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INNOVATIVE SOLUTIONS FOR CORROSION CHALLENGES

Intelligent Analytical Chemistry approach for Process Water Analysis and Steam Quality

SABIC - MS LAB

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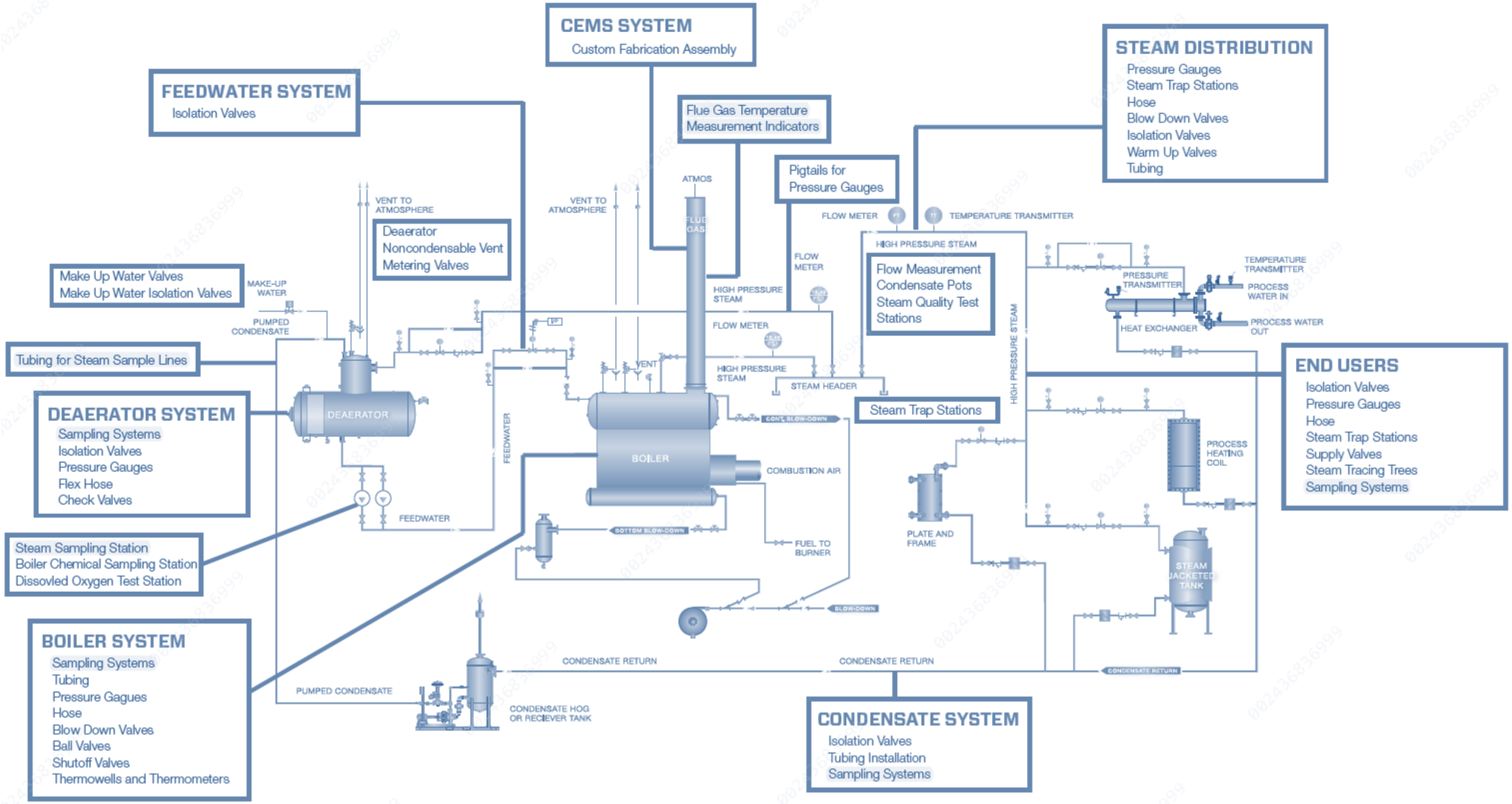
Introduction

- Steam & Industrial Water are the main head of corrosion protection for any industry especially for Petrochemical, Refinery and Power plants. All heat transfer components (Turbine, Boilers, Polisher, shell/tube, plate/frame, plate/coil, and tracing, with all operation assets.) base performance calculations on 100 % steam quality. Hence... this paper looking for and discus factors affected on the water quality of (feed, pre-heated, super-heated) water in different stages of steam generation processing.
- However, the water treatment analysis by utilizing various analytical methodologies and measurement techniques for Water impurities which include dissolved and suspended solids salts impurities by basic and elementary analysis different analytical methods.

