

# Gas Sample Conditioning Systems

**For Continuous Emissions and  
Process Monitoring**

- Improve Data Quality
- Protect Analyzers
- Reduce Maintenance

Product offering includes:

Nafion® Dryers and  
GASS™ Sampling Systems

Baldwin™ Coolers,  
Sample Probes,  
Conditioning Systems,  
and Flow Drawers

Dilution Probes



**PERMA PURE LLC**

A HALMA COMPANY

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# Baldwin™-Series Thermo-Electric Coolers

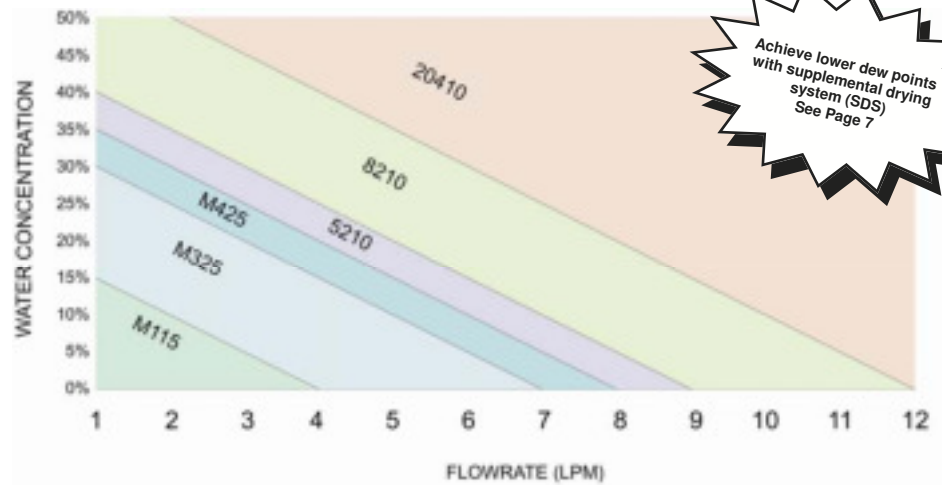
*Classic*  
Thermo-Electric Cooler

The Baldwin™-Series Classic thermo-electric coolers by Perma Pure offer a history of reliable performance for high flow rate, high ambient temperature, and high water volume applications. All Baldwin-Series coolers use thermo-electric elements (Peltiers) to cool the sample gas to the desired dew point temperature. Condensate is removed as it forms by a small peristaltic pump.



- Dependable water removal
- Low maintenance
- Single or dual sample streams
- Analog controlled
- EZ-Clean twist-apart impingers
- LCD temperature display
- Excellent corrosion resistance
- Alarm relays protect analyzers

Model	Impingers	
	Active	Passive
M115		1 x 5 in.
M325	1 x 5 in.	1 x 5 in.
M425		2 x 5 in.
610P		1 x 10 in.
5210	1 x 10 in.	1 x 10 in.
8210		2 x 10 in.
20410	2 x 10 in.	2 x 10 in.



**Achieve lower dew points with supplemental drying system (SDS) See Page 7**

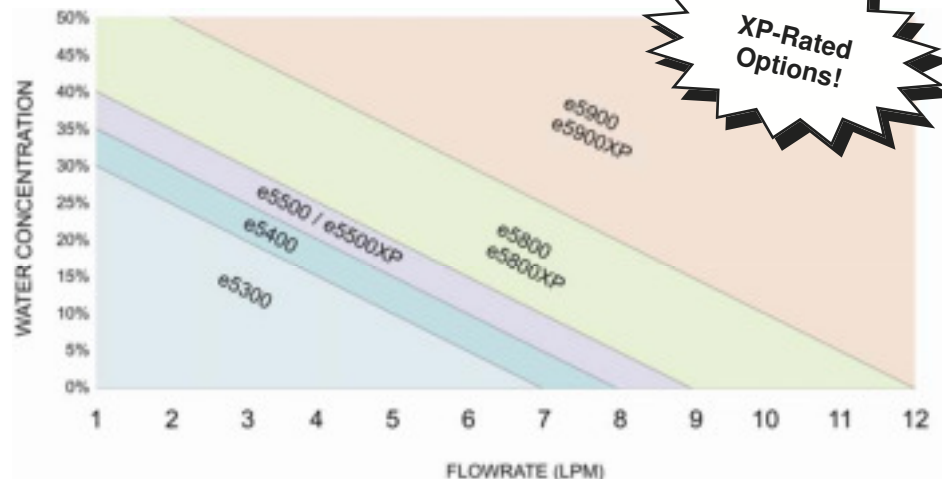
## **eCOOL™** DIGITAL THERMO-ELECTRIC COOLER

A revolution in gas sample conditioning, the Baldwin-Series eCool™ coolers offer all the water removal features of the "Classic" series with the additional convenience of digital controls for remote monitoring and data collection.



