COMPRESSED AIR BEST PRACTICES

airbestpractices.com

Global Food Safety Initiative (GFSI) Compliance: Two Compressed Air System Specifications

Brought to you by:

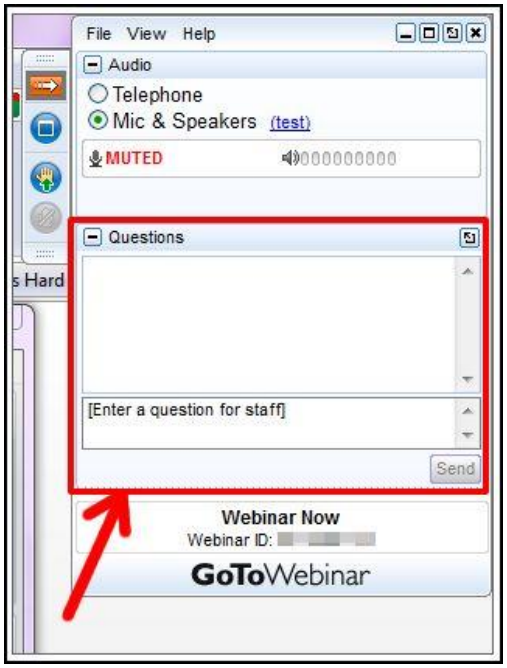
Atlas Copco

TRACE Analytics LLC

For your free subscription, please visit
http://www.airbestpractices.com/magazine/subscription.

COMPRESSED AIR
BEST PRACTICES
airbestpractices.com

Q&A Format



- Panelists will answer your questions during the Q&A session at the end of the Webinar.

- Please post your questions in the Questions Window in your GoToWebinar interface.

- Direct all questions to Compressed Air Best Practices® Magazine

Brought to you by:

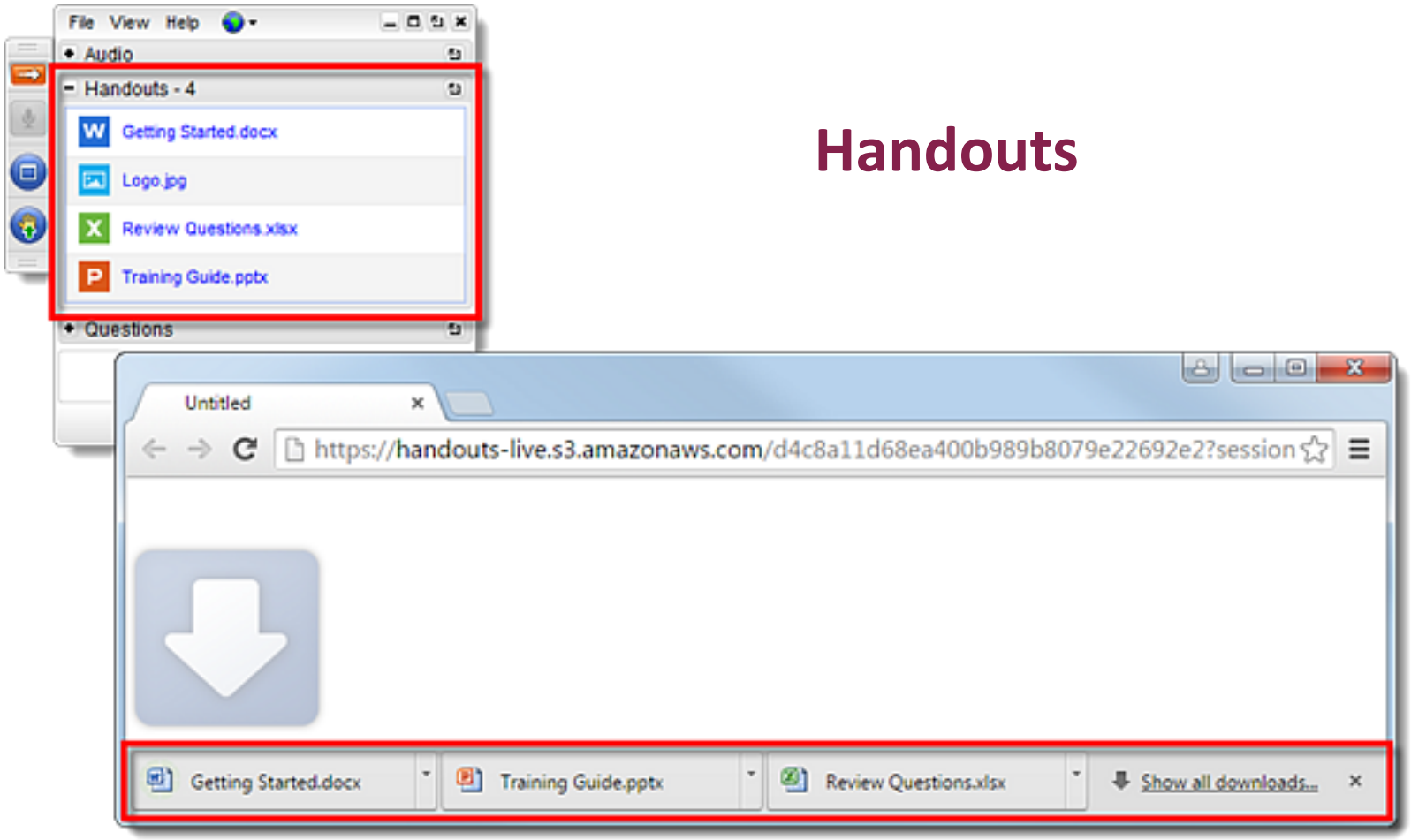
Atlas Copco

TRACE Analytics LLC

For your free subscription, please visit http://www.airbestpractices.com/magazine/subscription.

COMPRESSED AIR
BEST PRACTICES
airbestpractices.com

Handouts



COMPRESSED AIR
BEST PRACTICES
airbestpractices.com

Global Food Safety Initiative (GFSI) Compliance: Two Compressed Air System Specifications

Introduction by Rod Smith, Publisher,
Compressed Air Best Practices® Magazine

For your free subscription, please visit
http://www.airbestpractices.com/magazine/subscription.

Rod Smith, email: rod@airbestpractices.com

COMPRESSED AIR
BEST PRACTICES
airbestpractices.com

All materials presented are educational. Each compressed air system is unique and must be evaluated on its own merits.

COMPRESSED AIR BEST PRACTICES
airbestpractices.com

About the Speaker

Jason Wizner, Air Technologies

- Graduated from Michigan State University with a degree in Manufacturing Engineering
- Enjoyed various roles in the compressed air industry for more than 26 years
- Currently works with Air Technologies, supplying compressed air as a utility to manufacturers via DirectAIR®

AIR TECHNOLOGIES®
Compressed Air Systems
LISTEN. COMMIT. DELIVER.

Brought to you by:

Atlas Copco

TRACE Analytics LLC

For your free subscription, please visit
http://www.airbestpractices.com/magazine/subscription.

Global Food Safety Initiative Compliance with Compressed Air Systems

Two Common Compressed Air Systems/Specifications

Presentation by : Jason Wizner
Air Technologies
DirectAIR˚ Account Manger

DirectAIR®
Compressed Air Utility Service

AIR TECHNOLOGIES®
Compressed Air Systems
LISTEN. COMMIT. DELIVER.

Compressed Air Use in the Food & Beverage Industry

- Compressed air is a safe and reliable power source
- Referred to as the 4th utility (next to electricity, water & gas)
- + 90% of all food processing companies use compressed air
  - Low pressure
  - Medium pressure
  - High Pressure

Direct AIR®
Compressed Air Utility Service

AIR TECHNOLOGIES®
Compressed Air Systems
LISTEN. COMMIT. DELIVER.

Most GFSI Suggest Companies Establish Their Own Good Manufacturing Practices (GMP) – relating to compressed air

- Food cleanliness legislation protects the consumer and places the responsibility on the food manufacturer
- Compressed air quality is determined by the removal of **3 Types of Contaminants**
  - Solid Particulates – measured in microns
  - Moisture – measured by pressure dewpoint
  - Oil – measured by ppm w/w
- Many companies have devised their own internal compressed air quality standards based on Good Manufacturing Practices (GMP) – which are not specific as to contaminants allowance
  - FDA – food-grade lubricants and particulate removal
  - SQF – particulate removal and “compressed air shall be clean and present no risk…”
  - ISO22000 – “compressed air systems shall be constructed to prevent contamination”

Direct vs. Indirect Contact with Compressed Air

To determine compressed air quality requirements, food plants must FIRST determine whether it comes in contact with food

Direct Contact

- Compressed air physically contacts food products
- Production, processing, packaging and transportation

Indirect Contact

- Compressed air contacts a component which may contact food
- Food packaging (film, trays) are contacted by compressed air – and then food contacts the packaging

Direct AIR®
Compressed Air Utility Service

AIR TECHNOLOGIES®
Compressed Air Systems
LISTEN. COMMIT. DELIVER.

