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9 MISTAKES TO AVOID IN YOUR SWAS SPECS

What to Know When Creating Technical Design Specifications for a Steam & Water Analysis System in a Fossil Power Plant

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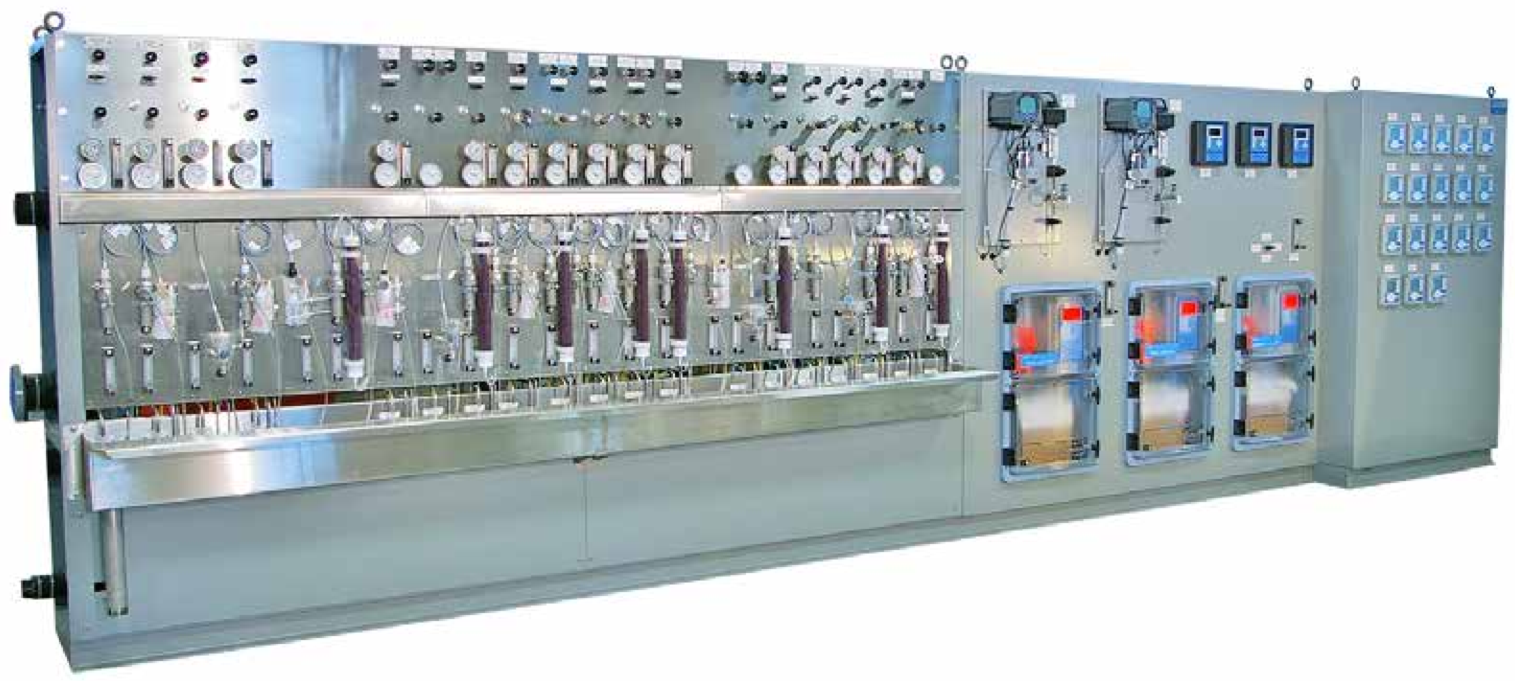
9 Mistakes to Avoid in Your SWAS Specs

How will this Guide Help Me?

This guide identifies 9 of the most common mistakes engineers make in their SWAS specifications (specs). It helps you avoid these mistakes and — more importantly — gives you the critical knowledge you need to create functional SWAS specs every time.

At the end of this eBook, you will be able to:

- Accurately specify a SWAS system based on type of plant, space constraints and unique features in your facility
- Spec a SWAS system that works well and is easy to operate and maintain
- Maintain up-to-date SWAS specs for current and future projects
- Stay ahead with the latest SWAS technologies and best practices



What is a SWAS

A steam and water analysis system (SWAS) conditions, analyzes and monitors the chemical properties of the steam and water used to generate electricity. A well-designed SWAS will maximize efficiency and output, while protecting plant assets, operators and the environment.

