

TECHNICAL SPECIFICATIONS

FOR THE SUPPLY OF AN ULTRAPURE WATER (16÷18 Mw-cm) PLANT AND A WASTE WATER TREATMENT(Neutralization) PLANT FOR SCUOLA SUPERIORE SANT'ANNA

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INTRODUCTION

The following document summarizes the requirements for the supply, installation, commissioning and start up of an UPW production plant and a Waste Water Treatment plant. The systems will be integrated in the new Clean Room of TeciP institute, to complete and guarantee operational continuity to the technological structure at high quality level. The technological hub is focused on semiconductor component manufacturing, the required UPW system will guarantee best results and yield on the fabrication of devices having line-width lower than 1.0um. Final product is directly sensitive to organic and inorganic pollution as UPW itself, if not produced on continuous basis with proper materials and shrewdness.

The plant configuration is left to supplier's care. The solution the Supplier deems most appropriate according to its know-how must also respect the standard ASTM D5127 "Ultra-Pure Water Used in the Electronics and Semiconductor Industries".

As described in the standard ASTM, the requested UPW production plant is an integrated system comprehensive of five general process sections: Pretreatment, Desalination, Organic and Biological Removal System, Particulate Removal, Storage and Distribution System.

The Waste Water Treatment plant is required to neutralize wastewaters produced along manufacturing, in order to allow the discharge into the sewer or, if conditions permit, the recovery and reintroduction to the UPW system.

1. Technical specification: minimum requirements

1.1 Configuration UPW production plant

- ❖ Plant will be integrated in existing building and dedicated area. Plant size and space management project has to fit in and agree with existing layout (see attached drawings). Particular care for space management of UPW plant, it needs to fit in a critical area.
- ❖ TOC analyzer for online water quality inspection
- ❖ Pretreatment. It must be selected upon raw water analysis data
- ❖ Desalination steps. Regenerable resins (by acid and basic solutions), anionic and cationic, for ion Exchange are not permitted.
- ❖ Organic and Biological Removal System
- ❖ Particulate Removal and ultrafiltration
- ❖ Storage, final polishing and pumping to the loop. Polishing at point of use is not permitted.
- ❖ Loop is NOT part of the supply.
- ❖ Each technological step must be complete with accessories such as pressure gauges, flow meter, conductivity meter, manual and pneumatic valves.
- ❖ Electrical panel and supervision system of the plant
- ❖ UPW water plant control system must be integrated with Wastewater (Neutralization) plant

1.2 Ultrapure water datas

- ❖ Water quality at the Point of Distribution between type E-1 and type E-2 (Standard ASTM D5127). Following the values that must be guaranteed:
 - Resistivity: 16÷18 M Ω .cm at 25°C
 - TOC: < 25 ppb
 - Particles: < 500 /mL (size 0.2 μ m)
<1000 /mL (size 0.1 μ m)
 - Bacteria: < 1 cfu/L
 - Temperature (loop): 15 °C
 - Pressure (loop): 5 bar
- ❖ Plant capacity must guarantee the following stream:
 - Peak capacity: 2.0 mc/h
 - Daily capacity: 10 mc/gg

1.3 UPW distribution loop (NOT part of this supply)

- ❖ See attached drawings
- ❖ Accepted loop material, according to water quality.
- ❖ Loop distribution length: approx 220 meters
- ❖ At least 20 'Zero Dead Leg' manual valves, distributed along the loop in each Point of Use. Each Point of Use has to be supplied with piping, bends and Tee for loop-users connection.
- ❖ Minimum continuous flow rate through the loop: > 1.0 m/sec
- ❖ Operative constant pressure 5 bar
- ❖ Operative temperature 15°C-18°C

1.4 Configuration Waste water Treatment plant

- ❖ The Waste Water Plant is dedicated to treat Dilute waste water from rinsing process. The scope is to Neutralize the entire volume and to drain into public sewer in accord with Italian legislation (see environmental legislation "D.Lgs. 152/2006 - Norme in materia ambientale")
- ❖ The waste water plant needs to be oriented and fully upgradable for water recycling, recovery and reintroduction of neutralized waters to the UPW system
- ❖ Plant will be integrated in existing building and dedicated area. Plant size and space management project has to fit in and agree with existing layout (see attached drawings)
- ❖ Drain lines for wastewater is NOT part of this supply. (see attached drawings)
- ❖ The waste Water Plant supervision system must be integrated with UPW plant.