- Remote control and monitoring of probe, sample line and cooler
- Digital control via custom windows application over a network or Modbus over TCP/IP
- CSA Rated Class I, Division II models available
  - e5500XP, e5800XP, e5900XP
- CE Rated

Model	Impingers	
	Active	Passive
e5300	1 x 5 in.	1 x 5 in.
e5400		2 x 5 in.
e5500	1 x 10 in.	1 x 10 in.
e5800		2 x 10 in.
e5900	2 x 10 in.	2 x 10 in.



**XP-Rated Options!**

## SO<sub>3</sub> Aerosol Removal Cooler, Model 10410

The Baldwin™-Series Model 10410 is specifically designed for removal of acid gas in applications with high SO<sub>3</sub> content (>10 ppm). After one passive (ambient) and one active (4°C) impinger, sample gas is pumped through one of two active Kynar®-packed impingers cooled to -7°C, which alternately freeze and thaw, wringing out acid liquids in the process.



- Designed for high SO<sub>3</sub> content
- Excellent corrosion resistance
- Yields sample dew points as low as -7°C
- Accepts flow rates up to 10 lpm

## Baldwin™-Series Heated Filter Probes

The Baldwin™-Series direct extractive filter probes feature an advanced design to extract sample gas and remove particulate while preventing condensation prior to the gas sample entering the heated sample line.

- Sure-lock filter reduces risk of leakage
- Range of filter elements for various applications
- Class I, Div. II rated
- Available with air blowback system
- Durinert® or Teflon®-coated filter assemblies



Model 31 – Portable  
Models 32C and 33C – General purpose  
Models 34C, 34R, 35C, 36C – with Blowback for high particulate applications  
Models 34C-Z and 34C-R-Z – Class I Div II with Blowback

## Portable Products for the Stack Testers

Perma Pure supports testing companies, integrators and service providers with a lineup of reliable, compact and transportable equipment.

- Baldwin™ Model 31 handheld heated filter probe
- Portable Zero-Air™ generator
- Baldwin™ e-Cool® Mini cooler
- Baldwin™ Tester's Choice cooler
- MiniGASS 28-12 portable Nafion® system



## Rack-Mounted Systems

Perma Pure can build a complete rack-mounted sampling system using any size Baldwin cooler to suite your application. Systems include sample pump, water slip sensor and your choice of impingers: stainless steel (best heat transfer), glass, Kynar® or Durinert-coated stainless steel (best corrosion resistance).



- Compact Design
- Incorporates any size cooler
- Kynar filter and water slip sensor
- Complete sampling system with sample pump
- Rack mounted for easy installation

## Dilution Probe

Dilution extraction probes draw, filter and dilute sample gases in preparation for analysis. The probe dilutes the sample gas 10 to 250 times with dry air, reducing the water vapor content and eliminating the need for high-cost heated line and conditioning systems.

- Selectable dilution ratios
- Out of stack orifice
- Dilution air pre-heater
- Plug-free operation
- Wet basis measurement
- Optional fast loop bypass



## Model 3300 Flow Control Drawer

The Baldwin™-Series Flow Control Drawer provides an easy and compact solution to control sample and calibration gases. The Model 3300 is a 19" rack mountable integrated gas flow control system for monitoring and controlling gases.

- Block and bleed manifold
- Opt. pressure transmitter
- Simple tube connectors
- Up to 6 gas analyzers
- Up to 8 calibration gas channels



