire - 26CH1B-0		
Question		
		Package Duty and
1	<p>Nominal cooling power required for the package is 2500 kW (~835kW per unit). Regulation range is 0-100% to be achieved without continuous start/stop of machines. Please identify the different regulation methods that will be applied in required regulation range.</p>	
2	<p>Target Temperature at the mixing point downstream the three Unit Evaporators is 6° C. Water flow is constant and equally distributed to the 3 units. Vendor to clarify if target temperature can be achieved in all operating cases as per Appendix C of the technical summary. If strictly required during transients or unfavourable operating conditions, slight deviations to the target temperature can be accepted.</p>	
3	<p>Refrigeration package shall be available to operate in all environmental conditions included in section 4.2 of Technical Summary.</p> <p>i. No glycol will be used in the chilled water circuit. Please confirm that all required anti-freezing protection will be included in the scope (e.g. for evaporator and chilled water piping in the scope of vendor, for air cooled condensers during extreme winter conditions).</p> <p>ii. Is this protection effective even there is no flow on chilled water circuit?</p>	
4	<p>Can Vendor Guarantee the availability requirement included in section 4.1 of the Technical Summary? Can a RAM (Reliability, Availability and Maintainability) study be performed by Vendor if required?</p>	
		Qualificati
5	<p>Package is classified as Safety Important Class SIC-2.</p> <p>Package instrumentation and control components that fulfil safety functions are SIC-2B classified.</p> <p>Has Vendor already provided chiller units that have been fully qualified for Nuclear Applications?</p>	
6	<p>Can vendor Provide RCC-E category K3 qualified Electrical and Instrumentation equipment</p>	

	Do Vendor propose a PLC fully qualified for Nuclear Applications (including Software/Algorithms)?
7	If a fully qualified complete PLC is not available, can Vendor propose a parallel (hardwired) Safety Control System to take care of the basic safety function when main control system is not available?
8	Is vendor able to provide qualification to static magnetic fields as per section 4.2 of Technical Summary? Units have to guarantee full functionality during and after a SL-2 Seismic Event.
9	i. Can proposed chillers be qualified to the seismic load included in Appendix D of Technical Summary? ii. Is this achieved with or without Seismic Isolation Devices? iii. Has supplier already performed or is able to perform a shaking table test on complete units.
10	Is Vendor able to demonstrate that proposed equipment can fulfil its safety functions during all required operating life (30 years)?

Materials of Construction	
---------------------------	--

11	Stainless Steel has been required as base case material for parts of the chillers in contact with chilled water (e.g. evaporator tubes and water boxes). Please confirm supply of stainless steel or indicate alternative proposed material suitable for chilled water parameters included in section 4.1 of the technical summary (e.g. pH range = 6.5-7.5). Vendor to confirm that materials exposed to the outdoor environment (e.g. air cooled
12	condensers) shall withstand ambient conditions included in section 4.2 of the technical summary.

Installation	
--------------	--

13	Installation Area is Outdoor (unsheltered). A container/cabinet is required to protect from extreme environmental conditions all components in the scope except forced air condenser that will be installed on the roof of the container itself. Is supplier able to supply this kind of configuration fulfilling all other requirements included in the Technical Summary? Installation layout is included in appendix E of Technical Summary.
14	Foundation Plinths with their embedded plates have already grouted. Supplier to confirm that available footprint for each unit is (~9150x2440 mm) and distance between adjacent chillers (~2050mm) can be respected

CHI-1001&1002&1003 Chillers

Supplier reply

Regulation

on

struction

on

イーター国際核融合エネルギー機構からの外部委託 に関心ある企業及び研究機関の募集について

＜ITER 機構から参加極へのレター＞

以下に、外部委託の概要と要求事項が示されています。参加極には、提案された業務に要求される能力を有し、入札すべきと考える企業及び研究機関の連絡先の情報を ITER 機構へ伝えることが求められています。このため、本研究・業務に関心を持たれる企業及び研究機関におかれましては、応募書類の提出要領にしたがって連絡先情報をご提出下さい。



china eu india japan korea russia usa

Route de Vinon-sur-Verdon - CS 90 046 - 13067 St Paul Lez Durance Cedex - France

To: Potential Candidates

Ref: IO/MS/23/YLI

Subject: Letter of Invitation for the Market Survey on “Supply of CHWS-1B Air Cooled Chillers”

Dear Madam/Sir,

The ITER Organization (IO) launches a Market Survey and requests information from companies having the interest, knowledge and capacity related to: **CHWS-1B Air Cooled Chillers**.

The main purpose of this Market Survey is to evaluate the market situation and to identify candidate suppliers having the potential capabilities to respond to the IO solicitation.

Please note that this is not a Call for Nomination.

You will find enclosed the Technical Summary related to this Market Survey (Annex I).

With this letter, we invite all potential companies, institutions or entities from ITER Member States to participate to this Market Survey through the questionnaire (Annex II).

We kindly invite the Domestic Agencies to publish this Market Survey on their websites or through other advertising methods, which will help to retrieve the requested information from a maximum of potential candidates.

Interested parties can return the completed questionnaire, **no later than 19th January 2024**, to the following email address Ye.Li@iter.org and in copy Andrew.Brown@iter.org .