Risks & Hazards: Quantifying the 3 Types of Compressed Air Contaminants

Define Compressed Air Quality using ISO 8573.1 for:

1.Solid Particle contamination – solid particles (including spores)

1. Pipe scale – does the plant have new or old (rusting) pipe systems?
2. Ambient dust taken into air compressor intake
3. Coatings from airend rotors in the air compressor
4. **Measured in Micron Size Diameter and Volume.**

2.Water contamination – water vapor and moisture

1. Moisture creates an ideal habitat for microorganisms and fungi
2. These can grow inside piping and be blown into food (direct contact) or onto containers (indirect contact)
3. **Measured in terms of pressure dewpoint.**

3.Oil contamination – aerosols/liquids and vapors

1. Lubricated air compressors introduce oil. So do contaminated piping systems.
2. Ambient hydrocarbons taken into air compressor (both lubricated and oil-free) intake
3. **Measured in terms of ppm w/w and mg/m3 (metric world).**

Define Compressed Air Quality using ISO 8573.1 for : Particulates / Water Content / Oil Content

- The International Standards Organization (ISO) established the 8573.1 compressed air quality definitions to facilitate measurement and definition of compressed air quality requirements using QUALITY CLASSES for the 3 mentioned contaminants
- **ISO 8573.1 assigns 3 Class Numbers to Define Plant Compressed Air Quality for: Particulates / Water Content / Oil Content**
- PLANT “A” Requires ISO 8573.1 Quality 1.2.1
    - First Digit is Class 1 Solid Particulates
    - 2nd Digit is Class 2 Pressure Dewpoint
    - 3rd Digit is Class 1 Oil Liquid and Vapor
- Quality Classes (for each of the 3 Contaminants) range from 0 (most stringent) to 9 (most relaxed)
- **End users are responsible to determine the air quality required for their application**

Use the ISO8573.1 Table to Define the Specification

ISO 8573-1:2010 Compressed Air Contaminants and Purity Classes

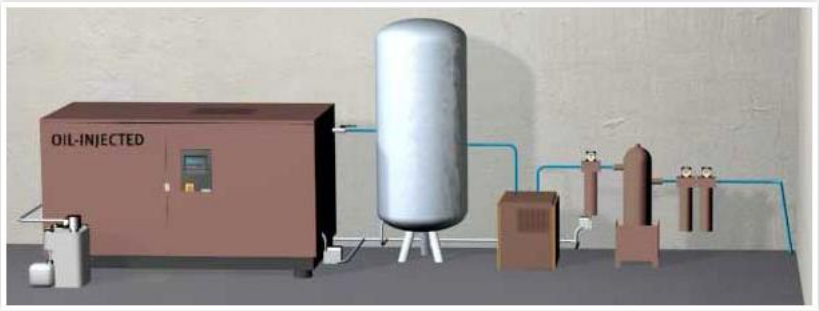
Class	Particles				Water			Oil
	By Particle Size (maximum number of particles per m^3) See Note 2			By Mass	Vapor Pressure Dewpoint		Liquid	Liquid, Aerosol, & Vapor See Note 1
	0.10 – 0.5 microns	0.5 – 1.0 microns	1.0 – 5.0 microns	mg/m^3	°C	°F	g/m^3	mg/m^3
0	As specified by the equipment user or supplier and more stringent than class 1							
1	≤ 20,000	≤ 400	≤ 10	-	≤ -70	≤ -94	-	≤ 0.01
2	≤ 400,000	≤ 6,000	≤ 100	-	≤ -40	≤ -40	-	≤ 0.1
3	-	≤ 90,000	≤ 1,000	-	≤ -20	≤ - 4	-	≤ 1
4	-	-	≤ 10,000	-	≤ +3	≤ +37	-	≤ 5
5	-	-	≤ 100,000	-	≤ +7	≤ +45	-	-
6	-	-	-	0 – ≤ 5	≤ +10	≤ +50	-	-
7	-	-	-	5 – ≤ 10	-	-	≤ 0.5	-
8	-	-	-	-	-	-	≤ 5	-
9	-	-	-	-	-	-	≤ 10	-
X	-	-	-	> 10	-	-	> 10	> 5

Microbiological Contaminants	Other Gaseous Contaminants
No purity classes are identified	No purity classes are identified Gases mentioned are: CO, CO_2, SO_2, NOX, Hydrocarbons in the range of C_1 to C_5

Direct AIR®
Compressed Air Utility Service

AIR TECHNOLOGIES®
Compressed Air Systems
LISTEN. COMMIT. DELIVER.

Two Examples of Food Industry Specifications



ISO 8573.1 Quality Classes 1.2.0

Used in "Direct-Contact & Indirect-Contact" Applications

- Class 1 Solid Particulates
- Class 2 Pressure Dewpoint (-40 F)
- Class 0 Oil Liquids and Vapors
- Oil-Free Air Compressor
- Desiccant Air Dryer
- Filters for oil, oil vapor and solid particulate removal

ISO 8573.1 Quality Classes 1.4.1

Used in "Indirect & No-Contact" Applications

- Class 1 Solid Particulates
- Class 4 Pressure Dewpoint (+ 37 F)
- Class 1 Oil Liquids and Vapors
- Lubricated Air Compressor with Food-Grade Lubricants
- Refrigerated Air Dryer
- Filters for oil, oil vapor and solid particulate removal

Direct AIR®
Compressed Air Utility Service

AIR TECHNOLOGIES®
Compressed Air Systems
LISTEN. COMMIT. DELIVER.

Spec/Example # 1

- Food Manufacturer specifies ISO8573.1 Class 1.4.1
- They use compressed air for multiple applications where air does NOT come into direct contact with food products but does come into indirect contact with food packaging

Direct AIR®
Compressed Air Utility Service

AIR TECHNOLOGIES®
Compressed Air Systems
LISTEN. COMMIT. DELIVER.

ISO Quality Classes 1.4.1

- Compressed Air Quality Specification Drives the Selection of System Components
- They use oil-lubricated rotary screw air compressors that include:
  - Oil-Lubricated Rotary Screw Air Compressors using Food-grade coolant/lubricant
  - Refrigerated compressed air dryers – Class 4
  - Solid particulate and oil coalescing filters – Class 1, Class 1
  - Aluminum (rust-free) piping system
  - Oil/water separation devices

Refrigerated or Desiccant Air Dryer?

Refrigerated Air Dryer-Class 4

Desiccant Air Dryer - Classes 1, 2 or 3

Each Application Must Determine Appropriate Dewpoint Level

Refrigerated Air Dryers and Heat-of-Compression Dryers will lose performance (dewpoint) if subjected to higher ambient and/or inlet temperatures than they were sized for.

Can Coalescing Filters Remove Oil?