Your technical design specification is the first step in designing a SWAS that operates accurately, reliably and safely under the specified operating conditions, without undue vibration, wear, corrosion or other performance issues.

Pro Tip:

Before you start your SWAS spec, make sure you know the type of analyzers required per the plant's specification requirements. Obtain a sample line list from the plant so you understand your analysis requirements before you start your spec.

MISTAKE #1: *Underspecifying*

Underspecifying means you're providing too little detail about specific equipment that the system needs to operate optimally.

Underspecifying includes:

- Not specifying secondary cooling components
- Not including sample flow indicators
- Not specifying analyzer probes on front above sink

Get specific.

Determine the components that will make the SWAS easy to operate and maintain, and last longer, then include them in your specification.

Components to include:

- Inlet isolation valve
- Blowdown valve
- Primary sample cooler
- Pressure reducing valve
- Thermal shutoff valve
- Secondary sample cooler
- Pressure, temperature and flow indicators
- Back pressure regulating/relief valve
- Automated sample sequencing
- Clean water header with solenoid flush valves
- Analyzers required per the plant's specification requirements

Pro Tip:

Clearly identify the desired solutions, then require suppliers to send design information (such as drawings, bill of materials and cooling calculations) to convey proof of concept and design.

MISTAKE #2: *Overspecifying*

Overspecifying means sending unnecessary or ancillary information that isn't related to the SWAS, or including fine details that won't impact SWAS operation. This can lead to contradicting statements within your specifications, making it difficult to build a system to your specs that operates well.

Overspecifying includes:

- Welding requirements for stairways and platforms
- Heating, Ventilation and Air Conditioning (HVAC) specs
- Large sized wire and/or cables specs
- Large gauge dial sizes not meant to be panel mounted
- Field-mounted transmitter requirements

Spec only what's necessary.

Remove ancillary specs and include only the specs that directly relate to the SWAS.

Think about what a well-designed SWAS needs, then specify those elements. This will eliminate wasted time on specifying unnecessary details, giving you more time to focus on the important details of your plan.

Pro Tip:

Work with an experienced SWAS strategic supplier that can guide you in fitting the appropriate specifications to the project scope and offer assistance referencing best-practice industry guidelines.

MISTAKE #3: *Not Providing Sample Tubing Size within the Plant*

Neglecting to specify sample tubing size can negatively affect SWAS performance. To optimize functionality, you must specify the plant tubing size that the SWAS system needs to be designed to accept.

Think about each sample line.

Ask yourself:

- What are the inputs feeding the SWAS?
- What's happening upstream?

Use your answers to specify the field tubing size and incoming sample condition.

Pro Tip:

After the SWAS inlet connection, 3/8 in. outside diameter (OD) tubing should be used on steam samples through the primary cooler. Remaining SWAS tubing is typically a minimum 1/4 in. OD. Tubing material should be SA 249 Grade 316.

MISTAKE #4: *Not Specifying the Sample Conditioning Equipment for Maximum Operation and Function*

Not specifying the sample conditioning equipment can cause significant issues, such as lack of sample flow, non-representative sampling and inaccurate analysis.

Ask yourself:

- How is the plant operating: Base load or cycling?
- Are sample conditions (e.g., sample temperature and pressure) provided?
- Are the sample conditioning requirements defined to achieve recommended flow rates, temperature and pressure?

Specify to optimize functionality.

Specify all operating and design conditions and sample conditioning equipment required, including:

- Back pressure regulators
- Secondary coolers
- Variable pressure reducing elements (>500 psig)
- Thermal shut off valves
- Make sure to specify sample conditions including total sample flow rate that meets best-practice sampling guidelines and meets downstream analyzer requirements

If the plant is in cycling operation, identify conditioning components geared towards maximizing efficiency and operation during cycling, such as automated flow control or high pressure magnetic traps to remove magnetite from the sample stream, and auto flushing capability for the analysis equipment.

Pro Tip:

Spec equipment that ensures optimal sample line flow rates of 5-6 ft/sec, optimal sample temperature of 77°F (25°C) and optimal pressure of 20 psig (1.4 bar) for analyzers.

