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Title	**Purchase Specification for the Plate Heat Exchangers in the Nuclear Waste Plasma Gasification System**
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1 PURPOSE AND SCOPE

1.1 Purpose

The purpose of this document is to provide details for the plate-in-frame heat exchangers to be supplied as part of the Nuclear Waste Plasma Gasification (NW PlasGas) and Uranium Contaminated Waste Oil Plasma Gasification (WOPG) demonstration facilities.

1.2 Scope

The scope of the document includes the purchase information for two plate-in-frame heat exchangers:

- KOH Heat Exchanger (H1504)
- Cooling Water Heat Exchanger (H1603)

These two heat exchangers will be utilised by both the NW PlasGas and WOPG facilities, but the facilities will not be operated at the same time. Furthermore, all operational work will be completed for one of the facilities, and thereafter, switchover to the other facility will be made. The heat exchangers provided by the supplier shall be able to handle the conditions of both facilities.

2 REFERENCES AND ABBREVIATIONS

2.1 References

This document refers to the following documents:	
[1]	ENS-NWPVR-PID-24002, P&ID – NW PlasGas Demonstration Plant Subsystem 15
[2]	ENS-NWPVR-PID-24003, P&ID – NW PlasGas Demonstration Plant Subsystem 16
[3]	ENS-NWPVR-CLC-24015: Scrubber Design for the Low-Level Waste Plasma Gasification (NW PlasGas) Demonstration System
[4]	ENS-OWPVR-CLC-24006: Scrubber Design for the Uranium Contaminated Waste Oil Plasma Gasification Project
[5]	ENS-NWPVR-SPE-24022: Plate Heat Exchanger H1504 Specification Sheet
[6]	ENS-NWPVR-SPE-24023: Plate Heat Exchanger H1603 Specification Sheet
[7]	ISO 9001:2015: Quality Management Systems - Requirements

2.2 Abbreviations

Abbreviation	Description
FAT	Factory Acceptance Test
KCl	Potassium chloride
K_2CO_3	Potassium carbonate
KF	Potassium fluoride
KOH	Potassium hydroxide
$KHCO_3$	Potassium bicarbonate
lb	Pound
NB	Nominal Bore

Abbreviation	Description
FAT	Factory Acceptance Test
KCl	Potassium chloride
NW PlasGas	Nuclear Waste Plasma Gasification
P&ID	Piping and Instrumentation Diagram
QMS	Quality Management System
RF	Raised Face
Sch	Schedule
WOPG	Waste Oil Plasma Gasification
wt%	Weight percentage

3 SYSTEM DESCRIPTION

3.1 KOH Heat Exchanger H1504

The KOH Scrubber S1501 is used to remove gaseous impurities from the off-gas stream before release into the building stack via the process ventilation system. An aqueous 30 wt% KOH solution is used in the scrubber to react with these gaseous impurities. The reactions are exothermic and generate heat. The scrubbing solution is therefore passed through the KOH Heat Exchanger H1504 to remove the heat generated during the reactions in the scrubber. The scrubber solution is re-used until the solution is deemed spent. Therefore, the composition of the scrubbing solution changes over time. The composition of the scrubbing liquid over time is shown in Figure 1 for the NW PlasGas facility [3] and Figure 2 for the WOPG facility [4].

A filter is installed in the solution feed stream to the heat exchanger to reduce the amount of solids passing through. This plate heat exchanger is cooled by the primary cooling water system. A block flow diagram of the system around this heat exchanger is provided in Figure 3. More details are available on the P&ID [1].

3.2 Cooling Water Heat Exchanger H1603

This heat exchanger is used to cool primary cooling water returning from the users in the NW PlasGas and WOPG facilities. The primary cooling water is contacted with secondary cooling water sourced from the cooling tower T1604, before it is recirculated back to the users in the facilities.

A block flow diagram of the system around this heat exchanger is provided in Figure 4. More details are available on the P&ID [2].