Introduction



Intelligent Analytical Chemistry approach

- Intelligent Analytical Chemistry approach is new trend which integrated the Artificial Intelligent and Analytical chemistry, to generate new technologies approach striving to analyze different types of industrial water & steam to check the quality and informing us current risks and upcoming challenges through forecasting results and failure prediction.

Intelligent Analytical Chemistry approach

- Also informative data about industrial water phenomena properties as Water impurities, which may by indicates by determines some of test parameters as SO42- , Cl-, NO3-, F-, Na+, SiO2, Fe2+ (ferrous), Fe3+ (ferric), Mn2+, Al3+, O2, H2S, NH3 and others as PH, conductivity, TDS, TSS, etc.…

Critical analysis for industrial water and boiler steam water

Analysis	Makeup	Condensate	Pol. Eff.	Dearator IN	Dearator OUT	Feedwater	SG Water	Saturated Steam	Superheated Steam
Spec. Conductivity	N	N	N			N	N		N
Cat. Conductivity	L	N	N			N	L/N		L
DG Cat. Conductivity		L							L
pH	L	N				N	N		N
Sodium	N	N	N			N	L/N	N	L
Silica	N	N	N			N	N	N	L
Disolved Oxygen	L	N		L	N	N		L	
Oxygen Scavenger						N	L/N		R
Iron		N	L			N	S	L	R
Copper		N	L			N	S	L	L
TOC	L					L	L		
Hardness	L						L		
Ammonia/Amine		N			N	L			
Chloride			L			L	L	L	L
Sulfate			L			L	L	L	L
Phosphate							N		

N = Normal, recommend continuous flow for online analyzer

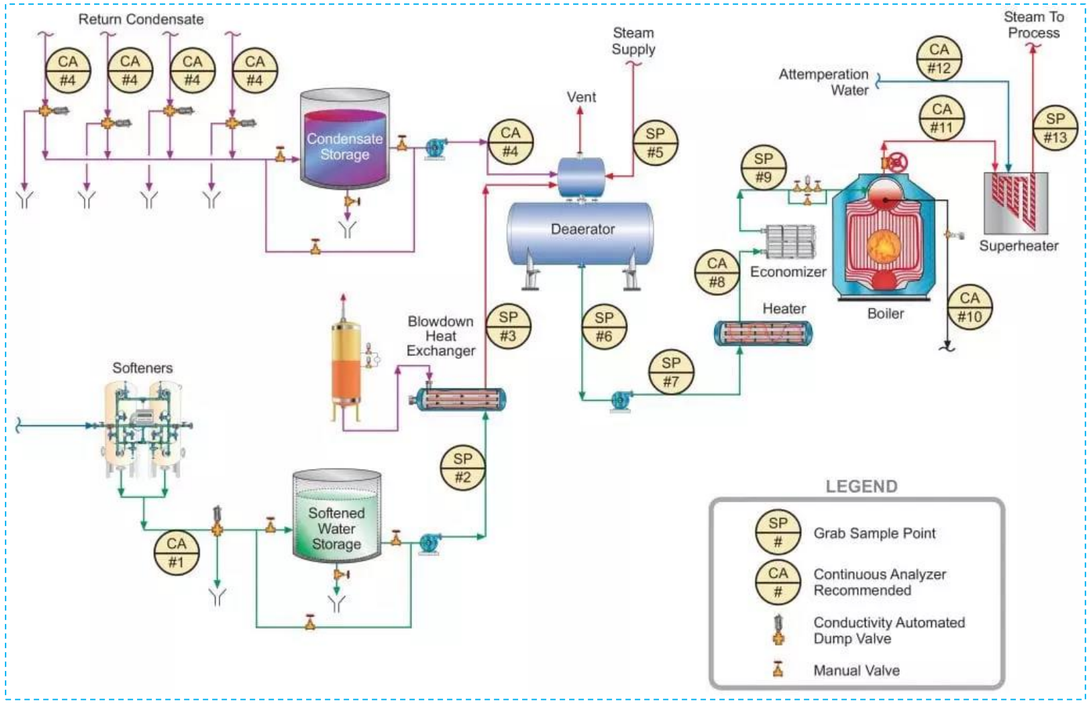
L = Less common, recommend sharing online analysis or with portable analyzer