Thanks in advance for your co-operation.

Yours faithfully,

Andrew Brown
Group Leader
Construction, Assembly and Logistics Section

Technical Specifications (In-Cash Procurement)

Technical Summary for CHWS-1B Air Cooled Chillers

This Technical Summary collects the main technical requirement for SIC qualified Air Cooled Chillers for system CHWS-1B.

It will be used for a market survey on available solutions for this equipment.

Table of Contents

1 PURPOSE2

2 SCOPE OF SUPPLY2

3 EQUIPMENT CLASSIFICATION AND QUALIFICATION.....2

4 PACKAGE DESIGN3

 4.1 DESIGN CONSTRAINTS3

 4.2 ENVIRONMENTAL CONDITIONS4

5 REGULATORY FRAME4

6 DOCUMENTATION TO BE PROVIDED WITH THE PROPOSAL.....4

APPENDIX A – SIMPLIFIED SYSTEM DIAGRAM.....5

APPENDIX B – SCOPE OF SUPPLY AND BATTERY LIMITS6

APPENDIX C - PROCESS DATASHEET.....8

APPENDIX D – FLOOR RESPONSE SPECTRA9

APPENDIX E –INSTALLATION AREA ON B74 – R1.....10

1 Purpose

CHWS-1A/B systems provide cooling water at 6°C to safety related clients (see Appendix A). The heat is then transferred from clients to the environment via air-cooled refrigeration units.

CHWS-1 A/B design considers two completely independent and segregated subsystems which are inherently compliant with the equipment redundancy assured by the clients.

Cooling function is continuously required in plant normal operation operation (refer to section 4.1).

During Accidental Conditions, additional safety related clients will be cooled by the system.

Each train consists of three air cooled chillers, two horizontal centrifugal pumps (1 working and 1 in standby), a water polishing unit, a pressurizer, strainers, valves, together with a dedicated piping distribution as well as instrumentation for monitoring and operational purposes.

This Technical Summary will be used for a market survey on available solutions for the SIC qualified Refrigeration Units required for system CHWS-1B.

2 Scope of Supply

The scope of supply shall include one Complete Refrigeration Package. Composed by 3 Identical Air Cooled Chiller Units (Tags: 26CH1B-CHI-1001&1002&1003) installed in parallel (Refer to Appendix A).

The chilled water circulation pumps are supplied by others and excluded from this scope of this document.

Each Unit shall include all required Mechanical, Electrical and Instrumentation & Control equipment required for its safe and reliable operation under the duty conditions established in Section 4.

Each Unit shall be installed on one independent skid along with required seismic isolation devices (to be included in the scope of vendor).

Taking into account that pump run at fixed speed and that chilled water flow is equally divided among the 3 units, Supplier should propose as option any additional equipment required to coordinate the repartition of the duty among the 3 Units (e.g. additional control unit).

Refer to Appendix B for Detailed scope of supply.

3 Equipment Classification and Qualification

From Safety Classification point of view CHWS-1B Refrigeration Units are Protection Important Component (PIC) that falls in **SIC-2** category.

Applicable instrumentation and control Safety Classification is **SIC-2B**. If more convenient for the design of the system, supplier should propose a parallel safety control system based on hardwired technology, used to cover only basic functions when main control system is not available,

Equipment included in the scope of supply shall be **fully qualified** to demonstrate that it has been designed and manufacturer to perform the required function without experiencing failures before, during and after applicable events.

A qualification plan will be issued after order by vendor. It shall include but is not limited to:

<u>Seismic Qualification</u> : Seismic Qualification is SC-1 (SF) . The supplied equipment shall withstand a SL-2 category earthquake (Refer to Appendix D for applicable Floor Response Spectra, FRS) with no impact on system stability and functional capacity (see Note 1)
<u>Static Magnetic Field Qualification</u>
<u>Electromagnetic Compatibility Qualification</u>
<u>Material Traceability</u>
<u>Evaluation of the effects of Aging</u>
<u>Electrical and Instrumentation/Control Qualification</u> : equipment for safety operation shall be qualified as per RCC-E (category K3 , refer to section 4 for applicable environmental conditions)

Note 1: A Seismic Isolation Device has been included in the scope (refer to Appendix B) to reduce the accelerations to acceptable level for the equipment installed onskid. Taking into account applicable FRS, supplier to state in the proposal if this equipment is required. Qualification plan shall indicate how the seismic qualification of the assembly can be achieved (e.g. shaking table test of chiller unit installed on seismic isolation device).