1.5 Waste water treatment datas

- ❖ Estimated concentrations of contaminants coming from washing and rinsing of semiconductor manufacturing (diluted) , if waste water is conveyed in a 1m³ tank:

process name	Chemical species	Approx molar concentration in 1m ³ tank [mol/L]	%v/v
BHF	[NH ₄ F]	9,50E-05	3,48E-04
	[HF]	3,00E-05	5,24E-05
Piranha	[H ₂ SO ₄]	1,58E-04	8,42E-04
	[H ₂ O ₂]	1,60E-05	3,68E-05
HF 8%	[HF]	3,90E-05	6,82E-05
Nitride	[H ₃ PO ₄]	1,63E-04	8,50E-04
Alu Etch	[H ₃ PO ₄]	5,80E-05	3,02E-04
	[HNO ₃]	3,30E-05	1,38E-04
	[CH ₃ COOH]	3,70E-05	2,12E-04
Poly Etch	[HNO ₃]	1,09E-04	4,55E-04
	[HF]	4,00E-06	6,99E-06
TI Etch	[NH ₄ F]	3,60E-05	1,32E-04
	[CH ₃ COOH]	5,80E-05	3,32E-04
Defreckel	[HNO ₃]	1,16E-04	4,84E-04
	[NH ₄ F]	4,00E-06	1,47E-05
Tmah	[TMAH]	2,80E-05	2,51E-04
	[I ₂]	1,00E-05	2,57E-05
AuEtch1	[KI]	2,00E-05	1,06E-04
	[HNO ₃]	3,90E-05	1,63E-04
Regia	[HCl]	9,00E-05	2,76E-04
	[(NH ₄) ₂ Ce(NO ₃) ₆]	3,00E-06	
CrEtch	[CH ₃ COOH]	5,00E-06	2,86E-05
	Citric acid	3,00E-05	3,47E-04
GaAs Etch	H ₂ O ₂	1,20E-05	2,76E-05
	NH ₄ OH	6,50E-05	2,50E-04
Formico	formic acid (10%v/v)		1,00E-04
Acetone	acetone		1,00E-03
IPA	Isopropanol		1,00E-03
DMSO	dimethylsulfoxide		1,00E-03
Microstrip	Organic solvents		1,00E-03
Developers			1,00E-03

Note 1: daily it may occur multiple processes of the same type. So, concentrations in the tank may be higher.

Note 2: a minimum constant flow of pure water reaches the tank to maintain the quality of ultrapure water at the point of use.

- ❖ Plant capacity must guarantee the treatment of the following stream:
 - Peak: 2 mc/h
 - Daily: 10 mc/gg

1.6 Cost of ownership and water production cost

- ❖ It is mandatory to expose the cost for each cubic meter of UPW produced. Considering energy and chemicals consumption.
- ❖ It is also required the annual costs for consumables, such as filters, osmosis membranes, nuclear grade resins, UV lamps, and whatever else is necessary for running ordinary maintenance
- ❖ Define the typical Up time

2. Technical specifications: evaluable features

2.1 Quantitative evaluation:

- ❖ Particle count analyzer for online water quality inspection for UPW
- ❖ Higher peak capacity, greater than 2.0mc/h, for UPW production plant and equally for Neutralization system. Each additional 0,10mc/h is evaluated to a maximum of 4.0mc/h
- ❖ One year extra warranty for both systems (UPW and Neutralization)