R = Rare or occasional, recommend measurement with portable analyzer

S = Less common except at startup, recommend measurement with portable analyzer

General Sampling Guidelines

- Careful sampling is necessary to ensure the success of modern analytical techniques. The accuracy of any test will be sacrificed if the sample is contaminated or deteriorates before the test can be performed.
- sampling techniques assure analytical accuracy, representative analysis, personal safety and correct boiler system control.



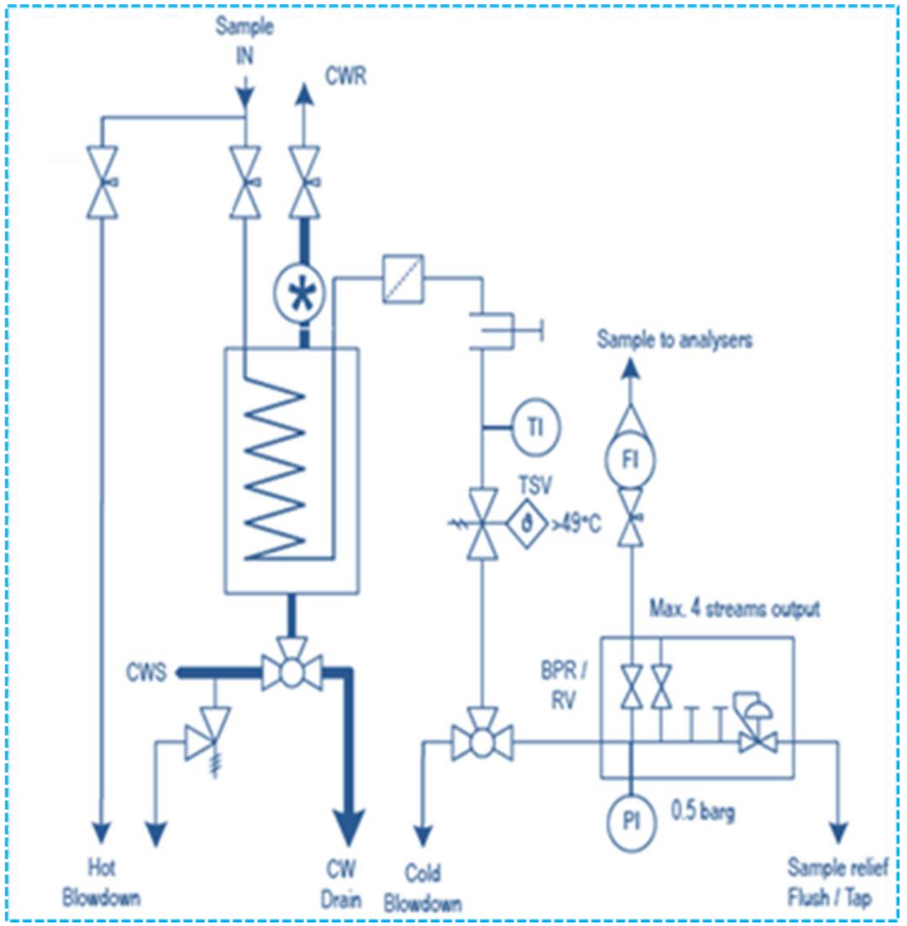
General schematic of recommended sample points for industrial process steam flow and condensate return

General Sampling Guidelines

ASTM D1066 Standard Practice for Sampling Steam

ASTM D3370 Standard Practices for Sampling Water from Flowing Process Streams

ASTM D5540 Standard Practice for Flow Control and Temperature Control for On-Line Water Sampling and Analysis



Typical P&ID Steam Sample Conditioning System

General Sampling Guidelines (Isokinetic Sampling Technique)

Sampling nozzles recommended by the ASTM and ASME have been in use for many years. The nozzles have ports spaced in such a way that they sample equal cross-sectional areas of the steam line.