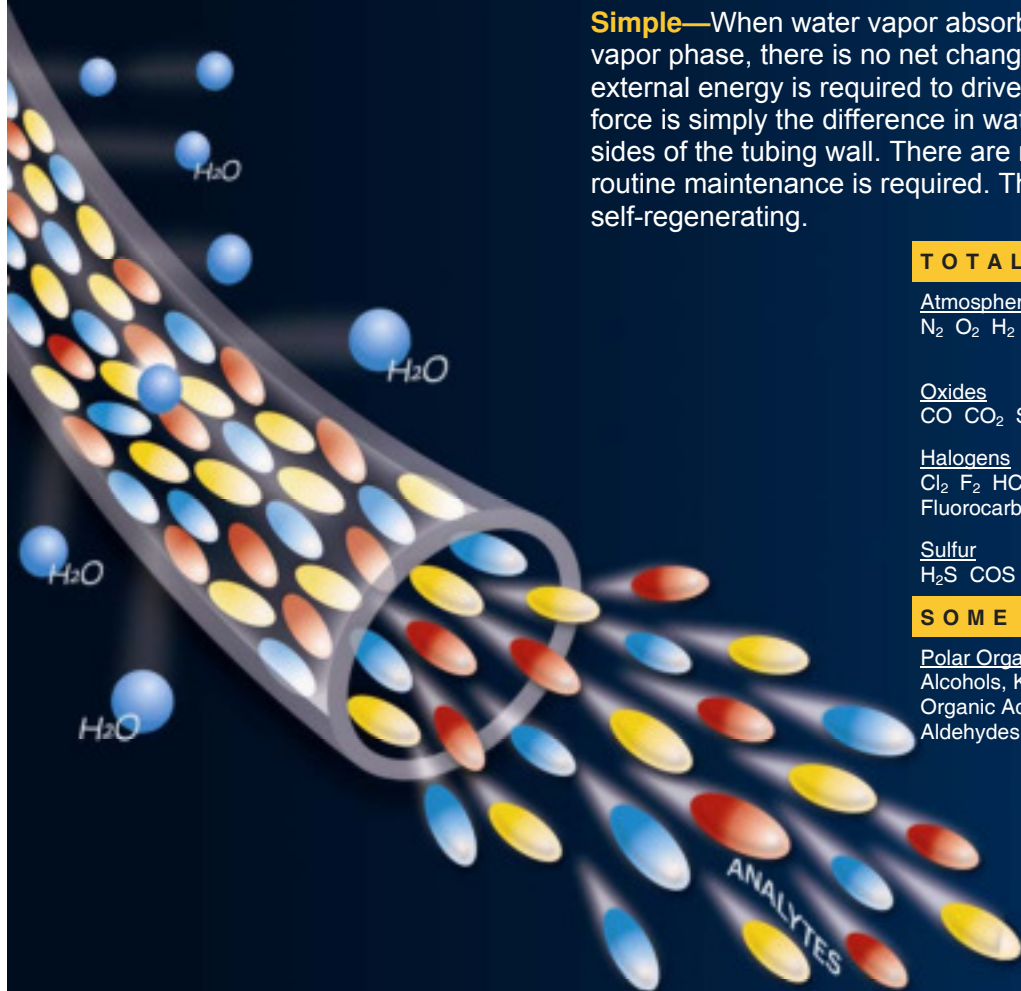
# Nafion® Membrane Drying Technology

## The Ultimate Water Vapor Removal Solution!

**Corrosion Resistant**—Nafion is a Teflon® and sulfonic acid copolymer. Like Teflon, Nafion is highly resistant to chemical attack, so it can be used with very corrosive gases.

**Fast & Selective**— Unlike microporous membrane permeation, a relatively slow diffusion process, Nafion absorbs and transfers water in “a fraction of a second” at a molecular level. Because this is a specific chemical reaction with water (not size based) other constituents are usually unaffected.

**Simple**—When water vapor absorbs onto the tubing from the vapor phase, there is no net change of free energy, and no external energy is required to drive the reaction. The driving force is simply the difference in water concentration on opposite sides of the tubing wall. There are no moving parts and no routine maintenance is required. The process is continuous and self-regenerating.



### TOTALLY RETAINED

<u>Atmospheric Gases</u> N <sub>2</sub> O <sub>2</sub> H <sub>2</sub> Ar He	<u>Hydrocarbons</u> All Simple Hydrocarbons
<u>Oxides</u> CO CO <sub>2</sub> SO <sub>2</sub> SO <sub>3</sub>	<u>Toxic Gases</u> HCN COCl <sub>2</sub> NOCl
<u>Halogens</u> Cl <sub>2</sub> F <sub>2</sub> HCl HF HBr Fluorocarbons	<u>Other Organics</u> Ethers, Cyanides, Esters
<u>Sulfur</u> H <sub>2</sub> S COS Mercaptans	<u>Inorganic Acids</u> HNO <sub>3</sub> H <sub>2</sub> SO <sub>4</sub>

### SOME LOSSES

<u>Polar Organics</u> Alcohols, Ketones, Organic Acids, DMSO, Aldehydes, THF	<u>Other</u> Ammonia, Amines, Nitriles
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### “Tube-in-Shell” Dryer Design



## GASS-2040™ Sample Conditioning System

The GASS-2040 conditions high-flow, high-moisture samples, eliminating acid mists or ammonia if present. It processes the toughest samples, with flows up to 25 liters per minutes and moisture contents in excess of 50%. The GASS-2040 can be mounted anywhere, including on the stack flange with an integral stack probe, which eliminates heated sample lines.