4 Package Design

4.1 Design Constraints

Design Life	30 years	
Duty	Nominal Thermal Power for the Refrigeration package = 2500 kW. To be shared between the three Units. This is the maximum thermal power required in accidental conditions (with ~5% margin). Normal operation duty is lower. Refer Process Datasheet in Appendix C for all operating cases.	
Chilled Water Flow	346 m ³ /h constant flow, equally divided among the 3 units (115m ³ /h per unit).	
Regulation	In order to guarantee continuous availability of cooling function regulation range shall be 0-100%. The regulation target is to guarantee, in all operating conditions, a temperature of 6°C in the chilled water manifold downstream the refrigeration package (refer to Appendix A). If strictly required, slight deviation to the target temperature can be accepted and shall be indicated by supplier in the proposal. However, vendor could propose to reduce the number of continuously working units in normal operation, if this is considered the optimal configuration for the refrigeration units. In accidental case all units will be running. Vendor to indicate the methods of regulations required (e.g. hot gas bypass), taking into account that continuous start/stop regulation is not acceptable.	
Chilled Water Design Conditions	Pressure (MPa absolute)	0.9
	Temperature (°C)	50
Chilled Water Quality	Liquid Handled	Demineralized Water (no glycol allowed)
	Operating Water Temperature Inlet / Outlet °C	12 / 6
	Sp. Gr.	1.0
	Conductivity @ 25 °C, µS/cm	≤ 1.0
	pH @ 25 °C	6.5 - 7.5
	Dissolved Oxygen conc. max. (ppb)	≤ 20
	Chloride, max. (ppb)	≤ 10
	Iron, max. (ppb)	≤ 10
	Copper, max. (ppb)	≤ 10
	Sodium, max. (ppb)	≤ 10
	TOC, max. (ppb)	≤ 100
	Silica max. (ppb)	≤ 200
Refrigerant Gas	Global Warming Potential (GWP)	<10
	Minimum pressure in the refrigerating circuit in all operating conditions shall be higher than atmospheric pressure	
	Low Flammability gas are preferred	
Available Footprint	For Each unit: ~9150x2440 mm. with a clearance between chiller units of ~2050mm (refer to Appendix E)	
Materials Of Construction	<u>Evaporator:</u> Austenitic Stainless Steel is the preferred material for the parts of evaporators in contact with chilled water. Supplier can propose other construction material taking into account the chilled water parameters (refer to 4.2), the given design conditions and the required qualifications <u>Other Equipment:</u> Supplier can propose other construction material taking into account the chilled water parameters (refer to 4.2), the given design conditions and the required qualifications	
Required Unit Availability	Failure to Start < 9.21E-03/day Failure to Run < 6.93E-05/hour	
Allowable Sound Pressure Level	<85 dBA at 1 meter of the skid	

4.2 Environmental Conditions

Units will be installed **outdoor**, on the roof of Diagnostic Building (B74-R1, Tokamak Complex).

Equipment of each unit (except condensers) shall be installed inside a **container/cabinet**.

Ambient Conditions	Maximum	Minimum
Temperature, °C	+ 45	- 25
Relative Humidity, % at 40 °C	60	
Annual Rainfall, mm	965	289
Daily Rainfall, mm	180	
Hourly Rainfall, mm	120	
Daily Snowfall, mm	230	
Wind Speed, m/s	25.22	
Static Magnetic Field	12mT*	
ATEX Area Classification	Safe**	
Radiation dose	Not Applicable	
Seismic Loads	Refer to Appendix D	

*a safety coefficient of 1.4 has to be applied to this value for the qualification to static magnetic field

**Adequate ATEX certification shall be included in the scope if required by the chiller configuration (type of gas, installation in closed container/cabinet)

5 Regulatory Frame

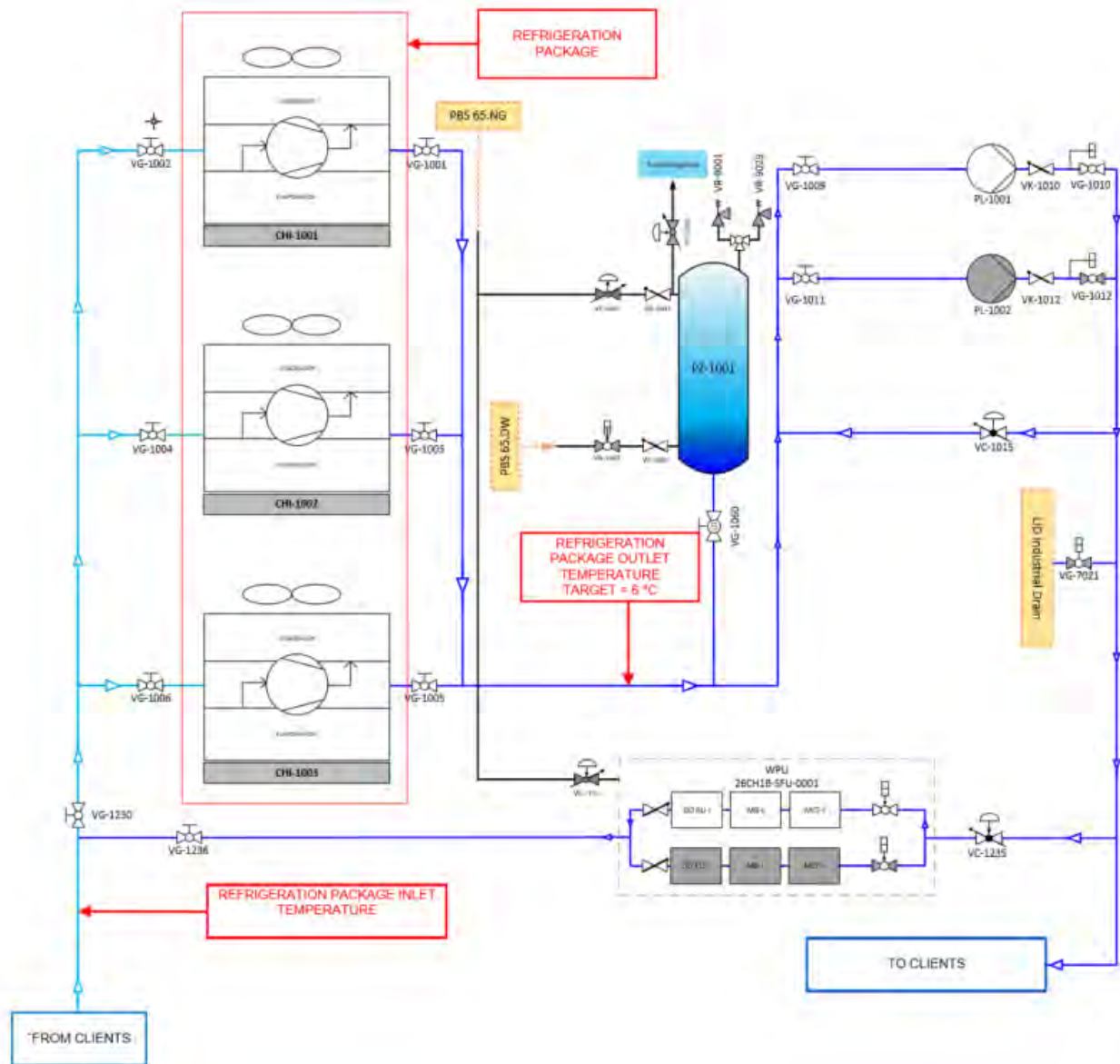
Offered package shall be in compliance with applicable French and European Regulation. This includes but is not limited to:

European Directive on machinery 2006/42/EC. Annex II, 1A to be applied for package certification
European Directive relative to pressure equipment 2014/68/UE
European Directive on Low Voltage Equipment 2014/35/UE
European Directive on Electromagnetic Compatibility 2014/30/UE
Cahier technique professionnel pour le suivi en service des systèmes frigorifiques sous pression” (CTP) du 23/07/2020
ASME Section VIII Division 1 (or equivalent)
RCC-E: Design and Construction rules for Electrical Equipment of Nuclear Island
AHRI Standard 551 591-2023 - Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle
IEC 60709 – 2018: Nuclear power plants - Instrumentation, control and electrical power systems important to safety - Separation
IEC/IEEE 60780 – 323 – 2016: Nuclear facilities - Electrical equipment important to safety - Qualification
IEC 60980 – Recommended Practices for Seismic Qualification of Electrical Equipment of the Safety System for nuclear generating stations
ASME-QME-1 2012-01-01 – Qualification of Active Mechanical Equipment Used in Nuclear Power Plants

6 Documentation to be provided with the Proposal

Minimum Set of Documentation
Technical Selection / Unit Datasheet
General arrangement drawing with overall dimensions (typical)
Technical Description of the package including Instrumentation and Control Arrangement
Unit/Package PID
Supplier Reference Lists for similar applications

Appendix A – Simplified System Diagram




Appendix B – Scope of Supply and Battery Limits

SCOPE OF SUPPLY OF EACH REFRIGERATION UNIT (Total Qty 3)	
1. Refrigeration gas compressor(s):	<ul style="list-style-type: none"> • Hermetic construction is preferred. • Semi-hermetic construction can be accepted or can be proposed by vendor as option, • Compressor electric motor(s) designed as per Manufacturer Standard, integral to compressors body, • Screw compressor technology has been considered as the base case. Other Technologies can be proposed by vendor based on his reference and his technical expertise. Reciprocating compressors are forbidden. • Compressors complete lube oil systems with oil separator and oil cooler (if required),
2. Evaporator, shell & tubes type,	
3. Forced Air Cooled condensers with AC type Fan motors,	
4. Economizer (Optional). To be included by vendor if required to cope with required operating conditions,	
5. Variable Frequency Drive (Optional). To be included by vendor to cope with required regulation range	
6. Hot gas bypass (Optional). To be included by vendor to cope with required regulation range	
7. On-skid set of safety and control instrumentations:	<ul style="list-style-type: none"> • High and Low Pressure switches/sensors for compressor inlet/discharge(1 set for each compressor), • Temperature Sensors for Evaporator Inlet And Outlet, • Flow transmitter on Evaporator Inlet to detect risk of freezing, • All other required safety and control instrumentation for safe and reliable operation of the package, • Instrumentation Junction Boxes, • Supplier to consider requirements on Separation for instrumentation important to safety.
8. All required pressure safety valves dual, fitted on three ways isolating valves	
9. Piping, Valves and fitting inside the skid	
10. Refrigerant gas receiver, flanged, valved, sized for complete refrigerant circuit drain	
11. First Charge of Refrigerant Gas	
12. Electrical Cabinet(s):	<ul style="list-style-type: none"> • Installed on skid to manage Electrical Motors and power distribution for any other equipment on skid (auxiliary equipment, PLC, HMI, valves...) • VFD (if required for regulation) or Softstarter for main AC motors shall be included in same cabinet or in a separated cabinet installed on skid • DOL start method for main motors is not accepted • One common entry for power supply in each refrigeration unit at the interface point along with required cable glands
13. PLC with local HMI panel installed in a dedicated control cubicle	<ul style="list-style-type: none"> • Preferred installation area is on skid • Supply to a centralized PLC able to control the duty and power repartition among the three chiller units is Optional, to be proposed by vendor • Units Control Parameters will be reported in control room. Required interface connections (hardwired and Modbus) to be provided by Vendor at battery limits • Units shall be designed to be operated either locally or remotely via control interface signals.
14. Cabinet/Container	<ul style="list-style-type: none"> • To protect from extreme environmental conditions all equipment included in the scope of supply, except condenser. Condenser will be installed on the top of the cabinet • Cabinet/Container configuration shall guarantee full accessibility and maintainability of components