2.2 Qualitative evaluation:

- ❖ Fully integrated system for diluted wastewater recycling: recovery and reintroduction of neutralized waters to the UPW system. Solution supported by a feasibility study and datas

3. Conditions, installation, commissioning, training, documents

3.1 Conditions

- ❖ Mandatory site visit inspection, intended to share and get acknowledge of the general and particular aspects of the installation site
- ❖ Conformity to CE standard and certification
- ❖ 1 year warranty
- ❖ Shipment, installation and commissioning included to:
Scuola Superiore Sant'Anna (Istituto TeciP)
Via G. Moruzzi 1
56127 Pisa (Italy)

3.2 Installation

Supplier is in charge for the shipment, for moving the crate from the track to the site, opening the package, tool positioning in the working area, connecting all the necessary facilities to the tool.

Supplier must also execute the acceptance procedure, final and functionality test.

3.3 Commissioning and startup

Installation, commissioning and start-up must be performed onsite by the Supplier. Specific instrumentation for TOC and particles count will be used to certificate water quality.

3.4 Training

Following installation and commissioning, the Supplier must train the staff of SSSA involved in the maintenance and use of the system.

3.5 Documents

❖ Supplier must:

1. Deliver P&ID (Piping and Instrumentation Drawing) of the plants. Detailed configuration of the equipment and list of parts and components
2. Space management proposal in agreement with existing layout .
3. Deliver layout of installation and the list of the facilities required for a proper functioning of the plants.
4. Describe after sales service and support solution in Italy Organizations , define typical intervention time
5. Deliver plant operating costs, divided between operating costs per cubic meter and the cost of annual consumables(According paragraph 1.6).

The Supplier that will win the tender must provide and integrate the following:

6. Deliver procedures for standard operation and maintenance
7. Deliver safety instructions
8. CE conformity declaration

The compliance of the proposal to the minimum requirements must be evident in the documentation (1-6).

❖ Scuola Superiore Sant'Anna provides the following:

1. Standard ASTM D5127 "Ultra-Pure Water Used in the Electronics and Semiconductor Industries"
2. Building drawings and plants dedicated area
3. UPW distribution loop
4. Drain lines distribution
5. Law reference for water drain according Italian and local Regulation

4. Appendix

4.1 Summary table of minimum requirements

4.1 Summary minimum requirements			
Parameter	Target Specs	Units	Note
Plants integration in existing building and space management	yes		
UPW production plant according to ASTM standard	yes		
TOC online analyzer	yes		
Guaranteed water quality	yes		according paragraph 1.2
Guaranteed production capacity	yes		according paragraph 1.2
Neutralization plant according italian legislation	yes		
Wastewater treatment capacity	yes		according paragraph 1.5
Supervision system of wastewater plant integrated with UPW plant	yes		
Neutralization plant fully upgradable for water recycling	yes		
Warranty	1	year	
Clear documention	yes		According paragraph 3.5
Shipment, installation, startup, training	included		

4.2 Summary table of evaluable features

4.2.1 Summary evaluable features (quantitative evaluation)			
Item	Parameter	evaluation system	Max points
A.1	Particle count analyzer for online water quality inspection. For UPW production plant.	If the parameter is absent = 0 If the parameter is present = max points	5
A.2	Higher peak capacity, greater than 2.0mc/h, for UPW plant and equally for neutralization plant	Minimum is 2,0mc/h. Each additional 0.10 mc/h to a maximum of 4.0mc/h, offered by supplier (a) is considered through the formula: $P(a) = \text{Offer}(a) / \text{Offer max} * \text{max points}$	20
A.3	one year extra warranty for both systems (UPW and neutralization)	If the parameter is absent = 0 If the parameter is present = max points	10

4.2.2 Summary evaluable features (qualitative evaluation)			
Item	Parameter	evaluation system	Note
A.4	Fully integrated wastewater recycling	System ready to use: hardware connection (pipelines). Special solution that guarantees performance of UPW production steps even with recycling water	35