### 3 Temperature zones

**First zone**—Sample passes through a heat exchanger, then through a coalescing particulate filter to remove particles down to 0.1 micron. Acid mists, if present, are coalesced then removed by an automatic drain. If ammonia is present, it is removed by a proprietary ammonia scrubber.

**Second zone**— Sample passes through a Nafion dryer. The initial portion of the dryer is heated above the sample dew point to prevent condensation.

**Third zone**—The sample passes through the remainder of the dryer, further reducing the dew point down as low as  $-25^{\circ}\text{C}$ , depending upon dryer model selected and sample flow rate. This zone operates at ambient temperature.

When an integral sampling probe is added, the GASS-2040 can be mounted right on the stack flange. The probe filter and blowback assembly are mounted inside along with a temperature controller and blowback timer. Conditioning the sample immediately after leaving the stack improves analytical integrity, eliminates the need for expensive heated sample lines, and reduces calibration times.

- Suited for high acid concentrations
- Optional built-in sample pump
- Achieves low sample dew points
- Stainless steel NEMA 4X enclosure
- Preserves water-soluble analytes

*Ideal for high moisture or SO<sub>2</sub>*

## MG-1228

The Mini-GASS 1228 offers many of the same proprietary sample conditioning qualities as the GASS-2040 in a smaller package for lower flow applications up to 10 lpm. The Mini-GASS comes with an optional integral probe and blowback system for stack mounting, which eliminates the need for heated sample lines. The Mini-GASS comes in a heated NEMA 4X enclosure to protect components and ensure maximum drying power. Like all Nafion® dryers and systems, the Mini-GASS requires dry purge air at least two times the sample flow rate.

- Dries samples up to 10 lpm
- 3 dryer choices for a range of conditions
- High Impact plastic NEMA 4X box
- Nafion® drying for low final dew point
- Optional integral probe for stack mounting
- Optional Z-purge for Class I Div II environments



## MG-1220

For mounting in climate-controlled, low dust environments, the Mini-GASS-1220 offers the same drying power as the MG-1228 in a lower cost package with only one heat zone. The lower portion of the Nafion® dryer extends below the heated enclosure to create a lower temperature “polishing” chamber.

- Dries samples up to 10 lpm
- 3 choices of Nafion® dryers for a range of conditions
- High Impact plastic NEMA 4X box
- Optional Z-purge for Class I Div II environments



## Ambi-GASS™

Ambi-GASS systems prepare non-condensing, ambient temperature gas samples for analysis. The Nafion dryers in the units provide full corrosion resistance and very high sample selectivity, so water-soluble gases are not lost. Ambi-GASS enclosures are fully sealed and corrosion-resistant so they can be mounted in harsh environments.



- Ambient sampling up to 99% RH
- Yields sample dew points as low as  $-25^{\circ}\text{C}$
- Accepts flow rates up to 25 lpm
- 0.1 micron coalescing/particulate filter
- No electrical power required; Intrinsically safe in hazardous areas

## ACES™

ACES systems prepare gas samples for analysis by electrochemical sensor (EC) analyzers when the sample is too humid for analysis but not condensing at ambient temperature. EC analyzers suffer reliability problems when the sample is either too wet or too dry. ACES systems reduce sample humidity to the ideal range for EC (typically 20-80%RH), while also removing any dust or dirt particles.



- Ambient sampling up to 99% RH
- 20-80% RH sample outlet
- Accepts flow rates up to 2 lpm
- 0.1 micron particulate filter

## Micro-GASS™

Micro-GASS systems prepare gas samples for analysis by electrochemical sensors when the samples are hot and too humid for analysis, typically condensing at room temperature.

- Heated sampling for electrochemical sensors
- Yields 30-70% RH samples
- Accepts flow rates up to 1 lpm
- Built-in pump draws sample to sensor
- 01 micron disposable filter



## Ambient Applications

Nafion® dryers used in ambient applications protect electrochemical (EC) cells from an excess of condensing water which can impair readings or ruin sensors. EC cells and other sensors used for these applications require moderate relative humidity but cannot withstand soaking conditions found inside closed tanks or in very humid environments.