<ul style="list-style-type: none">Required HVAC, fire protection, noise insulation and leakage detection devices shall be included in the scope
15. Metallic Cable Glands at battery limits
16. Anti-freezing system, heat insulation/tracing, if required by the design of the equipment
17. Baseplate, with its anchor bolts and stainless steel shimming,
18. Seismic isolation structure/devices to cope with applicable seismic Floor Response Spectra (Refer to Appendix D):
<ul style="list-style-type: none">It shall include all devices required to reduce accelerations to acceptable levels for the unit (e.g. dampers, springs)It shall include all structural elements required for the interface with unit baseplate and civil works. A secondary baseplate is required at the interface with foundation
19. All additional item to be supplied to cover the complete qualification of the chillers, including, if required, full scale test equipment
20. Testing (required quality class : QC-1):
<ul style="list-style-type: none">Full Scale Performance TestingAll Other Required Testing required by the applicable Quality Class as well as by Applicable Standards and Codes (3.1 Material Certificates, NDTs, etc.)All Testing Required in the Qualification plan, including full scale <u>shaking table test</u> for seismic qualification
21. All Required Surface protection and coating suitable for Outdoor installation
22. All Required Spares for Commissioning and Start-up
23. Quality documentation specific to material and components of each unit
24. All power and Instrumentation and Control cabling inside the skid battery limits.
25. UPS equipment (including accumulators) when required by Vendor to reach the safe state of the units after complete loss of main power supply
COMMON SCOPE OF SUPPLY FOR ALL REFRIGERATION UNITS
26. Additional centralized PLC (Optional) for the load repartition/regulation of the three chiller units, Including required interconnection cabling and communication with the individual PLCs of each refrigeration unit.
27. All Drawings, Calculation Notes, Common Qualification documentation as per agreed Vendor Document List (to be discussed later)

BATTERY LIMITS	
Process	Flanged Connection at Skid Edge for Evaporator Inlet and Outlet
Electrical	1 Single Electrical Connection at Skid Edge, 400 VAC 50 Hz, 3P+N+PE. The rest of voltage levels to be generated internally inside the electrical cabinet of each skid by the vendor.
Instrumentation	Junction Boxes at battery limits. Modbus (signal related to non-safety functions) and Hardwired (signals related to safety functions). Separation to be applied between safety and non-safety classified instrumentation
Civil/Structure	Chillers will be anchored on plinths equipped with embedded plates (Refer to Appendix E)

Appendix C - Process Datasheet

 REFRIGERATION PACKAGE DATASHEET PROCESS DATA												
REFRIGERATION PACKAGE CONFIGURATION												
1	Package vendor :						System : CHWS-1B					
2	Package manufacturer :						Service : Chilled Water					
3	N. of refrigeration Units included the package : 3						Units TAGs : 26CH1B-CHI-1001/1002/1003					
4	Unit model :						Compressors items TAGs :					
5	Units process sparing : 3x33%						Evaporators items TAGs :					
6							Condensers items TAGs :					
7							Other :					
8							Other :					
9												
10												
11	Quantity of elements per unit :						Refrigeration Package Control:					
12	Compressor : <input type="radio"/> Serial <input type="radio"/> Parallel						Control system of each package:					
13	Condenser : <input type="radio"/> Serial <input type="radio"/> Parallel						<input checked="" type="radio"/> Local PLC <input type="radio"/> Centralized Control System					
14	Evaporator : <input type="radio"/> Serial <input type="radio"/> Parallel						Centralized Control System for the Refrigeration Unit (3)					
15	Other : <input type="radio"/> Serial <input type="radio"/> Parallel						<input checked="" type="radio"/> Local PLC <input type="radio"/> Centralized Control System					
16	Other : <input type="radio"/> Serial <input type="radio"/> Parallel											
17	Other : <input type="radio"/> Serial <input type="radio"/> Parallel											
18												
19												
20	Package service description : Normal Operation: Package is continuously operated. Duty can vary from Minimal to Maximal Thermal Load											
21	Operation during accidents: Additional safety related clients will be cooled by the package.											
22	Duty can vary during the operation and can go down to low thermal power. In order to insure prompt availability of the cooling function, 0-100% regulation range has been considered. Start/stop regulation is forbidden											
23	Cooling water flowrate is constant et equally divided between the three units. No water flow regulation device is taken into account											
24	Inlet and Outlet temperature is referred to the mixing point downstream to chillers											
25	Target Temperature to clients is 6 °C. Vendor to indicate if this value can be guaranteed in all operating cases.											
26	PROCESS CONDITIONS IN OPERATING CASES											
27												
28	Design (Accidental Conditions)		Maximal Normal Operation		Minimal Normal Operation		Case 4		Case 5			
29	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet		
30												
31	Temperature (4) :	6	12.0	6	9.1	6	6.9				°C	
32	Pressure :										bar a	
33	Total process flowrate :	346		346		346					m³/h	
34	Latent heat :										J/kg	
35	Density :	1000		1000		1000					kg/m³	
36	Viscosity :										cP	
37	Thermal Conductivity :										W/mk	
38	Solidification Temperature :										°C	
39	Specific Heat	4186		4186		4186					J/kgK	
40												
41												
42	Package Duty											
43	Total Duty Required :	2400		1230		350					kW	
44	N. of Units in operation (7):	3		2		2						
45	Duty of each chiller unit :	800		615		175					kW	
46	Electrical Power for each chiller :										kW	
47	Total Electrical Power :										kW	
48	Energy Efficiency Ratio :											
49	Duration :										days/year	
50												
51	Design Refrigeration Power	2400		kW								
52	Required Margin on Refrigeration power	4.5		%								
53	Total Refrigeration Power Required	2508		kW	reached with 3 units in operation							
54	Refrigeration power required for each chiller unit :	836		kW	(1)							
55	Refrigeration power provided for each chiller unit :			kW	(5)							
56	Control / regulation :	<input type="radio"/> By compressor slide control valve <input type="radio"/> By speed variation <input type="radio"/> By Hot gas by-pass (5)										
57	Regulation Range :	from 0 %	to 100 %		(2)							
58												
59	REMARKS											
60	(1) Refrigeration power required for each chiller unit shall cover power required in maximum case											
61	(2) Regulation Range takes into account the Refrigeration Margin.											
62	(3) Need for a centralized PLC to be discussed with Vendor taking into account the different load cases											
63	(4) Outlet temperature is calculated from required thermal load. Refer to table at page 3 for allowable process values											
64	(5) Method of regulation to be defined by vendor.											

