PERMA PURE
PROTECT LIFE

Gas Sample Conditioning Systems

For CEMS and Process Analysis



Improve Accuracy | Protect Analyzers | Reduce Maintenance

Perma Pure's CEMS and process analysis solutions include coolers, probes, highly-selective permeation tubing, and integrated sampling systems, which are used by leading continuous emissions monitoring systems suppliers, industries and governments. We are proud to partner with our broad and diverse customer base to meet the latest SOx and NOx requirements, making the world healthier and cleaner. Our commitment to protect life starts with a focus on quality and partnership with our customers to meet the challenges of a dynamic global marketplace while making the world safer and healthier.

Serving a Wic

Perma Pure gas sample conditio

POWER GENERATION •

Model Number	Maximum Water In Gas Stream - %				Maximum Rated Flow - LPM									XP	Requires Drain Pump	
	0-12%	12-20%	20-30%	30-50%+	1	2	2-3	3-4	4-5	5-6	6-8	8-10	10+		Yes	No
Baldwin-Series Coolers																
ICOOL-A-1	•				•	•									•	
ICOOL-A-2	•				•	•	•	•							•	
4C-M115S	•	•			•										•	
4C-225S	•	•			•	•									•	
4C-M325S	•	•			•	•	•								•	
4C-M425S	•	•			•	•	•	•							•	
4C-5210S	•	•			•	•	•	•	•						•	
4C-8210S	•	•			•	•	•	•	•	•	•				•	
4C-10410K	•	•			•	•	•	•	•	•	•	•			•	
4C-20410S	•	•			•	•	•	•	•	•	•	•	•		•	
4E-5500XP	•	•			•	•	•	•	•	•				•	•	
4E-5800XP	•	•			•	•	•	•	•	•	•			•	•	
4E-5900XP	•	•			•	•	•	•	•	•	•	•		•	•	
Baldwin-Series Cooler Sample Conditioning Systems																
4S-9A	•	•			•											
4S-MP5400 (Portable)	•	•			•	•	•	•								
4S-9PA	•	•			•	•	•	•	•							
4S-9AA	•	•			•	•	•	•	•	•	•					
4S-M8B (Portable)	•	•			•	•	•	•	•	•	•					
4S-9-10410K	•	•			•	•	•	•	•	•	•	•				