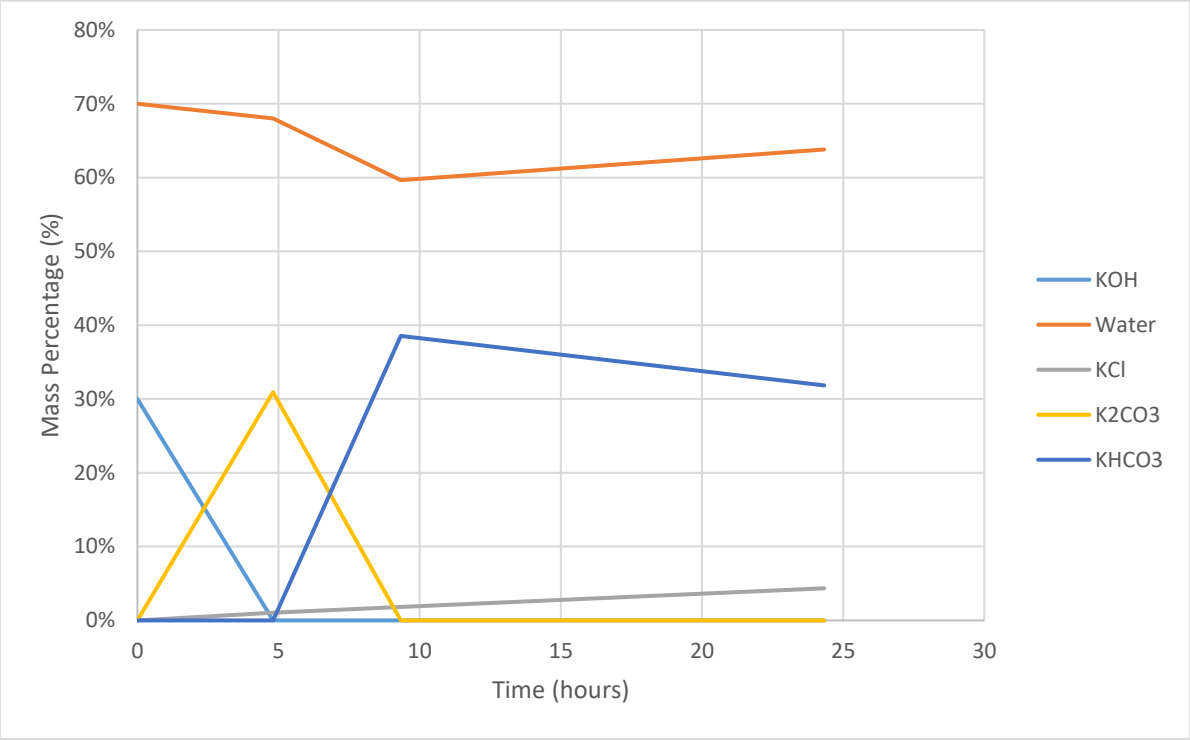

Figure 1: NW PlasGas Project: Composition of scrubbing liquid over time [3]