Prefilter

- General purpose coalescing filter
- Particle removal down to 1 micron
- Removal of liquid water & maximum remaining aerosol oil content of 0.1 mg/m³ (0.1 ppm) at 70ºF.
- **No vapor removal**

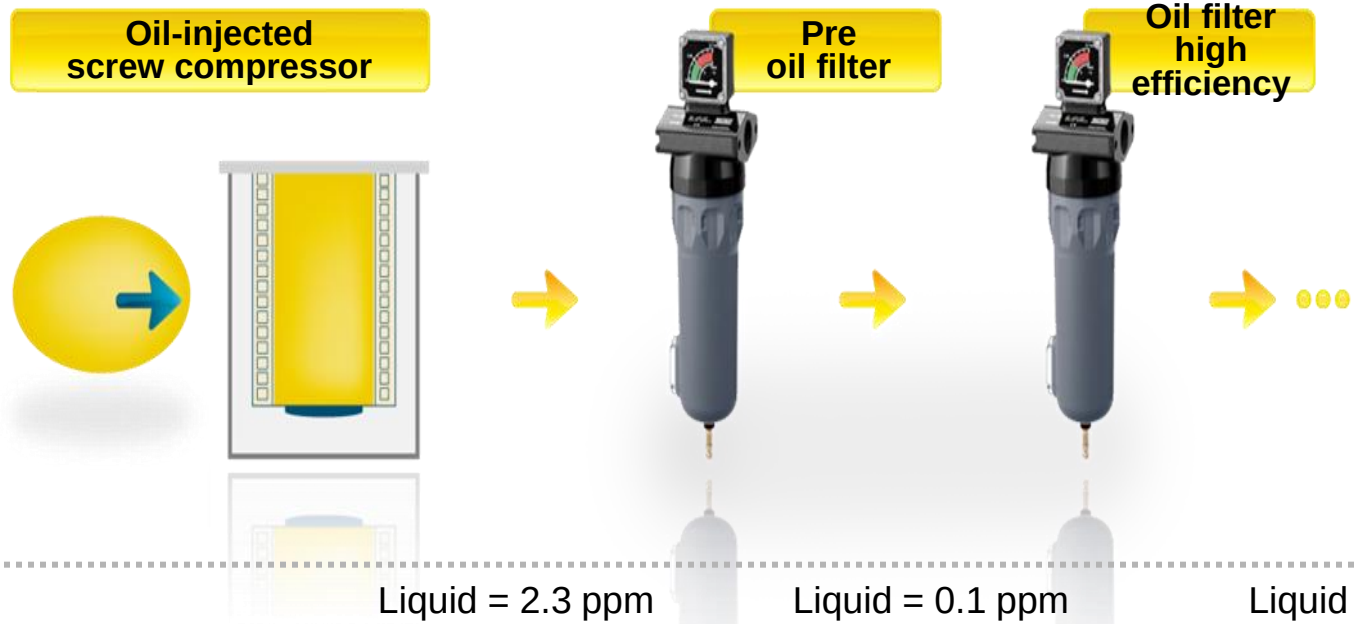
High efficiency filter

- High efficiency coalescing filter
- Particle removal down to 0.01 micron and maximum remaining aerosol oil content of 0.01 mg/m³ (approximated to 0.01 ppm) at 70ºF.
- **No vapor removal**

Coalescing filters only remove aerosols and liquids, NOT oil vapors

Impact of Temperature on Total Oil Content

Total oil content = liquids (including aerosols) + vapor
Oil vapors can be up to 4X the qty of oil aerosols in output air



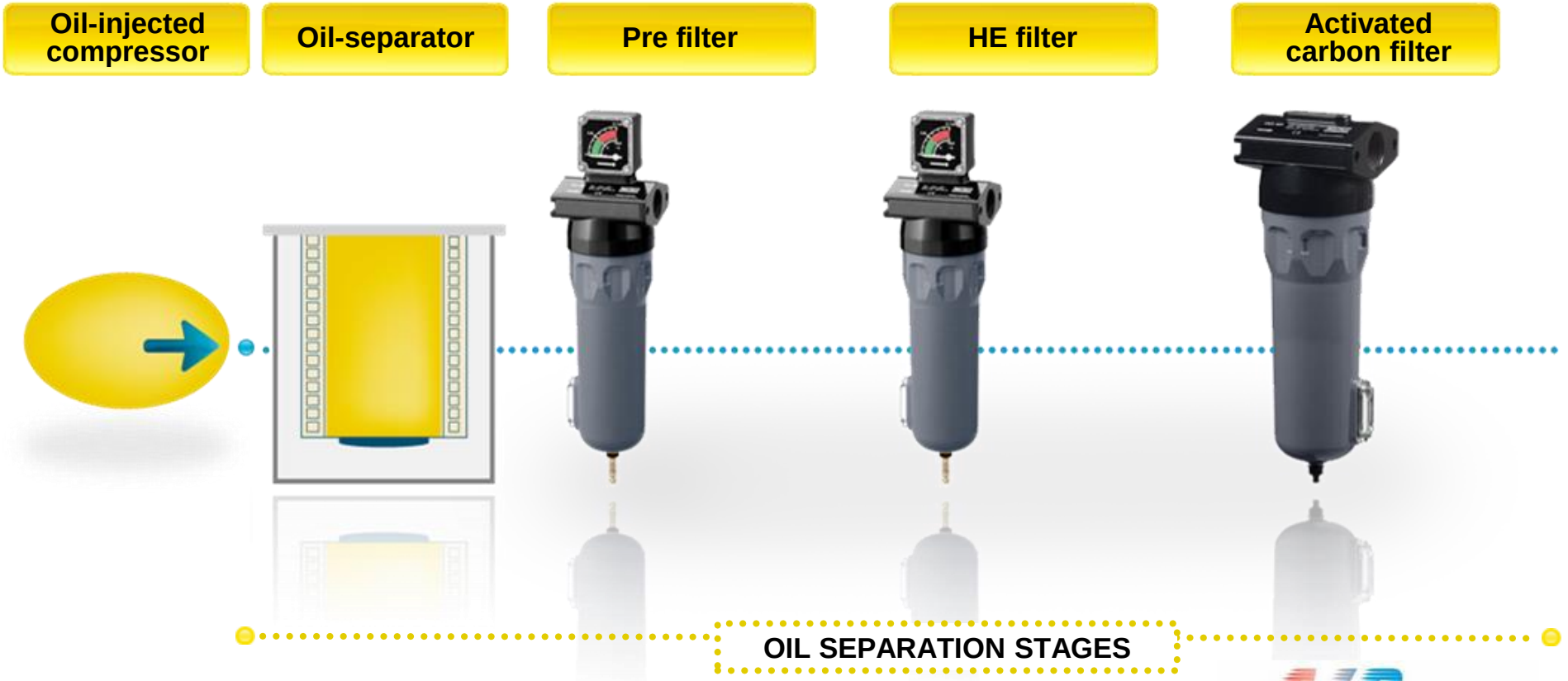
Compressed air temperature	68ºF	Liquid = 2.3 ppm Vapor = 0.04 ppm **Total = 2.34 ppm**	Liquid = 0.1 ppm Vapor = 0.04 ppm **Total = 0.14 ppm**	Liquid = 0.01 ppm Vapor = 0.04 ppm **Total = 0.05 ppm**
	104ºF	Liquid = 5 ppm Vapor = 0.26 ppm **Total = 5.26 ppm**	Liquid = 1.5 ppm Vapor = 0.26 ppm **Total = 1.76 ppm**	Liquid = 0.23 ppm Vapor = 0.26 ppm **Total = 0.49ppm**

Direct AIR®
Compressed Air Utility Service

AIR TECHNOLOGIES®
Compressed Air Systems
LISTEN. COMMIT. DELIVER.

How to Achieve ISO 8573-1 Class 1 with Oil-injected Compressors

Activated carbon filters may also be required in cases where air outlet of the compressors is above 70°F



Direct AIR®
Compressed Air Utility Service

AIR TECHNOLOGIES®
Compressed Air Systems
LISTEN. COMMIT. DELIVER.

Pros/Cons to Oil-lubricated Compressor System with drying and filtration

Pros

- Sometimes called technically oil-free air
- Lower initial costs
- Air quality conforms at best to Class 1 (oil) per ISO 8573-1
- More Popular with Food Manufacturers that have indirect or no-contact with the food product.

Cons

- Higher chance of contamination
- Higher operation and maintenance costs with the additional filtration
- Energy efficiency not as high with additional filtration involved

Spec/Example # 2

A major manufacturer in the Food and Beverage Industry has determined they require compressed air that meets ISO 8573.1 Class 0,2,0

They use compressed air for:

- Direct contact with food
- Pneumatic equipment and conveying
- Actuators, instruments and valves
- Product packaging

Direct AIR®
Compressed Air Utility Service

AIR TECHNOLOGIES®
Compressed Air Systems
LISTEN. COMMIT. DELIVER.

Spec/Example # 2

- The Compressed Air Quality Specification calls for ISO8573.1 Class 0,2,0
  - Class 0 Solid Particulates
  - Class 2 Pressure Dewpoint
  - Class 0 Oil
- They use oil-free rotary screw air compressors
  - Integrated coalescing pre-filter
  - Desiccant air dryers
  - Particulate after-filters

Direct AIR®
Compressed Air Utility Service

AIR TECHNOLOGIES®
Compressed Air Systems
LISTEN. COMMIT. DELIVER.

Pros/Cons to Oil-free Compressor System

Pros

- Guaranteed oil-free air
- No contamination
- Air quality conforms to Class 0 (oil) as per ISO 8573-1 ed 2 (2010)
- No oil/water separation devices required
- More Popular with Food Manufacturers that have direct contact with the food product.