Coolers

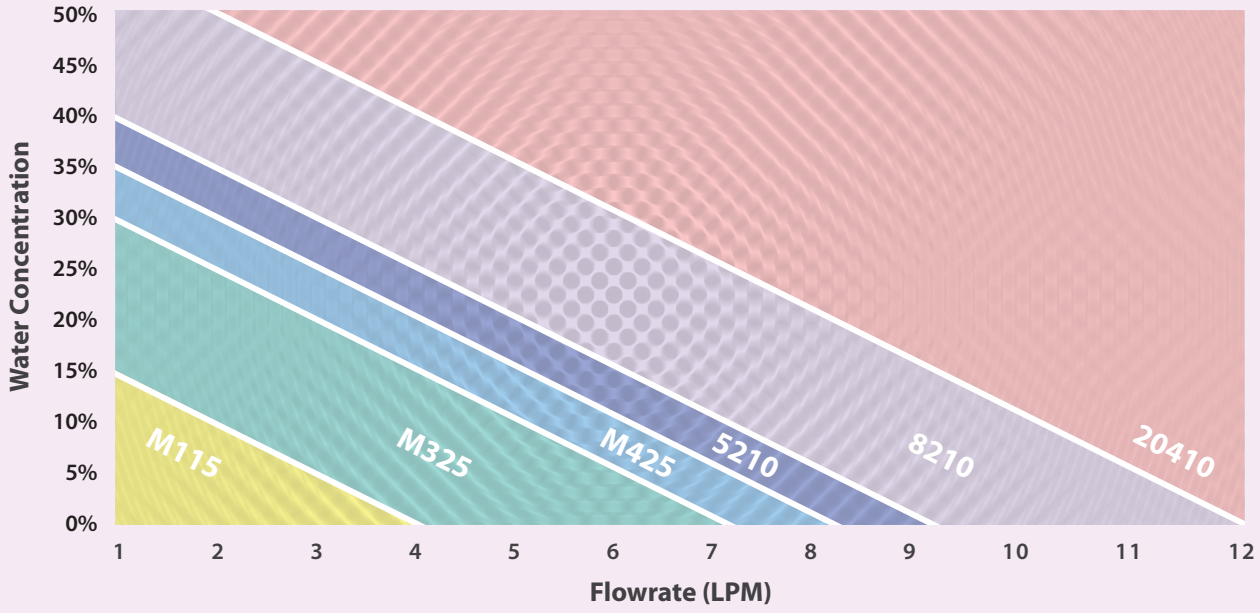
Baldwin™–Series Thermo-Electric Coolers

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
- EZ-Clean twist-apart impingers
- LCD temperature display
- Durinert coated impingers
- Alarm relays protect analyzers
- Analog controlled
- ***New!*** Digital control to be released soon



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



SO_3 Aerosol Removal Cooler



The Baldwin™-Series Model 10410 is specifically designed for removal of acid gas in applications with high SO_3 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 SO3 content
- Excellent corrosion resistance
- Yields sample dew points as low as –7°C
- Accepts flow rates up to 10 lpm

eCool™

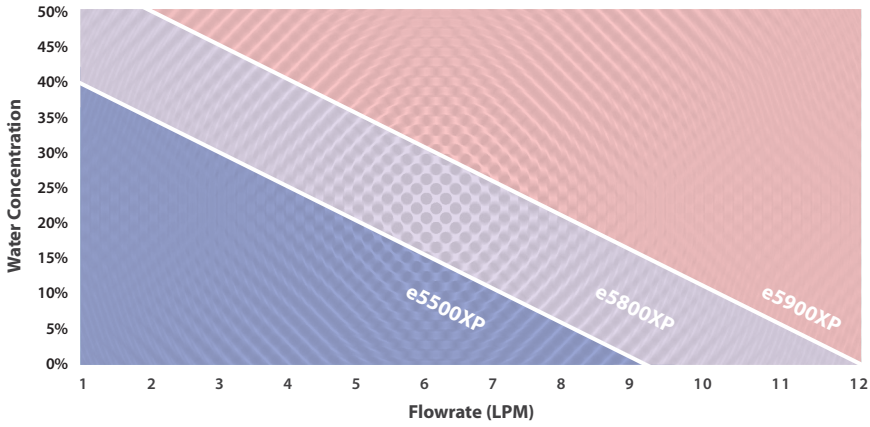
CSA Approved Class 1, Div 2 XP Digital Thermo-Electric Cooler



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 remote monitoring and data collection.

- Remote monitoring of cooler temperature via custom Windows application over a network or Modbus over TCP/IP
- CSA Rated Class I, Division II models available
- e5500XP, e5800XP, e5900XP

Model	Impingers	
	Passive	Active
e5500XP	1 x 10 in.	1 x 10 in.
e5800XP		2 x 10 in.
e5900XP	2 x 10 in.	2 x 10 in.



Complete Sample Conditioners



Perma Pure can build a complete rack-mounted sampling system using any size Baldwin cooler to suit 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
- Sample system available with XP components
- Rack mounted for easy installation
- Complete sampling system with sample pump

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



Models 33C – General purpose

Models 34R – with Blowback for high particulate applications

Models 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.

- Portable Zero-Air™ generator
- Baldwin™ e-Cool® Mini cooler
- Baldwin™ Tester's Choice cooler
- MiniGASS 2812 portable Nafion™ system



Flow Control Drawer

Model 3300

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

SDS Supplemental Drying System

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.



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

Filters, Scrubbers & More!