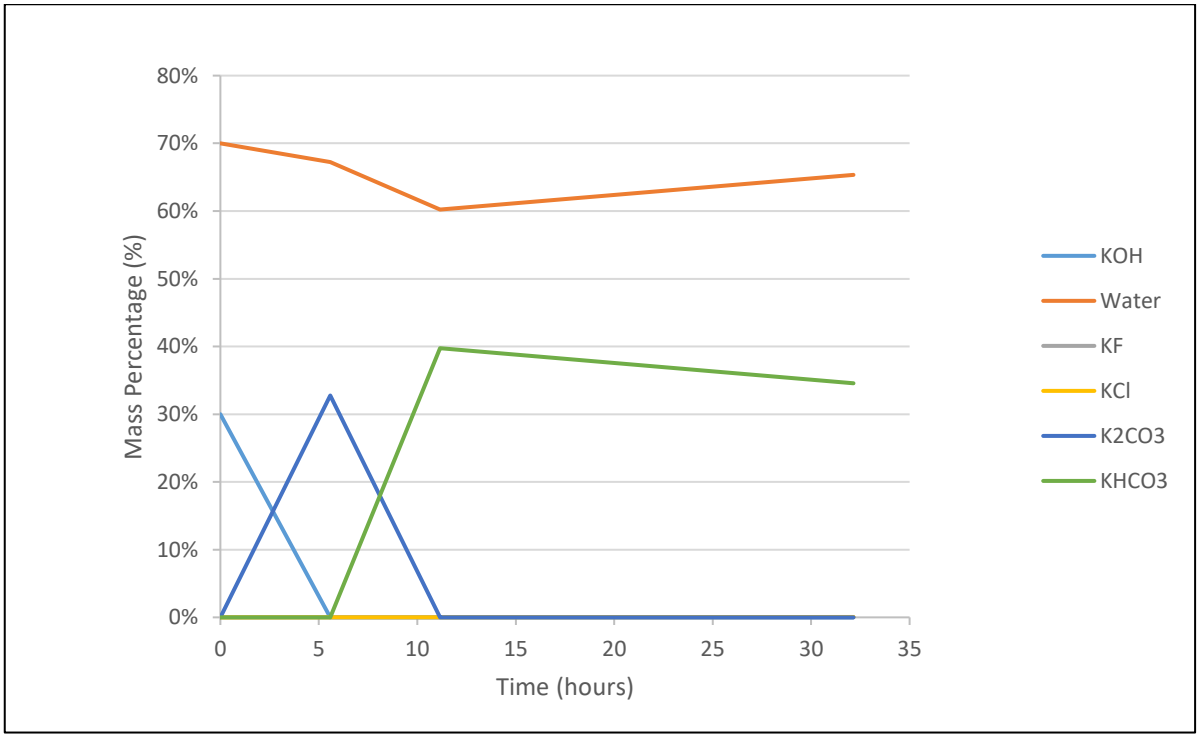

Figure 2: WOPG Project: Composition of scrubbing liquid over time [4]