MISTAKE #5: *Not Identifying the Utilities Available*

Steam and water systems need proper power and water resources to operate effectively. When you don't identify the utilities available, you leave out an important element of the system's functionality.

Ask yourself:

- What is the source and quality of the cooling water available?
- What is the minimum and maximum temperature of the cooling water?
- Is a clean flush water source available? If so, what is the source and operating conditions?
- What are available power sources?
- Are other utilities for instrumentation, such as air or nitrogen, available?

Identify the right resources.

Clearly state what plant utilities are available for the SWAS and provide details, including:

- Power sources
- Water sources, including cooling water and clean flush water
- Composition of resources
- Operating conditions, including the minimum and maximum temperature of cooling water
- Other utilities available, such as air or nitrogen

MISTAKE #6: *Not Specifying the Materials Requirements*

SWAS materials significantly affect functionality and performance of the entire system. Where the SWAS is located within the plant often dictates its materials, but it's also important to consider the source of cooling water and each sample's design conditions. The plant location also can determine which National Electrical Manufacturers Association (NEMA) or Ingress Protection (IP) rating the SWAS dry section (the control and monitor panel) will require.

Ask yourself:

- Should the SWAS conditioning front be stainless steel or carbon steel?
- Are there corrosion concerns?
- Is there a concern with electrical components becoming wetted?
- Is the system near or under potential wash down locations? Does this affect materials of constructions desired — all stainless steel or carbon steel acceptable?
- What kind of temperature control for heating and cooling is required?

Spec the right materials.

Consider the SWAS location and the sources feeding the SWAS, then choose materials based on the placement and functionality of the system.

Recommendations:

- The sample conditioning sink and face above the sink should be 304 stainless steel (304SS) to help prevent corrosion
- All piping or tubing and system components wetted by the sample stream should be type 316 stainless steel. Type 304 is acceptable for other components
- Cooling water valves should be of material suitable for the cooling water composition and conditions
- Cooling water headers, drains and sample sink should be a minimum of 304SS
- Any high pressure blowdown header should be 304SS sch.80
- All parts subject to high pressure or temperatures or other severe duty should be of materials suitable for the service
- Electrical enclosures should be rated appropriately for the location

MISTAKE #7: *Not Specifying What You Don't Want*

It's just as important to indicate the elements you don't want in the SWAS as it is to specify your requirements. Stating what to avoid in the SWAS eliminates confusion and streamlines the entire process right from the start.

Ask yourself:

- Did you clearly specify which equipment is not acceptable?
- Did you include language such as "or equal" or "or acceptable alternative"?

Clarify what you don't want.

Clearly specify which equipment isn't acceptable. For example, if secondary cooling with individual sample coolers is preferred, clearly state that it's not acceptable to include primary cooling only and use temperature compensation within the analyzer because it wouldn't achieve the optimal sample temperature of 77°F (25°C).

Avoid "or equal to" and "or acceptable alternative." This can create significant work for you during evaluation of proposals. Make sure you include an approved supplier list or specify an acceptable alternative.

Be specific. If there are multiple acceptable solutions to meet the requirement, list them specifically. For example, state that degassed conductivity may be used with reboiler or nitrogen sparger technology.

Be clear. Clearly lay out what is not acceptable. For example, state that a forepressure regulator is not an acceptable alternative if the system requires an automated variable pressure reducing element to maintain sample flow during cycling operation.

MISTAKE #8: *Not Specifying the Layout & Location of the System for Ease-of-use*

The layout and location of the SWAS are critical elements of its functionality and performance.

Ask yourself:

- Is the SWAS equipment layout specified to be ergonomic, and easy to use and maintain?
- Is it located indoors or outdoors? If outdoors, is covering available?
- What NEMA rating is required for the dry section (control and monitor panel)?
- Is a full walk-in equipment shelter required for housing the SWAS? If so, how does this change the configuration of the preferred SWAS design (e.g., wall-mounted system or freestanding in center of equipment shelter)?
- If it's in an equipment shelter, have the requirements of the shelter (e.g., lighting/temperature control/outlets, sloped roof, etc.) been clearly defined?

Clearly state the layout and location, then spec accordingly.

Describe the location. Is it within a plant? In a climate-controlled lab? Outdoors? Clearly state the location within the specification.