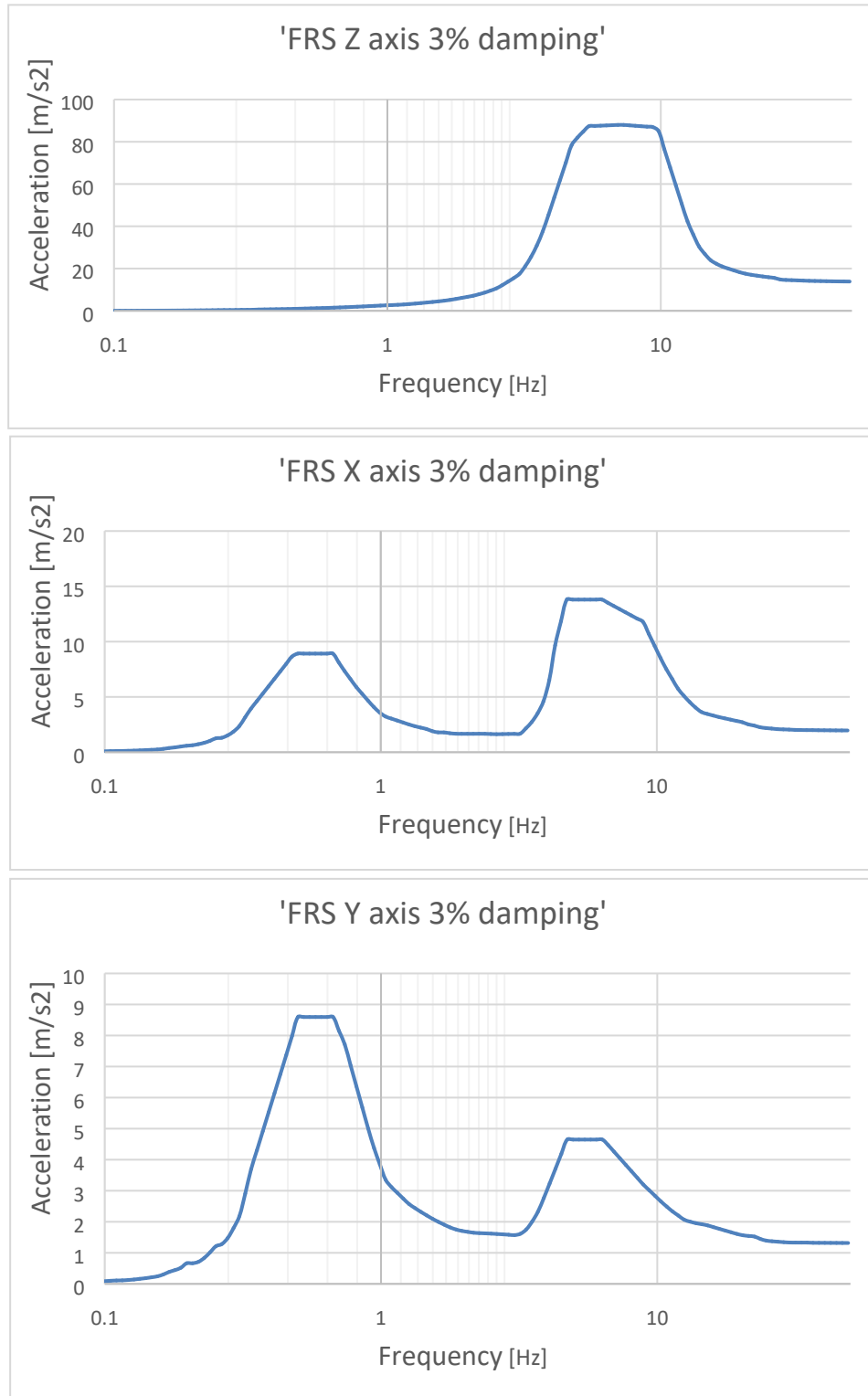
Appendix D – Floor Response Spectra

The values curves here below represent the SL-2 FRS in the installation area of the equipment.