Ammonia Scrubbers



AS™-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
- Heaters available in 115 or 230 VAC

Acid Scrubbers



The 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 H2SO4 removal
- Easy media replacement
- No moving parts
- Corrosion resistant

Filters

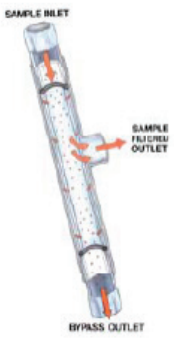
Particulate/Coalescing

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
- As low as -50°C dew point
- Easy installation
- Molecular sieve desiccant
- Self-regenerating
- No maintenance
- Solid-state controls
- Up to 90 lpm
- 115 V / 230 V



Nafion™-Based Gas Sample Conditioning Systems

CEMS & Process Monitoring



Perma Pure is the exclusive manufacturer of Nafion™ tubing, a highly-selective permeation membrane. 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.

Our Nafion™-based solutions take advantage of the material's unique properties that allow the removal of water vapor without dissolving water soluble acid gases. Removal of moisture improves accuracy of measurements by eliminating interference. It also reduces maintenance expenses by protecting the analyzer and other components, as well as eliminating or lowering the temperature of the heated line.



Applications best suited to Nafion™

- High moisture content (>30%) gas streams
- Water soluble analytes such as H2S, HCl, NOX, SOX
- Very low dew points (<-10°C) required (infra red analyzers, high SO2)

Nafion™ Membrane Drying Technology

The Ultimate Water Vapor Removal Solution!

Corrosion Resistant

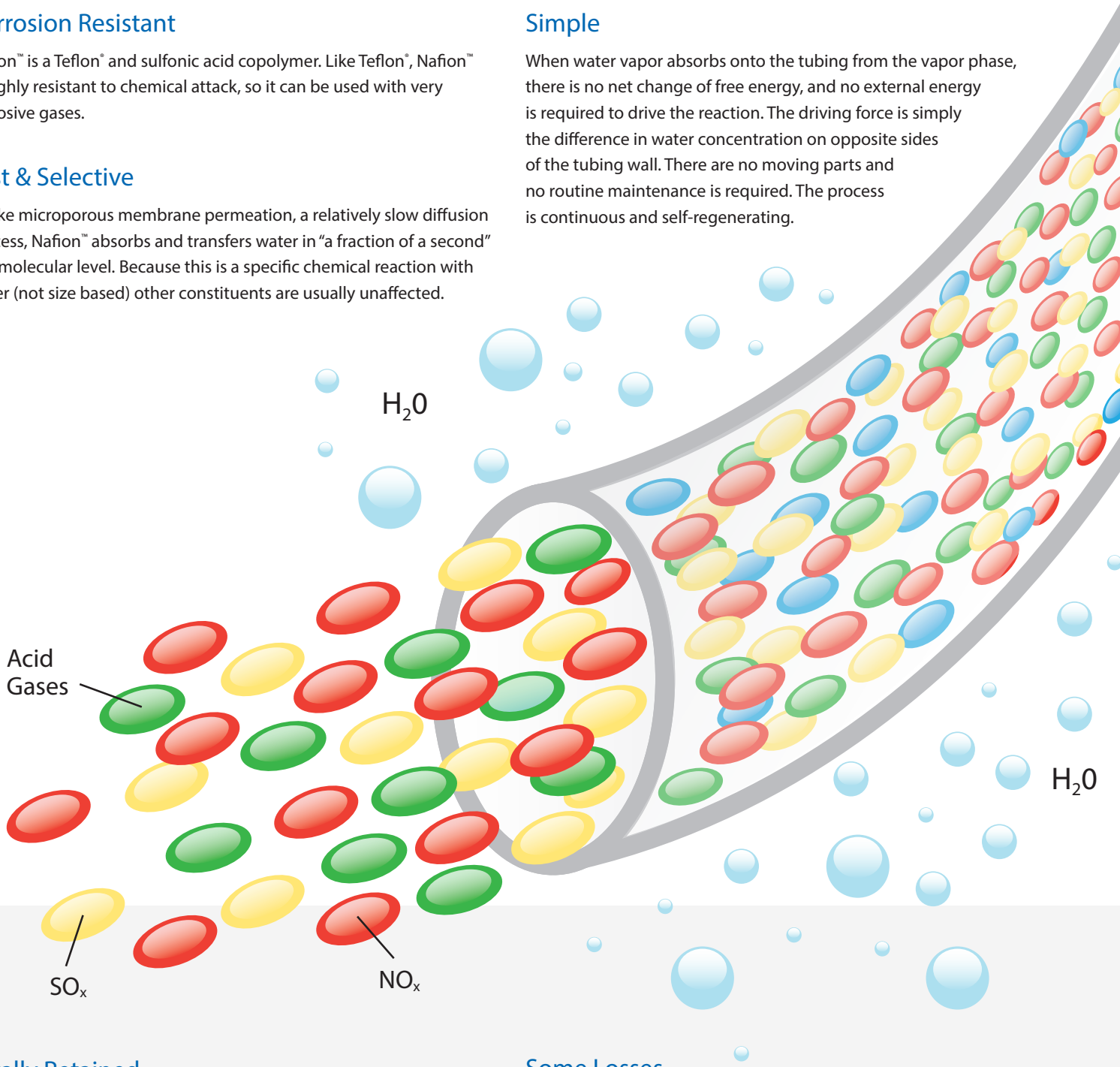
Nafion™ is a Teflon® and sulfonic acid copolymer. Like Teflon®, Nafion™ is highly resistant to chemical attack, so it can be used with very corrosive gases.