Make it easy to use and maintain. Ensure all equipment requiring routine operation is easily accessible from the front. Implement an ergonomic design to make it operator-friendly.

Make it safe. Locate all high energy containing equipment on the back of the conditioning rack where possible, separated from the equipment requiring frequent accessibility, to create a safe working environment for plant personnel. If the SWAS is mounted in an equipment shelter, consider locating the high energy equipment (such as the primary cooling rack) outside of the equipment shelter on an exterior wall.

Consider clearance. Define the clearance needed around the SWAS and associated equipment to optimize operational safety and maintenance access.

Understand the path to installation. Consider clearance within the plant to make sure the SWAS can easily reach its final location and be properly installed.

Understand temperature control. Consider what the SWAS will need to maintain temperature in its location, especially if it's outside.

Pro Tip:

If a walk-in shelter is required, be specific about the design so that it is suitable for a safe working environment. For example, a modified shipping container should not be considered an acceptable equipment shelter for a SWAS — and that should be stated in your spec.

MISTAKE #9: *Not Specifying Your Preferred Analyzer Brands & Sequencing*

Not specifying whether automated analyzer sequencing is acceptable and to what level automated analyzer sequencing is acceptable (i.e., which analyzers can sequence and how many sample lines per analyzer) can cause confusion with the desired frequency of analysis. What's more, if sequencing is acceptable but not clearly listed, the supplier might supply more equipment that is not required, leading to unnecessary costs and potential space constraints.

Ask yourself:

- Did you clearly list your preferred analyzer brands? Are multiple analyzer brands acceptable? If so, did you list each as acceptable?
- Is automated sequencing acceptable? If so, how many lines can be sequenced?
- Does the plant have the right personnel available to operate and maintain the specified SWAS?

Clearly state which analyzer brands you prefer for each chemical.

This ensures proper frequency of analysis, and saves time during the proposal evaluation because it easily identifies preferred solutions.

Specify which analyzers are to be dedicated and which analyzers can be shared with a sample sequencer. For shared analyzers, specify the maximum number of lines allowed.

Consider size available when specifying acceptable level of sequencing. Typically, the more sequencing allowable results in a smaller SWAS footprint.

Consider personnel. The amount of personnel available to operate, calibrate, and maintain the equipment can impact the allowable levels of sample sequencing. Allowing sample sequencing will reduce the number of analyzers and therefore reduce operational, calibration and maintenance costs.

Consider Reagent Consumption. Sharing analyzers where practical will lower the cost of reagent consumption.

I Know What to Avoid. Now What?

Now you can accurately specify a SWAS based on the type of plant, space constraints and unique features in the facility. With this knowledge, you can spec a SWAS that works well and is easy for the plant personnel to operate and maintain. Plus, you'll have an up-to-date template for future projects that allows you to spec new systems based on your SWAS requirements.

Print this handy checklist so you can create perfect SWAS specs next time — and every time.

✓	RECOMMENDED SYSTEM COMPONENTS:
	Inlet Isolation Valve — Specify needle or globe type based on the temperature and pressure requirements that will allow proper sample flow and ensure operator safety. Graphoil packing is required for valves on sample lines >600°F.
	Blowdown Valve — Provide a high-pressure blowdown valve in parallel to the inlet isolation valve on each sample line. The blowdown valve should discharge to a common header insulated for protection. The manual high-pressure blowdown valve should allow the operator to manually blowdown the sample line to remove any particulate build up in the line. All high-pressure blowdown valves will be rated for service conditions of the highest energy sample at a minimum. Blowdown header should be schedule 80 stainless steel, 1 ½ in. minimum. Low pressure blowdown consisting of a three-way valve downstream of the pressure reducing valve can be included for routine blowdown during operation.
	Primary Sample Cooler — Specify coil designed, full counter-flow sample coolers to reduce sample temperature to within 5°F (3°C) of the temperature of the primary cooling water. Certified performance data on all coolers should be provided by supplier at design conditions.
	Pressure Reducing Valve — Specify a variable, orifice-type pressure reducing valve on sample lines with inlet pressures exceeding 500 psig (35 barg). In order to provide proper support and guidance of the nut, the valve must have a fully retractable tapered rod with a threaded shaft that extends into the bushing. The device should have a speed handle for ease of operation. Lines with sample pressures less than 500 psig (35 barg) should use a metering type valve sized to provide the proper flow rate and pressure reduction of the sample.
	Thermal Shutoff Valve (TSV) — Include a TSV on each sample line (operating temperature ≥120°F (49°C)) to protect operators and instrumentation. The TSV will isolate the sample line at temperatures in excess of 120°F (49°C) to protect down-stream analyzers from cooling water failure.
	Secondary Sample Cooler — Include secondary sample coolers on each sample line in conjunction with a temperature control unit (TCU) to achieve a controlled sample temperature of 77°F ± 1°F (25°C ± 0.5°C).