Cons

- Substantially Higher Initial Cost of Acquistion
- Lower energy efficiency
- Higher major rebuild/replacement costs of the major componentry.

Direct AIR®
Compressed Air Utility Service

AIR TECHNOLOGIES®
Compressed Air Systems
LISTEN. COMMIT. DELIVER.

With DirectAIR®, Air Technologies owns and operates the compressed air system and provides air like a utility

- Complete Modular Systems delivering clean, dry compressed air to any customer air quality specifications
- Provides 100% Reliable, Risk-free Air on a 24/7 basis.
- Insures the performance specifications that the Customer requires.

DirectAIR®
Compressed Air Utility Service

AIR TECHNOLOGIES®
Compressed Air Systems
LISTEN. COMMIT. DELIVER.

COMPRESSED AIR BEST PRACTICES
airbestpractices.com

About the Speaker

Deepak Vetal,
Product Marketing Manager,
Atlas Copco

- Has more than 15 years of experience in the compressor industry
- Worked at different levels in sales and marketing, including: Sales and Service Engineer, Key Account Manager, and Marketing Manager at the national level
- Currently serves as the Product Marketing Manager of Oil Free Compressors at Atlas Copco

For your free subscription, please visit
http://www.airbestpractices.com/magazine/subscription.

Atlas Copco

COMPRESSOR SYSTEMS FOR FOOD & BEVERAGE INDUSTRY

Deepak Vetal – 25th Feb 2016

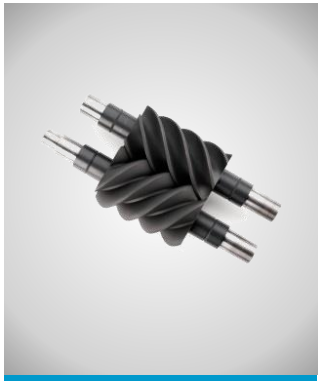
Atlas Copco

AGENDA

- Core Technologies
- Specs 1 : Oil Injected Compressor system
- Dryer selection
- Specs 2 : Oil Free Compressor system
- Value Analysis
- ISO22000

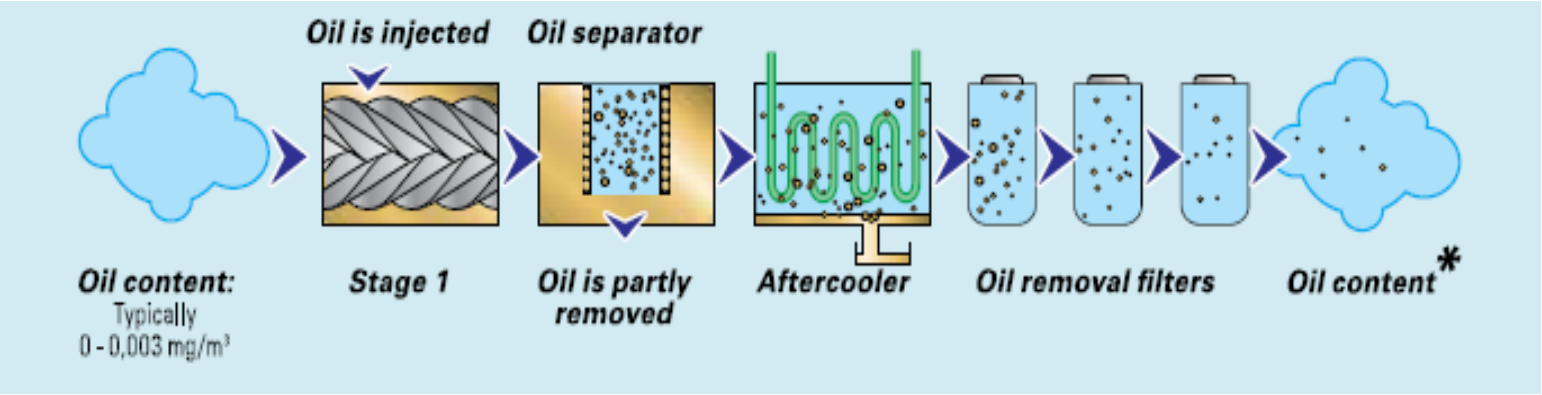
CORE TECHNOLOGIES

Oil-injected screw technology



Oil-free screw technology

SPECIFICATION 1 : OIL INJECTED COMPRESSOR SYSTEM

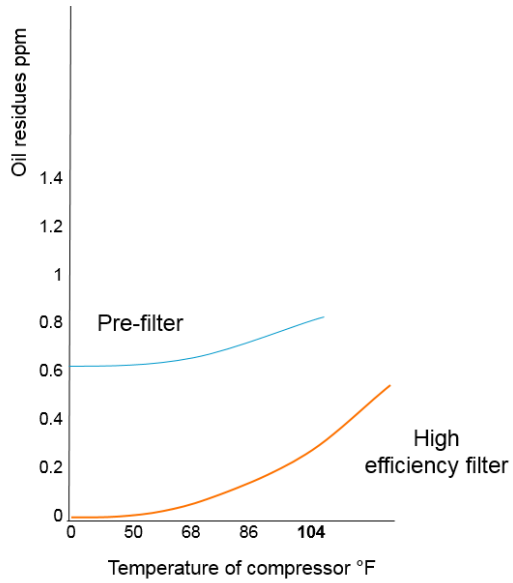


- Oil used as coolant, lubricant and sealant is oil injected compressors

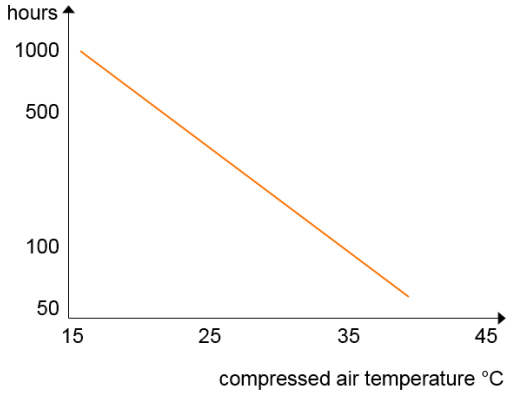
Atlas Copco

Residual oil content and life of carbon filter

Oil Residues (aerosols +liquids) in function of the temperature



Life Carbon filter reduces with increase in air inlet temperature



USE OF FOOD GRADE OIL

Food Grade oil is mineral oil, petroleum based derivate

- We have to read MSDS, some of them says :
  - Skin contact & inhaling should be avoided as much as possible
  - Serious health problems can occur

Material Safety Data Sheet

EXPOSURE CONTROLS AND PERSONAL PROTECTION

Eye Protection: Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. Wear goggles if splashing or spraying is anticipated. Wear goggles and face shield if material is heated above 125°F (51°C). Have suitable eye wash water available.

Respiratory Protection: If elevated airborne concentrations above applicable workplace exposure levels are anticipated, a NIOSH-approved **organic vapor respirator** equipped with a **dust/mist prefilter** should be used.

General comment: Use good personal hygiene practices. **Wash hands** and other exposed skin areas with plenty of mild soap and water **before eating**, drinking, smoking, use of toilet facilities, or leaving work.

Do not touch damaged containers or spilled material **unless wearing appropriate protective equipment**.