Damping value considered for mechanical and electrical equipment in ITER standards is 3%.

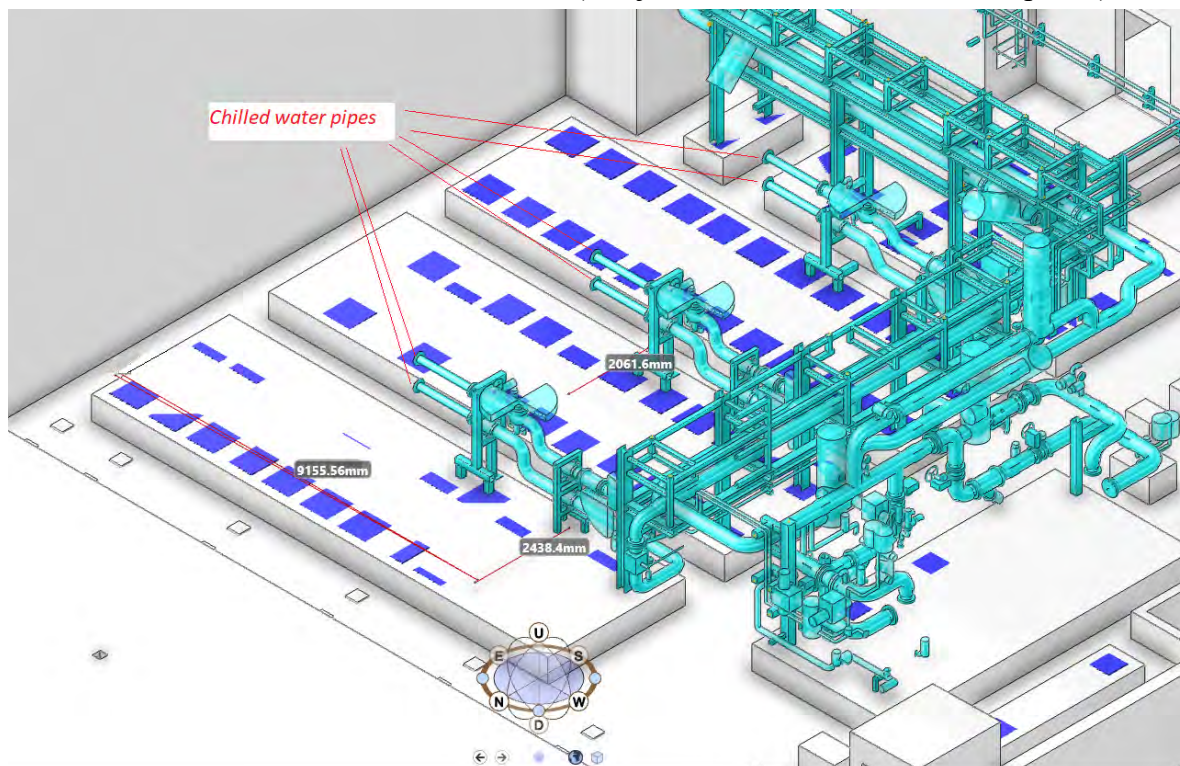
This is taken from U.S. Nuclear Regulatory Commission - REGULATORY GUIDE 1.61-DAMPING VALUES FOR SEISMIC DESIGN OF NUCLEAR POWER PLANTS - Washington, DC 20555-0001 - March 2007

Vendor to check and validate the damping factor to be applied.