Instructions for these nozzles can be found in ASTM D 1066, "Standard Method of Sampling Steam" and ASME PTC 19.11.

Field steam studies have shown that sampling nozzles of designs other than these often fail to provide a reliable steam sample.

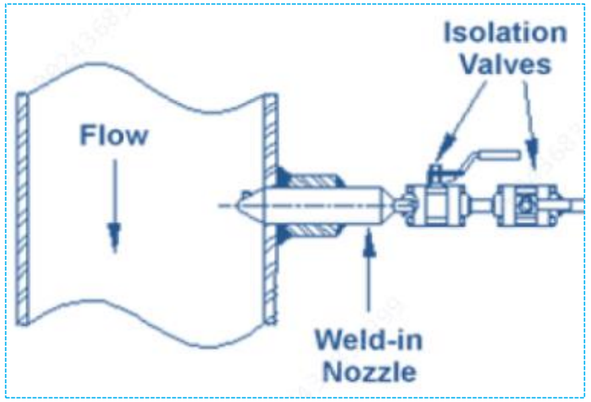
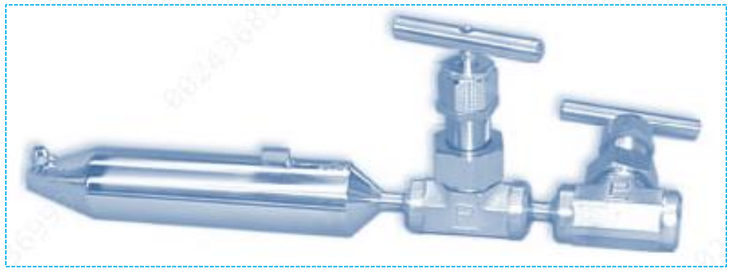


Diagram of Isokinetic sampling weld-in Nozzle



single-port isokinetic sampling nozzle

Hyphenation in Analytical Chemistry

- The sensitivity of instrumental procedures in some cases is not totally accompanied by a comparable selectivity and because of that, when complex samples are directly analyzed, the combination between separation procedures and, as sensitive as possible, detection it is necessary to assure both, selectivity and sensitivity of analytical determinations.
- Hyphenation19 is a main keyword of today's Analytical Chemistry and it means the coupling between different techniques and instruments, in order to improve the determinations by creating synergistic combinations.

Hyphenation in Analytical Chemistry

- The on-line coupling between high performance liquid chromatography (HPLC) and atomic spectrometry or that between gas chromatography (GC) and Fourier transform infrared spectrometry (FTIR) or mass spectrometry (MS) are good examples of the potential for hyphenation processes.
- On the other hand, the correct integration of both, instruments and chemical processes, such as sample pretreatment and precolumn or post-column derivatization, are necessary to assure fast, selective and sensitive determinations and for that, once again, the use of flow analysis strategies is very convenient to perform all these steps in as short as possible time interval, thus avoiding contamination risks.

Innovated analytical methods for water analysis

	EPA 200.7 (ICP-OES)	EPA 200.8 (ICP-MS)	EPA 200.9 (AA)
Aluminum	✓	✓	✓
Antimony	✓	✓	✓
Arsenic	✓	✓	✓
Barium	✓	✓	
Beryllium	✓	✓	✓
Boron	✓		
Cadmium	✓	✓	✓
Calcium	✓		
Cerium	✓		
Chromium	✓	✓	✓
Cobalt	✓	✓	✓
Copper	✓	✓	✓
Iron	✓		✓
Lead	✓	✓	✓
Lithium	✓		
Magnesium	✓		
Manganese	✓	✓	✓

	EPA 200.7 (ICP-OES)	EPA 200.8 (ICP-MS)	EPA 200.9 (AA)
Mercury	✓	✓	
Molybdenum	✓	✓	
Nickel	✓	✓	✓
Phosphorus	✓		
Potassium	✓		
Selenium	✓	✓	✓
Silicon	✓		
Silver	✓	✓	✓
Sodium	✓		
Strontium	✓		
Thallium	✓	✓	✓
Thorium		✓	
Tin	✓		✓
Titanium	✓		
Uranium		✓	
Vanadium	✓	✓	
Zinc	✓	✓	

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THANK YOU

Reach out.

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