DRYER SELECTION (LIFE CYCLE COST)

		Ref	HOC-MD	Heat Reg.	Heat less	HOC-ND	HOC twin
Maintenance cost	Dessicant	✗	✓	✓	✓	✓	✓
	Drums	✗	✓	✗	✗	✓	✗
	Valves	✗	✗	✓	✓	✗	✓
	Filters	✗	✗	✓	✓	✗	✓
Energy cost	Regen	✗	✗	✓	✓	✓	✓ ✗
	Purge	✗	✗	✓ ✗	✓	✗	✓ ✗
	Pres. drop	Low	Low	Higher	Higher	Low	Higher
Total cost of ownership		Lower	Lowest	Higher	Highest	Lower	Low

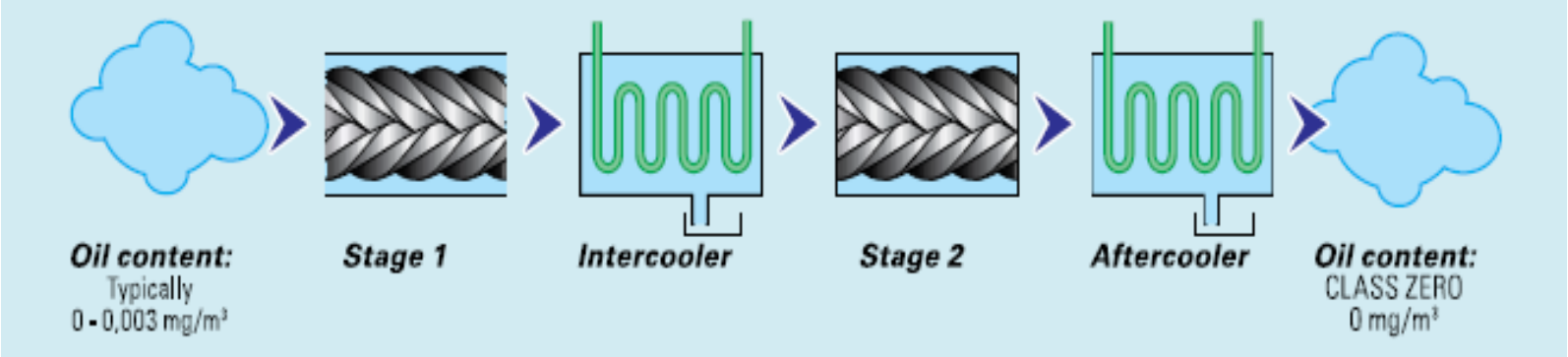
- Refrigerated dryers can give us minimum +3 degC / +37 degF pressure dew point where as desiccant dryers can offer negative dew points

Atlas Copco

Risk analysis

- Sensitive applications call for risk evaluation
- (HACCP)Hazard Analysis and Critical Control Point
- What if oil separator ruptures ?
  - Monitor the pressure drop across the separator
  - Replace as recommended or if you see higher pressure drops
- What if the oil level increases ?
  - Test the quality of air for oil content
- What if carbon filter is saturated ?
  - Replace as recommended

SPECIFICATION 2 : OIL FREE COMPRESSOR SYSTEM



ISO CLASS 0

HOC DRYER

Normal Drying process

Compression process	Heat generation	Cooling	To the dryer

Drying with heat of compression

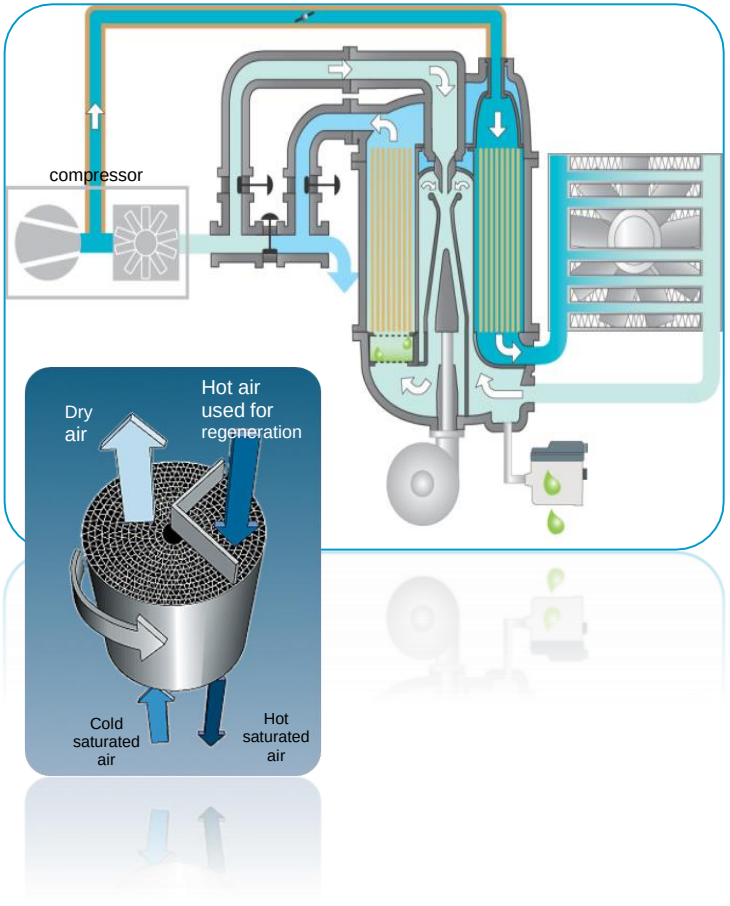
Compression process	Heat generation	Heat used for regenerating desiccant	To the dryer

HOC – TWIN TOWER

- Showing only one method below
- Hot air goes through vessel A and heats up / regenerates the saturated desiccant
- After that all the air goes through the cooler and enters vessel B for drying, after which it enters the AirNet

HEAT OF COMPRESSION – DRUM DRYER

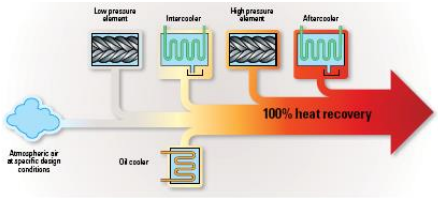
- Air flow through a rotating drum of desiccant impregnated on paper
- Hot compressed air from compressor used to regenerate
- Two main sections
  - drying air section (75%)
  - regeneration air section (25%)
- Unique concept
  - Lowest energy (0.18 Kw)
  - No compressed air loss



BENEFITS OF OIL-FREE COMPRESSOR SYSTEM

- Guaranteed oil-free air
- No contamination
  - Eliminating the risk
- Initial cost is higher but payback can be faster
- Air quality conforms to Class 0
- Lower pressure drops across the system
- More heat recovery possible

Huge opportunities for
Energy Recovery



Shower
s

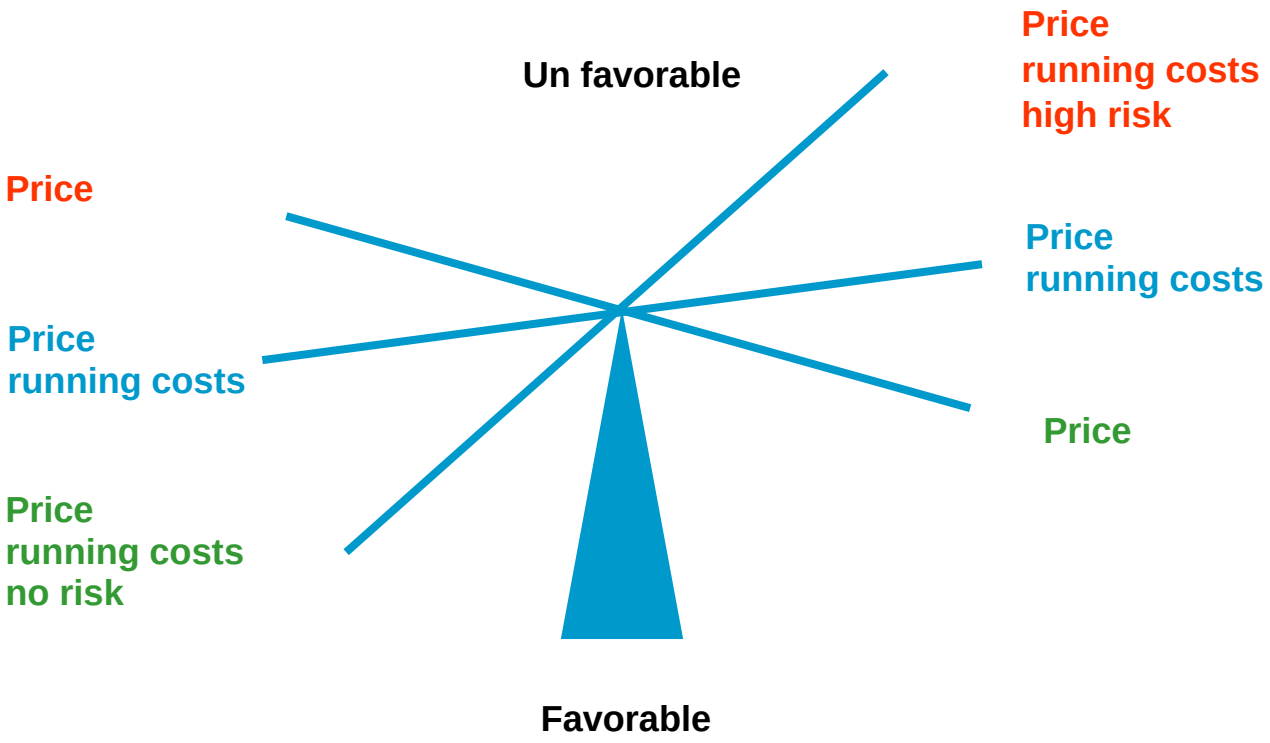
Boile
r feed

Space
heating

Value analysis

Oil-free solution

Oil-injected + filters



ISO 22000 COMPLIANCE OF COMPRESSOR MANUFACTURERS KEY FOR CUSTOMERS?