✓ RECOMMENDED SYSTEM COMPONENTS:

	Pressure, Temperature, and Flow Indicators — Include a pressure gauge, temperature gauge and sample line total flow indicator for safety and ease of operation.
	Back Pressure Regulating/Relief Valve (BPRV) — Provide a BPRV on each sample line for precise pressure control to the analyzers. The BPRV provides pressure relief capability downstream of the pressure reducing valve. This relief protects the associated measuring cells and/or analyzers from overpressure in accordance with pressure limitations imposed by the analyzer manufacturer. BPR also acts as a grab sample valve, with the discharge being used for the grab sample.
	Automated Sample Sequencing — Provide time sharing of wet analyzers (e.g. silica, sodium, phosphate, oxygen scavenger, etc.) where practical. Analyzer time sharing should be accomplished using a Sample Sequencer capable of driving one or two four-valve sample manifolds to allow sequencing of multiple samples to an analyzer with a single Sequencer electronics package. The Sequencer should be microprocessor-based with track and hold capability. It should be capable of sequencing the samples in any order, as well as having internal universal power supply to drive the manifold valves.
	Clean Water Header with Solenoid Flush Valves — Include a clean water header to help keep analyzer sensors wet and flush the SWAS analyzers during shutdown conditions. This will maximize equipment life and ensure equipment is operational when starting up. Each sample line should include a solenoid valve from the header to the sample analyzer branch to allow for flushing control when needed.

Pro Tip:

Recommend Additional Services

These services can help you operate and maintain your SWAS system at peak performance for years to come.

***Startup and Commissioning Services** — Specify a multi-point operational startup and commissioning process to help safeguard the SWAS for trouble-free activation.*

***Preventative Maintenance Service Agreement** — A service provider is recommended to conduct regularly scheduled maintenance to keep your SWAS at peak performance. Safety inspections, calibration and certifications of your components, analyzers, parts, consumables and much more.*

Find out how you can maximize SWAS performance.

✓ ADDITIONAL COMPONENTS TO CONSIDER, TYPICALLY FOR PLANTS WITH CYCLING OR SLIDING PRESSURE OPERATION:

	Magnetic Traps (on any sample lines where magnetite plugging is a concern) — The magnetic trap should isolate magnetite particulates to protect sample conditioning and analytical instruments from critical downtime and costly repairs. Must be located on the high pressure side of the sample line, upstream of the pressure control valve for maximum protection. Include a flush valve assembly for easy cleaning and maintenance of the trap. The trap should not be pluggable and should allow for sample integrity to be maintained.
	Automated Sample Conditioning Module — Automated sample conditioning will automatically maintain sample flow rate at a constant level with varying source pressure, including automatic startup and blowdown, along with automatic shutdown. The conditioning module should supply digital signals to the site distribution control system for sample temperature, pressure and flow readings. The automatic conditioning module display should be mounted on the front of the SWAS, preferably on the conditioning rack.
	Automated Flow Control — Mount an automated flow controller on the high-pressure reducing valves for fully automatic operation of the pressure reducing valve, maintaining consistent sample flow, regardless of fluctuating pressure conditions.

Pro Tip:

The essential elements of representative sampling are precise temperature, pressure and flow control — these are at the core of any good sampling system. ***Make sure your spec delivers.***

Never make a mistake in your SWAS specs again.
Connect with our SWAS experts.

About Sentry Equipment

With proven sampling expertise since 1924, Sentry® products and services provide power generators the critical insights to optimize processes and control corrosion. We deliver true representative sample conditioning and analysis techniques to customers around the globe, empowering them to accurately monitor and measure their water chemistry for improved production efficiency, output and safety.

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