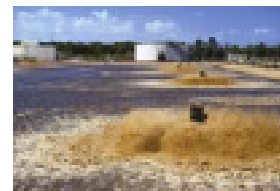
### Oil/Gas Production, Coal Handling, Manufacturing

Safety sensors used in personal or area monitors to detect levels of:

- $\text{H}_2\text{S}$  and  $\text{CH}_4$  (Waste treatment, gas production)
- Phosgene,  $\text{Cl}_2$  and  $\text{HCN}$  (Manufacturing)
- $\text{CO}$  (Coal handling)



### Wastewater Treatment Facilities



Monitoring of tank or digester gases:

- $\text{CH}_4$
- $\text{H}_2\text{S}$
- $\text{O}_2$

### Traffic Safety & Chemical Warfare

- $\text{CO}$  Sensors (Tunnels and Subways)
- Toxic gas (area monitors)



Nafion® ambient sample conditioning devices such as the Ambi-GASS (high flow) or ACES (< 2 lpm) will protect the sensor and enable years of accurate data flow.

## GASS-Module™



The GASS-Module is a cost-effective approach to gas sample conditioning that removes water, particulates and coalescible liquids from gas samples while retaining analyte gases. The GASS-Module is a heated sampling system that brings maximum performance at minimal cost to systems integrators and OEM manufacturers of gas analysis systems by deferring all control to the central system, eliminating any electronics in the module and reducing the size and complexity of the device.

- Complete sampling system
- Dries continuously
- Samples up to 30% water by volume
- No moving parts
- Yields sample dew points as low as  $-35^{\circ}\text{C}$

# Filters, Scrubbers & More

## Ammonia Scrubbers

AST™-Series ammonia scrubbers remove ammonia from a gas stream to protect analyzers and sample lines from clogging due to the formation of ammonium salts. The proprietary scrubber media has been formulated for continuous operation. Its life expectancy is dependent upon the sample flow rate and ammonia concentration in the gas stream. It is very selective in its reactions with the gas, removing only ammonia. It is also a very safe, stable chemical to handle and store.



- Removes only ammonia
- Eliminates ammonium salts
- Easy media replacement
- Optional heater
- No moving parts
- Exclusive, long-life media

## Acid Scrubber

The Baldwin™-Series Acid Safety Scrubber helps protect your analyzers from corrosion due to hydrochloric and sulfuric acid. The calcium carbonate scrubber is recommended for coal-fired boiler, waste incinerator, and other applications where acidic gases are common.



- Compact Design
- HCl and H<sub>2</sub>SO<sub>4</sub> removal
- Easy media replacement
- No moving parts
- Corrosion resistant

## Filters

### Particulate / Coalescing

The FF-250™-Series filters are high-efficiency particulate and coalescing filters designed for high-temperature, corrosive service. Used as a coalescer, this filter will remove liquid droplets and particulate down to 0.1 micron with an efficiency of 95% or greater.



### Inertial Bypass Filter

The FB™-Series bypass filter are inertial separation filters for high particulate load applications.



## Heatless Air Dryer

HD™-Series heatless dryers are ideal for low-flow, compressed air drying applications. Dryer operation is fully automatic, with outlet dew points as low as -50°C. Electrical power and air pressure are all that is required for use.



- Supplies continuous dry air
- -50°C dew point
- Easy installation
- Molecular sieve desiccant
- Self-regenerating
- No maintenance
- Solid-state controls

## SDS Supplemental Drying System



- Eliminates formation of acid mists
- Selective Nafion® membrane technology
- Single or dual sample streams
- Improves chiller performance
- Corrosion resistant
- Improves sensitivity of IR measurements

SDS™-Series drying systems provide a boost to an existing gas sample conditioning system. The SDS will reduce the dew point of the sample from +4°C down to below -15°C, reducing the total moisture content by an additional 80%. Lowering the gas sample dew point is essential in order to eliminate the formation of acid mists. Rather than replace an existing cooler with a "super" cooler, the SDS is a cost effective way of extending the life and improving the performance of your existing sample conditioning system.

The SDS can process one stream of up to 10 lpm, or two streams of up to 5 lpm each.