- We believe that as the ISO 22000 certification is key for customers, It should be key for compressor manufacturers as compressed air plays an important role in the food manufacturing process
- Working with certified suppliers gives customers peace of mind that the key piece of manufacturing equipment was made in a clean, safe environment
- Contribution to customers' ISO 22000 certification process
- Being ISO 22000 certified means that a company has a Food Safety Management System (FSMS) in place
  - This standard demonstrates an organization's ability to control food safety hazards

Atlas Copco

COMMITTED TO

SUSTAINABLE PRODUCTIVITY.


Atlas Copco

COMPRESSED AIR
BEST PRACTICES
airbestpractices.com

About the Speaker

Ruby Ochoa, President & Owner
Trace Analytics, LLC

- More than 30 years of experience in compressed air and gas quality testing
- Member of the International Society of Pharmaceutical Engineers (ISPE) Critical Utilities Community of Practice steering committee
- Member of the Medical Gas Professional Healthcare Organization (MGPHO)
- On the National Fire Protection Agency's (NFPA) technical committee for Respiratory Protection

For your free subscription, please visit
http://www.airbestpractices.com/magazine/subscription.

TRACE Analytics LLC

Compressed Air Testing to comply with ISO 8573-1 Purity Classes

presented by
Ruby Ochoa, President & Co-Owner
Trace Analytics, LLC

ISO 8573-1:2010 Contaminants

Particles

Water

Oil

Microbes

Gases

TRACE Analytics LLC

ISO 8573-1:2010 Purity Classes

ISO 8573-1:2010 Compressed Air Contaminants and Purity Classes

Class	Particles				Water			Oil
	By Particle Size (maximum number of particles per m^3) See Note 2			By Mass	Vapor Pressure Dewpoint		Liquid	Liquid, Aerosol, & Vapor See Note 1
	0.10 – 0.5 microns	0.5 – 1.0 microns	1.0 – 5.0 microns	mg/m^3	°C	°F	g/m^3	mg/m^3
0	As specified by the equipment user or supplier and more stringent than class 1							
1	≤ 20,000	≤ 400	≤ 10	-	≤ -70	≤ -94	-	≤ 0.01
2	≤ 400,000	≤ 6,000	≤ 100	-	≤ -40	≤ -40	-	≤ 0.1
3	-	≤ 90,000	≤ 1,000	-	≤ -20	≤ - 4	-	≤ 1
4	-	-	≤ 10,000	-	≤ +3	≤ +37	-	≤ 5
5	-	-	≤ 100,000	-	≤ +7	≤ +45	-	-
6	-	-	-	0 – ≤ 5	≤ +10	≤ +50	-	-
7	-	-	-	5 – ≤ 10	-	-	≤ 0.5	-
8	-	-	-	-	-	-	≤ 5	-
9	-	-	-	-	-	-	≤ 10	-
X	-	-	-	> 10	-	-	> 10	> 5

Microbiological Contaminants	Other Gaseous Contaminants
No purity classes are identified	No purity classes are identified Gases mentioned are: CO, CO_2 , SO_2 , NOX, Hydrocarbons in the range of C_1 to C_5

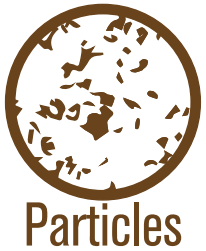
Note 1: ISO 8573 Oil includes aerosol, vapor in the range of C_{6+} , and liquid oil. Liquid oil is typically sampled when wall flow is present, contamination is suspected, or results are greater than 5 mg/m^3 . Trace can provide a separate kit for liquid oil testing.

Note 2: For Particle Class 0, 1, & 2 (0.1 - 0.5 µ range only), a laser particle counter with a high-pressure diffuser is required. Rental of this equipment is available on a reservation basis. Contact us for details. To qualify for Particle Classes 0 through 5, there can be no particles greater than 5µ present.

In some cases, Trace uses alternative sampling techniques or analytical methods to those specified in ISO 8573, for details see Smith White Paper, 2012.

Air & Gas Specifications referenced above may be viewed and/or purchased from: ANSI - American National Standards Institute

TRACE Analytics LLC



Analytical Methods for Particles
ISO 8573-4:2001

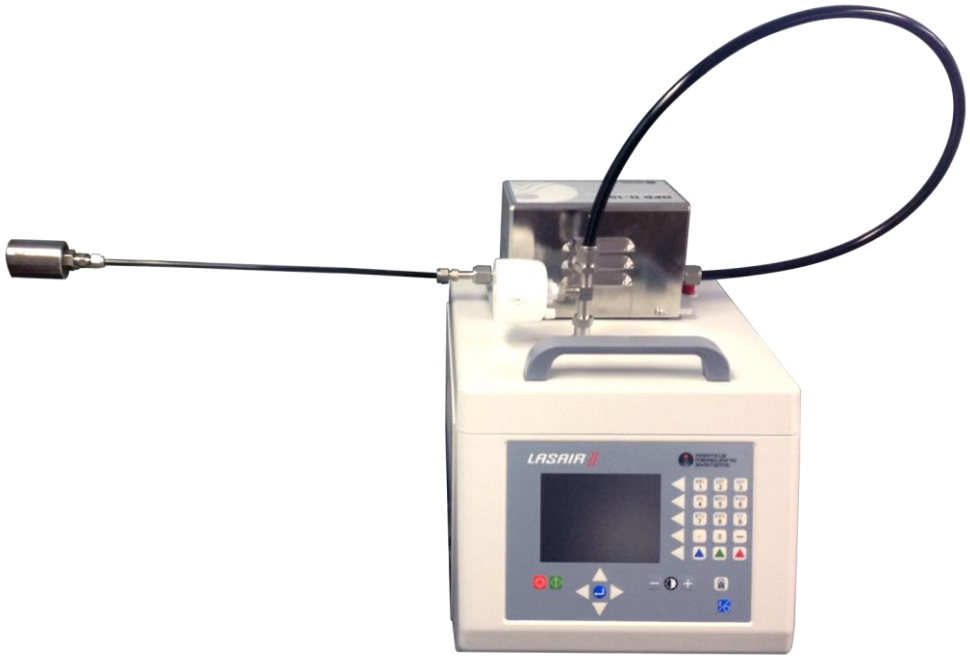
- Laser Particle Counter
  - Applicable for sizes ≥0.10 microns
- Membrane Surface with Microscopy
  - Applicable for sizes ≥0.50 microns
- Other methods
  - Condensation nucleus counter
  - Differential mobility analyser
  - Scanning mobility particle sizer

TRACE Analytics LLC

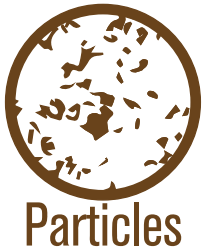
Particles

Sampling for Particles
with Laser Particle Counter

- Quantity and size
- 3 size ranges
  - 0.1 – 0.5 microns
  - 0.5 – 1.0 microns
  - 1.0 – 5.0 microns



TRACE Analytics LLC



Sampling for Particles
with Laser Particle Counter

Final Sample Normalized
Trace LPC01
001 Valid
2013/08/29 19:42:53
2013/08/29 19:42:53#121

μ	Δ	Σ
0.1	107789	151251
0.2	33294	43462
0.3	9815	10168
0.5	318	353
1.0	35	35
5.0	0	0