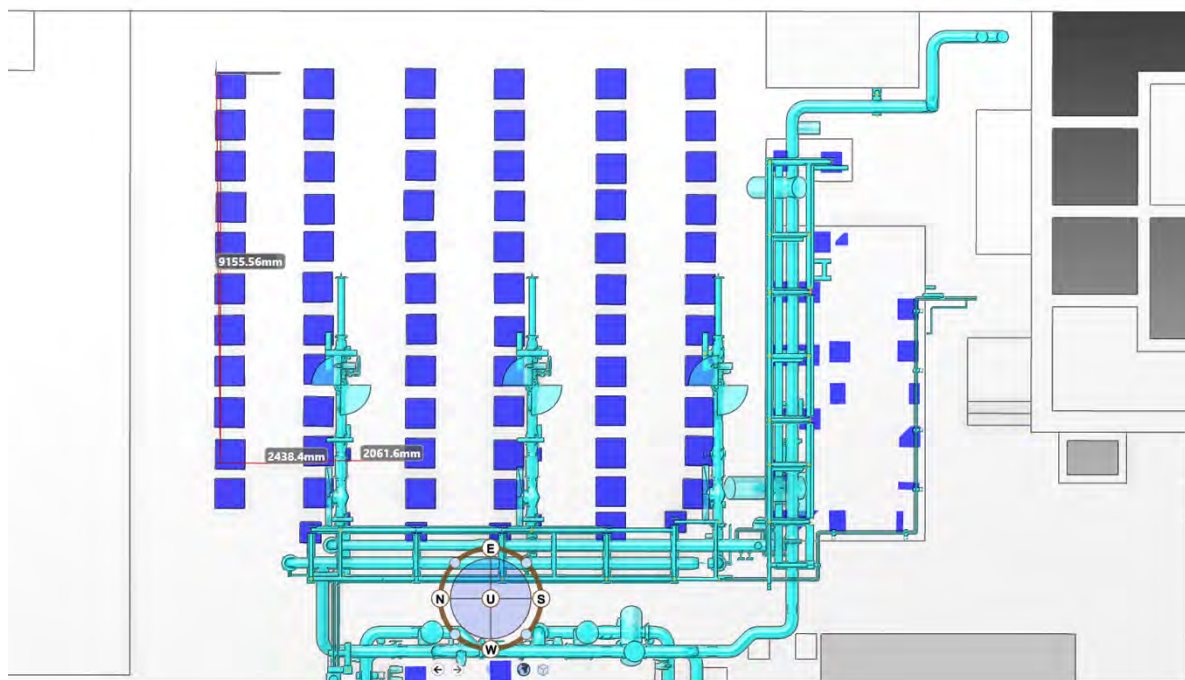


Appendix E –Installation Area on B74 – R1

Overall View of the installation Area (3 adjacent Plinths with embedded plates)



Location of embedded plates on chillers plinths



Technical Questionnaire - 26CH1B-0		
Question		
		Package Duty and
1	<p>Nominal cooling power required for the package is 2500 kW (~835kW per unit). Regulation range is 0-100% to be achieved without continuous start/stop of machines. Please identify the different regulation methods that will be applied in required regulation range.</p>	
2	<p>Target Temperature at the mixing point downstream the three Unit Evaporators is 6° C. Water flow is constant and equally distributed to the 3 units. Vendor to clarify if target temperature can be achieved in all operating cases as per Appendix C of the technical summary. If strictly required during transients or unfavourable operating conditions, slight deviations to the target temperature can be accepted.</p>	
3	<p>Refrigeration package shall be available to operate in all environmental conditions included in section 4.2 of Technical Summary.</p> <p>i. No glycol will be used in the chilled water circuit. Please confirm that all required anti-freezing protection will be included in the scope (e.g. for evaporator and chilled water piping in the scope of vendor, for air cooled condensers during extreme winter conditions).</p> <p>ii. Is this protection effective even there is no flow on chilled water circuit?</p>	
4	<p>Can Vendor Guarantee the availability requirement included in section 4.1 of the Technical Summary? Can a RAM (Reliability, Availability and Maintainability) study be performed by Vendor if required?</p>	
		Qualificati
5	<p>Package is classified as Safety Important Class SIC-2.</p> <p>Package instrumentation and control components that fulfil safety functions are SIC-2B classified.</p> <p>Has Vendor already provided chiller units that have been fully qualified for Nuclear Applications?</p>	
6	<p>Can vendor Provide RCC-E category K3 qualified Electrical and Instrumentation equipment</p>	

	Do Vendor propose a PLC fully qualified for Nuclear Applications (including Software/Algorithms)?
7	If a fully qualified complete PLC is not available, can Vendor propose a parallel (hardwired) Safety Control System to take care of the basic safety function when main control system is not available?
8	Is vendor able to provide qualification to static magnetic fields as per section 4.2 of Technical Summary? Units have to guarantee full functionality during and after a SL-2 Seismic Event.
9	i. Can proposed chillers be qualified to the seismic load included in Appendix D of Technical Summary? ii. Is this achieved with or without Seismic Isolation Devices? iii. Has supplier already performed or is able to perform a shaking table test on complete units.
10	Is Vendor able to demonstrate that proposed equipment can fulfil its safety functions during all required operating life (30 years)?

Materials of Construction	
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11	Stainless Steel has been required as base case material for parts of the chillers in contact with chilled water (e.g. evaporator tubes and water boxes). Please confirm supply of stainless steel or indicate alternative proposed material suitable for chilled water parameters included in section 4.1 of the technical summary (e.g. pH range = 6.5-7.5). Vendor to confirm that materials exposed to the outdoor environment (e.g. air cooled
12	condensers) shall withstand ambient conditions included in section 4.2 of the technical summary.

Installation	
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13	Installation Area is Outdoor (unsheltered). A container/cabinet is required to protect from extreme environmental conditions all components in the scope except forced air condenser that will be installed on the roof of the container itself. Is supplier able to supply this kind of configuration fulfilling all other requirements included in the Technical Summary? Installation layout is included in appendix E of Technical Summary.
14	Foundation Plinths with their embedded plates have already grouted. Supplier to confirm that available footprint for each unit is (~9150x2440 mm) and distance between adjacent chillers (~2050mm) can be respected

CHI-1001&1002&1003 Chillers

Supplier reply

Regulation

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struction

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