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

Atmospheric Gases
N_2, O_2, H_2, Ar, He

Hydrocarbons
All Simple Hydrocarbons

Oxides
CO, CO_2, SO_2, SO_3

Toxic Gases
HCN, $COCl_2$, NOCl

Halogens
Cl_2, F_2, HCl, HF, HBr, Fluorocarbons

Other Organics
Ethers, Cyanides, Esters

Sulfur
H_2S, COS Mercaptans

Inorganic Acids
HNO_3, H_2SO_4

Some Losses

Polar Organics
Alcohols, Ketones, Organic Acids, DSMO, Aldehydes, THF

Other
Ammonia, Amines, Nitriles

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 minute 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.

Three Temperature Zones

1st 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.

2nd Zone: Sample passes through a Nafion™ dryer. The initial portion of the dryer is heated above the sample dew point to prevent condensation.

3rd Zone: The sample passes through the remainder of the dryer, further reducing the dew point down as low as –25°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 and water vapor concentrations
- Optional built-in sample pump
- Low acid and NOx measurements without losses
- Achieves very low sample dew points not possible with other methods
- Stainless steel NEMA 4X enclosure
- Preserves water-soluble analytes

Wall-mounted unit can be used in place of existing system, replacing sample probe and conditioner.



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. The Mini-GASS can be operated using dry purge air or with a heatless dryer option enabling the use of oil-free compressed air.

- 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



Ambient Application

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:

- H2S and CH4 (Waste Treatment, Gas Production)
- Phosgene, Cl2 and HCN (Manufacturing)
- CO (Coal Handling)

Wastewater Treatment Facilities

Monitoring of tank or digester gases:

- CH_4
- H_2S
- O_2

Traffic Safety & Chemical Warfare

- CO Sensors (Tunnels & Subways)
- Toxic Gas (Area Monitors)

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
- 0.1 micron disposable filter