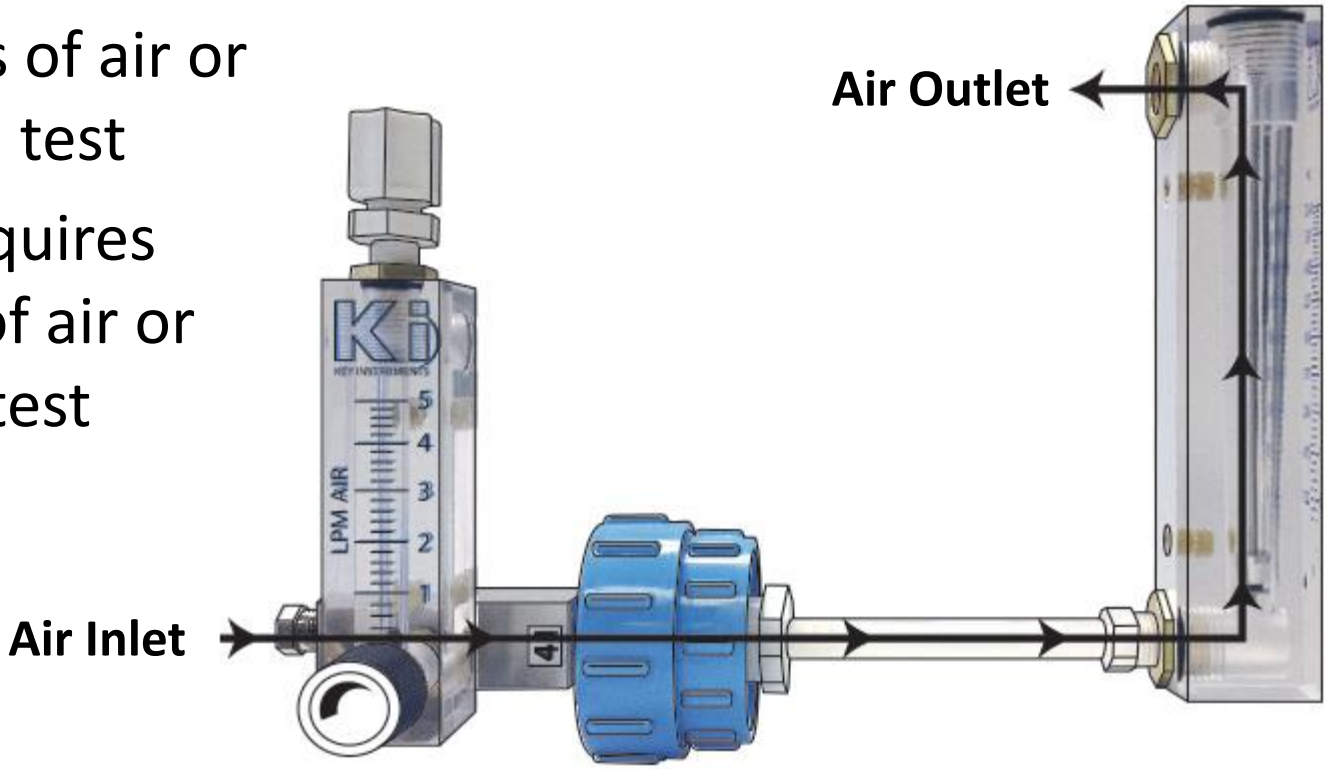
0.0283 cm 0.028324 cmm
Alarm: Pump
Alarm: Laser
Alarm: 5% Limit

TRACE Analytics LLC

Particles

Sampling for Particles
with Filter Membrane and Microscope

- Class 1 requires 12,000 liters of air or apx 120 min test
- Class 2-5 requires 1200 liters of air or apx 12 min test

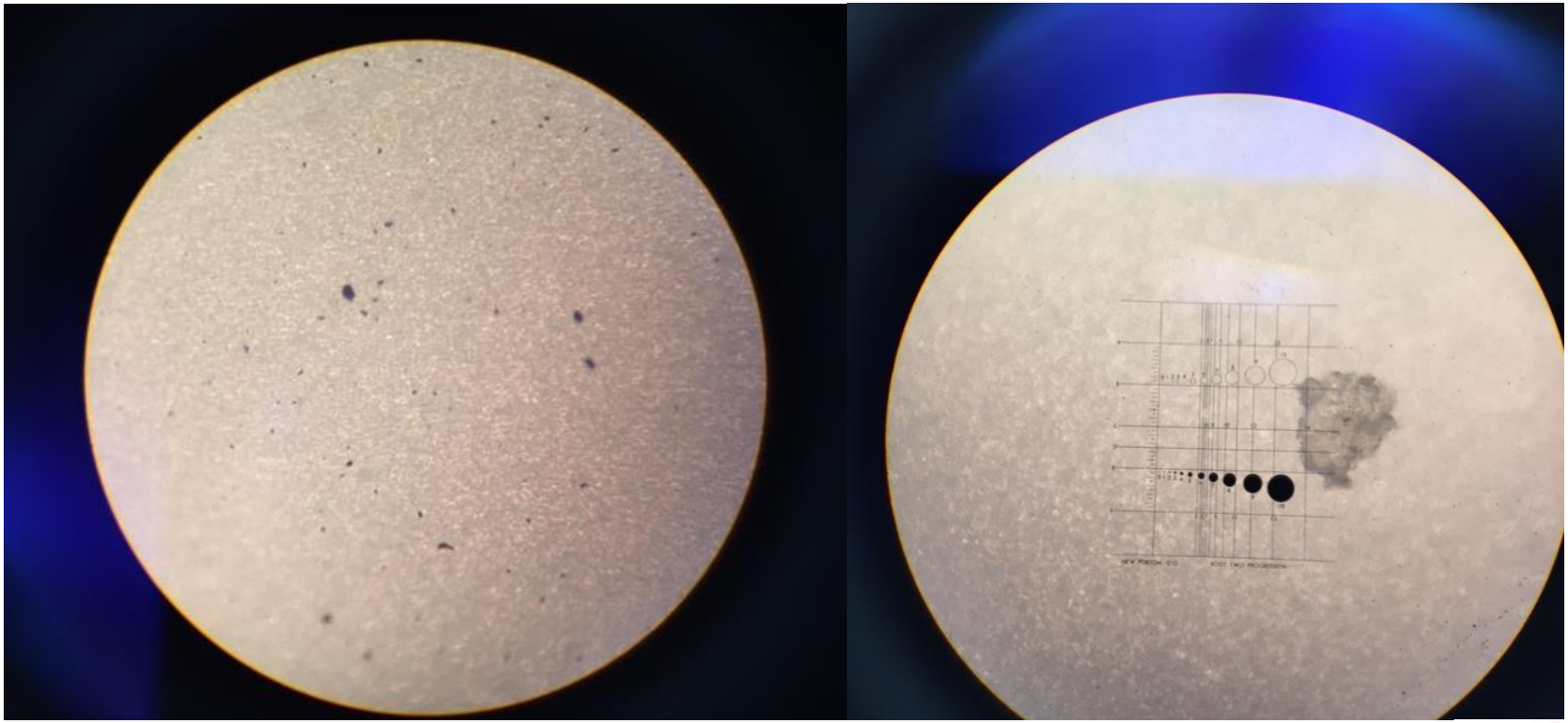


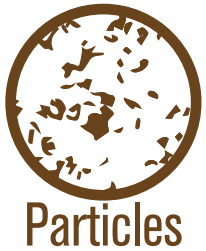
Both particles and oil aerosol collected at same time

TRACE Analytics LLC

Sampling for Particles

Membrane Surface with Microscopy



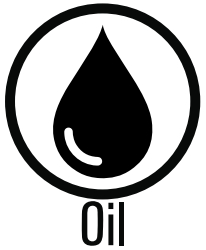


Analytical Method for Particles

ISO 8573-8:2004

- Class 6, 7, and X determined by mass concentration
- Reported in mg/m3
- Sample collected on filter membrane
- Gravimetric method

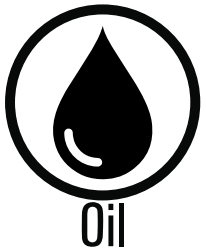
TRACE Analytics LLC



Sampling for Total Oil
includes Oil Aerosol & Oil Vapor

- Per ISO 8573-1 oil is defined as a mixture of hydrocarbons composed of six or more carbons (C_{6+})
- Lighter hydrocarbons C_{1-5} (those commonly reported for breathing air) are not included in Total Oil but addressed in ISO 8573-6 and do not have an established Purity Limit

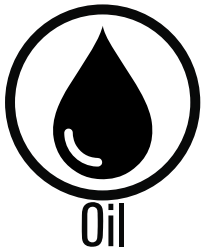
TRACE Analytics LLC



Analytical Methods for Oil Aerosol
ISO 8573-2:2007

- Method A is for Liquid Oil
  - Samples all the air flow passed through two coalescing filters. Liquid oil discharged into graduated cylinder. Then weighed and reported in milligrams.
  - Method A used when heavy contamination levels are suspected.
  - Contamination range 1 mg/m^3 to 40 mg/m^3
  - Sampling time between 50 to 200 hours