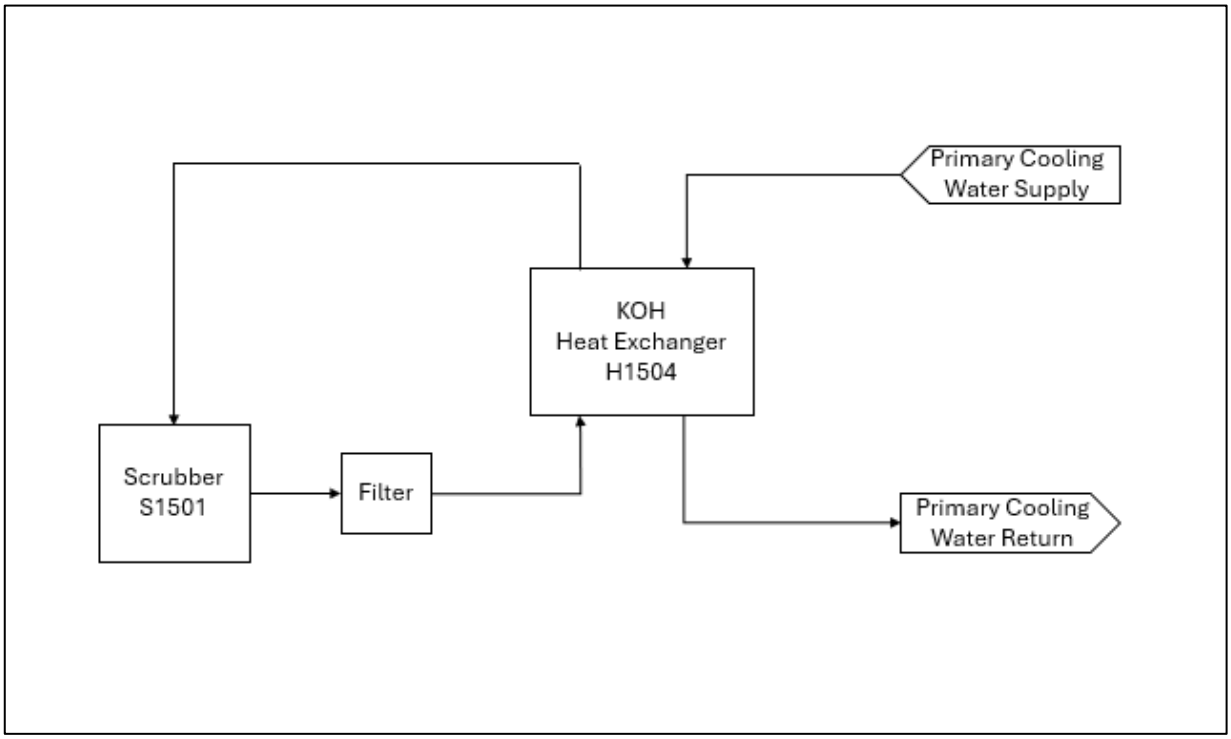

Figure 3: Block Flow Diagram for the KOH Heat Exchanger System

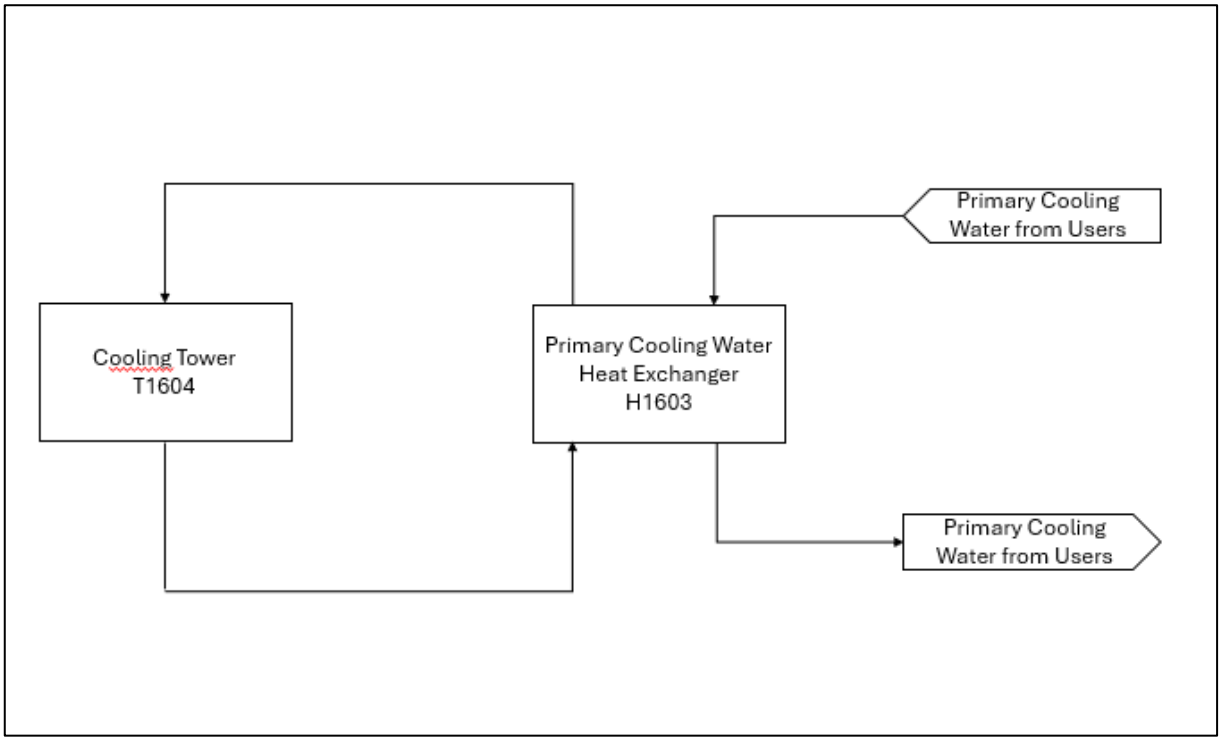

Figure 4: Block Flow Diagram for the Primary Cooling Water Heat Exchanger

3.3 System Location

The location of the different heat exchangers are as follows:

- H1504 is located within the recycle loop of the Scrubber S1501, inside Laboratory 150, Building V-H2.
- H1603 is located at the cooling tower T1604, outside Laboratory 150, Building V-H2.