IndiGASS

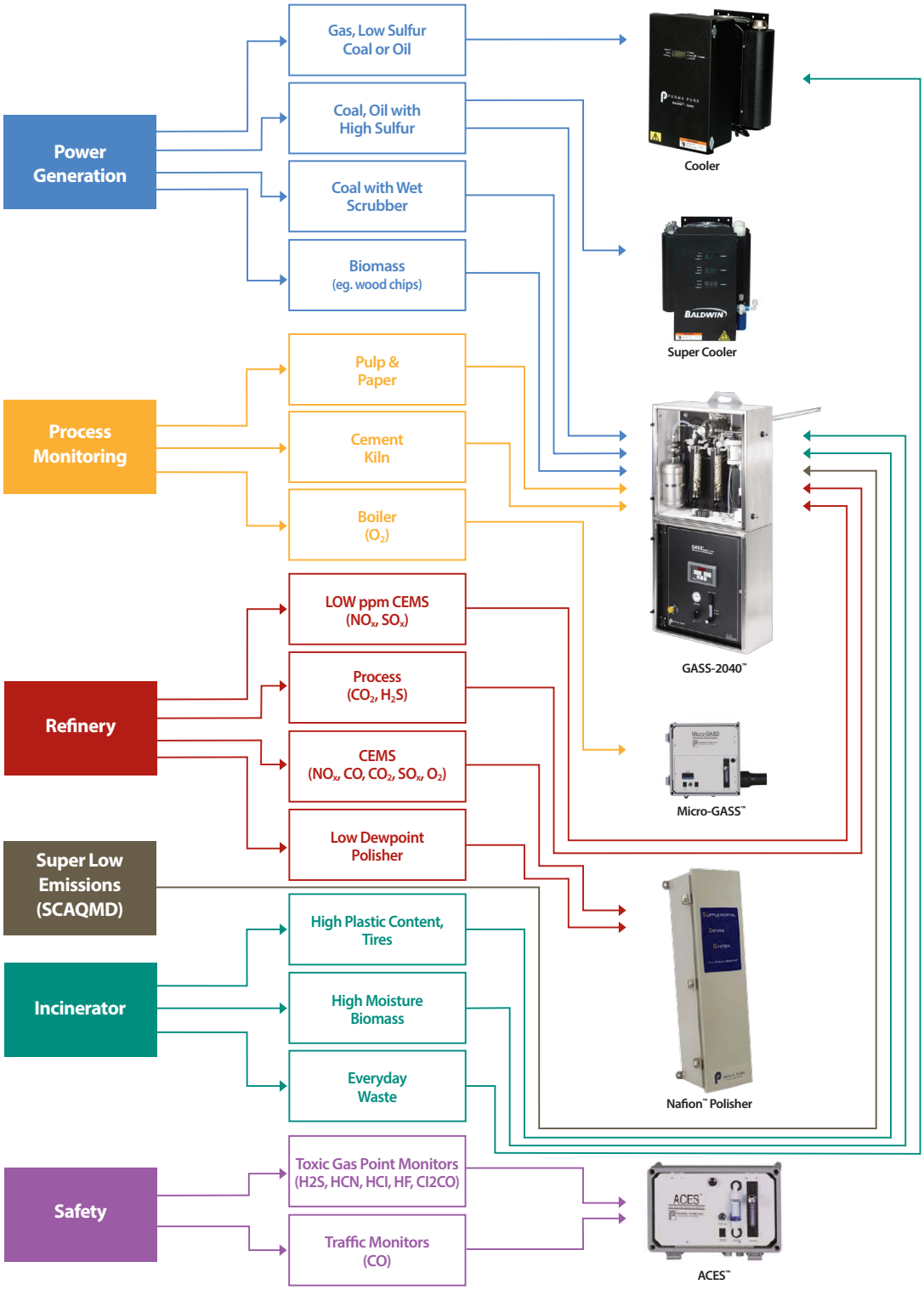
IndiGASS systems produce an ideal dry, clean, and cool sample by continuously removing water and particulates from the sample stream, without altering the concentrations of typical analyte gases (including CO, CO_2, HCl, NO_X, O_2, SO_2, and VOC).



- Compact footprint

PERMA PURE
PROTECT LIFE

Choosing Thermo-Electric Coolers or Nafion™ Membrane Dryers



Perma Pure LLC • A Halma Company • info@permapure.com • www.permapure.com

Lit. No.: Systems-Bro-1610 Supersedes: New

©2016 Perma Pure LLC. All rights reserved. Speculations subject to change.
Nafion™ is a registered trademark of The Chemours Company.