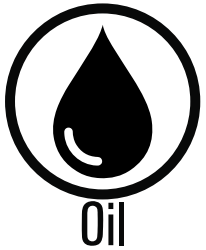
TRACE Analytics LLC



Analytical Methods for Oil Aerosol
ISO 8573-2:2007

- Method B1 is for full flow
  - Collect sample with three filter membranes in series
  - High efficiency micro-fiberglass membrane
  - Contamination rage 0.001 mg/m^3 to 10 mg/m^3
  - Sampling time between 2 min to 10 hours
  - Oil extracted with solvent
  - Analysis by infrared spectrometer

TRACE Analytics LLC



Analytical Methods for Oil Aerosol
ISO 8573-2:2007

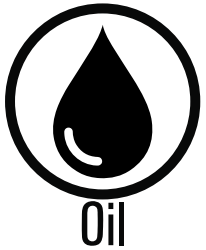
- Method B2 is for partial flow
  - Similar to B1
  - Sample probe
  - Isokinetic conditions
  - Tap into piping to obtain sample
  - Requires pressure seals to avoid leaks

TRACE Analytics LLC

Sampling for Oil Aerosol
Alternate ASTM Method

- Pre-weighed non-gridded membrane
- Gravimetric Analysis
- Extract Oil with Solvent
- Class 1 requires a minimum of 5,000 liters of air, apx 50 minute test
- Class 2 – 4 requires 500 liters of air, apx 10 minute test

TRACE Analytics LLC



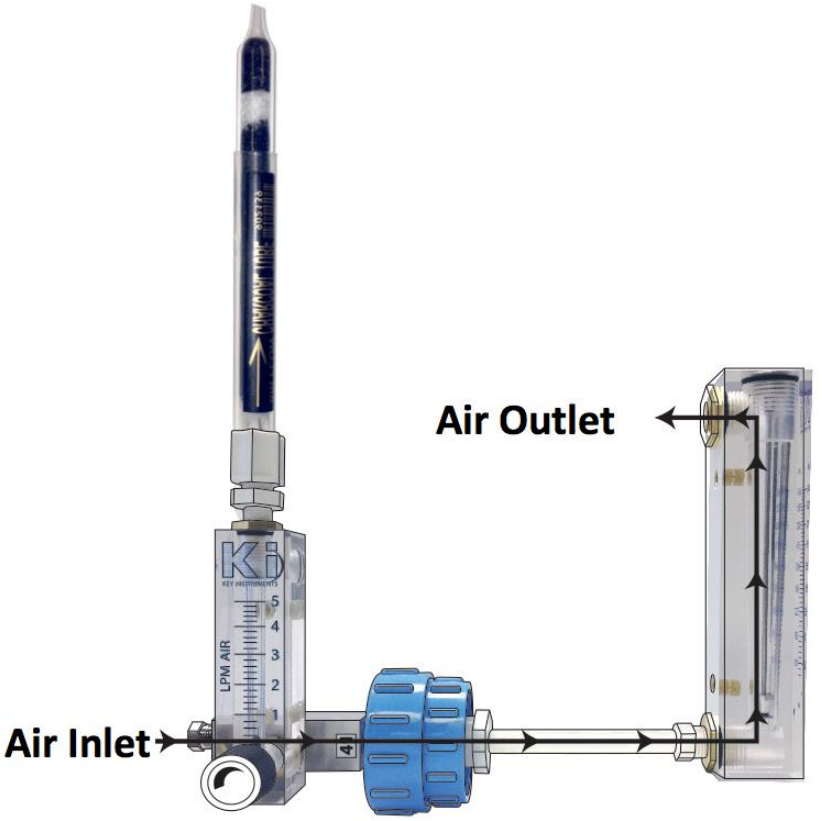
Analytical Methods for Oil Vapor
ISO 8573-5:2001

- Methods include:
  - ◆Gas Chromatography to determine oil vapors
  - – Chemical indicator tubes to be used as an initial indicator only

TRACE Analytics LLC

Sampling for Oil Vapor
Charcoal Tube

- Class 1 requires a minimum of 400 liters of air, apx 100 minute test
- Class 2 – 4 requires 40 liters of air, apx 10 minute test
- Runs concurrently with particle & oil aerosol test

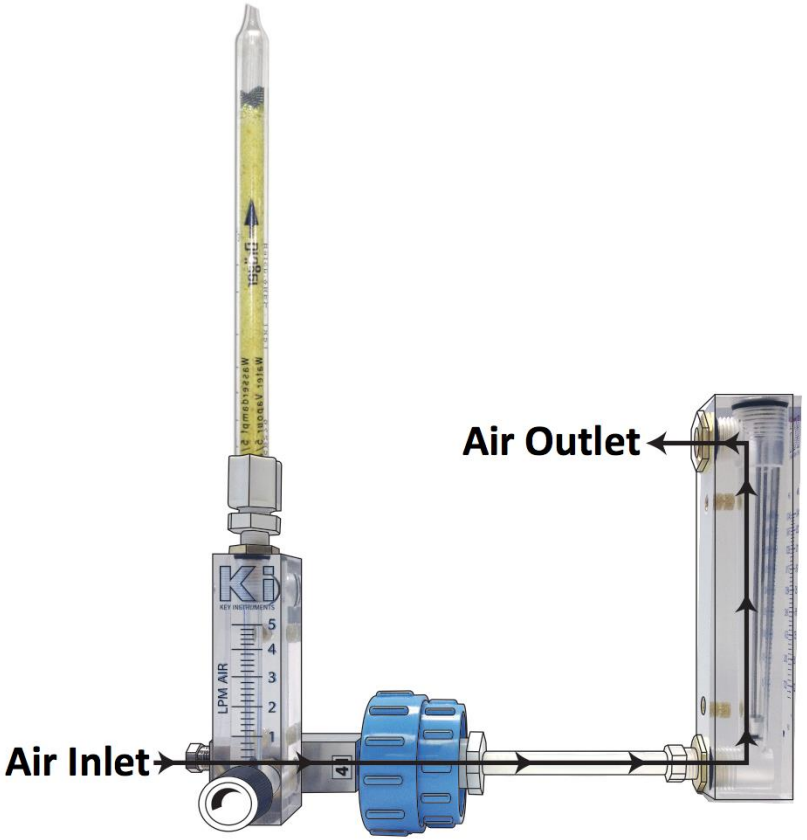


Analytical Methods for Water Vapor
ISO 8573-3:1999

- Methods include:
  - Psychrometer
  - Chilled mirror hygrometer
  - Electrical sensors
    - Chemical reaction methods e.g. direct-reading/ length of stain detector tubes
  - Spectroscopic

Sampling for Water Vapor
Chemical Reaction / Detector Tubes

- 2.5–5.0 minute test for refrigerated dryers
- 12.5 minute test for desiccant dryers, -40°F
- Runs concurrently with particle & oil aerosol test



Sampling Tips

- Connection between sampler and outlet should be
  - Short, straight, stainless steel or PTFE material
  - No elbows, tees, dead ends
- If flexible tubing must be used
  - Avoid common pvc/rubber it allows inward moisture diffusion
  - Specify low particle shedding with hydrophobic properties
  - Lay flat with minimal bends, not less than 6” bend radius
- If possible, avoid quick disconnect fittings, pressure gauges, valves – anything with o-rings instead use high purity fittings
- Locate compressor air inlet away from hydrocarbons

TRACE Analytics LLC

Thanks!

- Additional information available at www.AirCheckLab.com
- Watch for upcoming article on same topic in CABP magazine
- ISO 8573 (9 parts sold separately) referenced in this presentation are copyrighted and available for purchase at www.webstore.ansi.org

TRACE Analytics LLC

Ruby Ochoa
cdatest@AirCheckLab.com, Ruby@AirCheckLab.com
800-247-1024, 512-263-0000

COMPRESSED AIR BEST PRACTICES
airbestpractices.com

Global Food Safety Initiative (GFSI) Compliance: Two Compressed Air System Specifications

Q&A

Please submit any questions through the Question Window on your GoToWebinar interface, directing them to Compressed Air Best Practices. Our panelists will do their best to address your questions, and will follow up with you on anything that goes unanswered during this session.

Thank you for attending!

Brought to you by:

Atlas Copco

TRACE Analytics LLC

For your free subscription, please visit http://www.airbestpractices.com/magazine/subscription.