Each heat exchanger is mounted on top of a stand within a bunded area.

4 SYSTEM TECHNICAL DATA

4.1 Site Conditions

Site-specific atmospheric data is provided in Table 1.

Table 1: Atmospheric data

Parameter	Minimum	Maximum
Mean summer temperature	18.9 °C	26 °C
Mean winter temperature	11.7 °C	16.4°C
Design dry bulb temperature	2 °C	32 °C
Design wet bulb temperature	-1 °C	21.6 °C
Atmospheric pressure	87.4 kPa	88.3 kPa

4.2 Process Parameters

Process parameters are available in the individual heat exchanger specification sheets as shown in Table 2.

Table 2: Process Parameters

Plate Exchanger Tag Number	Data Sheet Reference Number
H1504	ENS-NWPVR-SPE-24022 [5]
H1603	ENS-NWPVR-SPE-24023 [6]

The heat exchangers will not be operated continuously. They are expected to be in operation for approximately 6 hours a day, 5 days per week.

4.3 Specific Requirements

Connection points must be provided on the heat exchangers as described in Table 3.

Table 3: Heat Exchanger Connection Points

Heat Exchanger	Location (Inlet / Outlet)	Size	Connection type	Flange Rating	Material
H1504	Hot side	25NB, Sch 40	Raised flange (RF)	150 lb	304L Stainless Steel
	Cold side	25NB, Sch 40	Raised flange (RF)	150 lb	304L Stainless Steel
H1603	Hot side	50NB, Sch 40	Raised flange (RF)	150 lb	304L Stainless Steel
	Cold side	50NB, Sch 40	Raised flange (RF)	150 lb	304L Stainless Steel

5 SCOPE OF SUPPLY

- The following will be required from the supplier:
- Design, manufacture, and supply plate-in-frame heat exchangers that conforms to all of the specifications of this document.
- Develop a quality control plan for the fabrication and assembly of the plate heat exchangers.
- Non-destructive examination (pressure test) of the fabricated heat exchangers shall be performed at the manufacturer's premises before it is delivered to Necsa.
- A pre-dispatch factory acceptance test will be carried out in the presence of Necsa's engineers, as follows:
    - Verification of all quality documents in accordance with ISO 9001:2015 [7] requirements.
    - Verification of material certificates for materials and components used to assemble the heat exchangers.
    - The manufacturer shall first perform all the above checks/verifications on their own, prior to calling Necsa's engineers for the pre-dispatch factory acceptance test.
- A leak test of the heat exchangers will be performed by Necsa after installation on site.
- In addition to the above, provide the following:
    - General assembly drawings detailing major dimensions and connections
    - Heat exchanger design and manufacturing package, including non-destructive examination certificates
    - Installation manual
    - Operating manual (including troubleshooting guides)
    - Maintenance manual
    - List of critical spares
    - Supply of spare gaskets for connecting piping
    - Necsa requires proof that the thermal performance of the heat exchangers has been demonstrated during the FAT.

6 QUALIFICATION OF BIDDER

Based on the quality classification of the various heat exchangers, the minimum qualification criteria for the supplier are as follows:

The supplier shall be ISO 9001:2015 [7] accredited.

7 REVISION HISTORY

This document has been revised in accordance with the following schedule:

Rev. No.	Date approved	Nature of Revision	Prepared
1	2025/02/04	First issue.	BM Khumalo
2	See title page	Updated to include the merger of the NW PlasGas facility with the WOPG facility.	M Correia