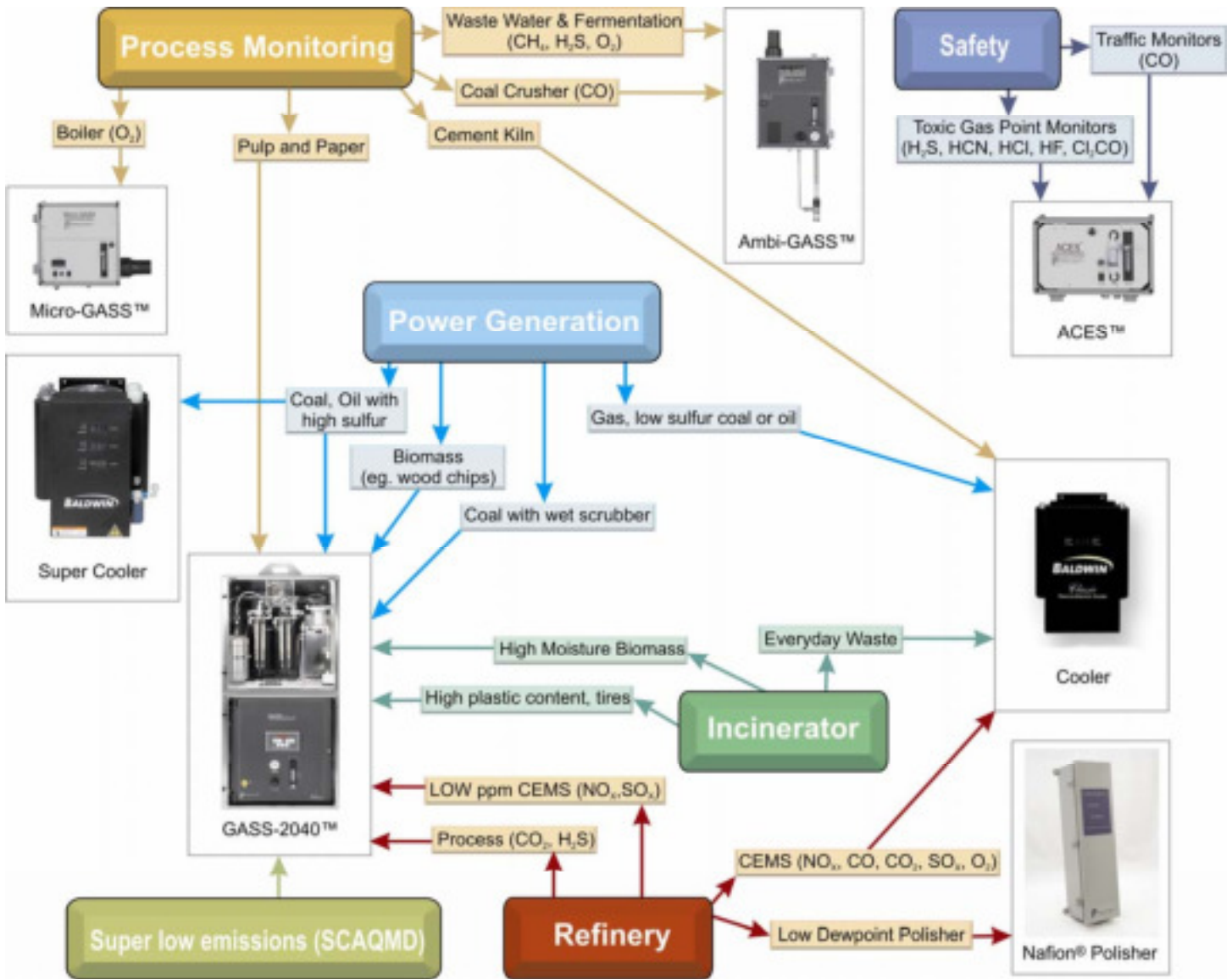
# Choosing Thermo-Electric Coolers or Nafion® Membrane Dryers

Perma Pure is the only company that offers a complete range of sample conditioning technology for any application. While traditional coolers will reduce unwanted moisture from many sample gas streams, certain applications require the membrane drying power of Nafion® to properly remove enough water vapor without dissolving water-soluble acid gases.

Applications best suited to Nafion include:

- High moisture content (>30%) gas streams
- Water soluble analytes such as H<sub>2</sub>S, HCl, NO<sub>x</sub>, SO<sub>x</sub>
- Very low dew points (<-10°C) required (infra red analyzers, high SO<sub>2</sub>)

The chart below clarifies the best Perma Pure solution for many typical applications. Please contact your Sales Representative or our world headquarters for further clarification.



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