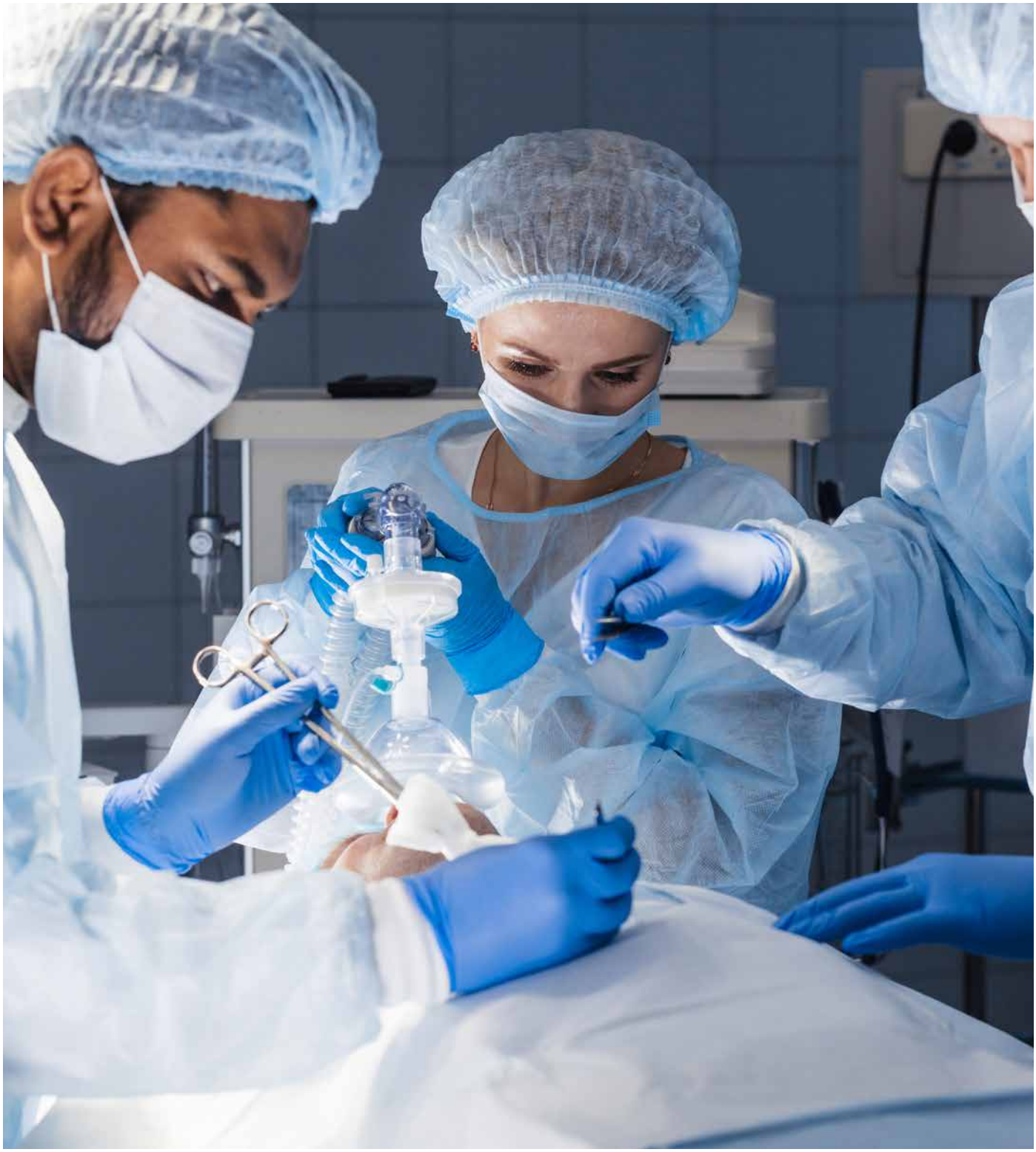
Donaldson
FILTRATION SOLUTIONS

PRODUCING MEDICAL AIR

Process Filtration



PRODUCING MEDICAL AIR

UNDERSTANDING MEDICAL AIR

Medical Air (MA) is the technical name for compressed air used in hospitals and healthcare facilities. Medical Air is filtered extensively to remove contaminants and particles. It contains no oil, nor does it emit an odor. It is also dry to reduce water build up in the facility's piping system.

Due to the volume requirements of larger institutions, many facilities forego purchasing cylinders or bulk containers in favor of producing their own Medical Air on-site. Like most commercial or industrial air compressors, Medical Air compressors pull in ambient air to produce compressed air which is filtered, analyzed, and ultimately sent to critical point-of-use locations throughout the facility.

USES FOR MEDICAL AIR

Medical Air has a myriad of uses in hospitals and healthcare facilities, but its more common applications include:

- Breathing air for ventilators where regulated filtered air helps reduce potential oxygen toxicity events for patients
- Carrier gas for anesthetic agents prior to and during procedures
- Power source for surgical tools and instruments in the operating rooms

STANDARDS FOR MEDICAL AIR

In the absence of globally-accepted standards for Medical Air derived from a compressed source, several domestic and international organizations have developed recommendations and best practices for its production and filtration including:

- USP Medical Air
- PhEur
- ISO 7396-1:2016
  Medical gas pipeline systems -
  Part 1: Pipeline systems for compressed medical gases and vacuum
- OSHA Standard 29 CFR 1910
- NFPA 99 Sec 4-3.1.9.1
- CSA Z 7396.1-17:
  Medical gas pipeline systems
- ISO 8573-1:2010 Compressed air -
  Part 1: Contaminants and purity classes[1]

USP Limit Values for MA	
O_2	>19.5% v/v and < 23.5% v/v
CO	≤ 10 ppm
CO_2	≤ 500 ppm
$NO + NO_2$	≤ 2.5 ppm
SO_2	≤ 5 ppm
Humidity	≤ -5°C PDP

ISO 7396-1:2016 Limit Values for MA	
O_2	≥20.4% ... ≤21.4%
CO	≤ 5 ml/m³
CO_2	≤ 500 ml/m³
$NO + NO_2$	≤ 2 ml/m³
SO_2	≤ 1 ml/m³
Humidity	≤ 67 ml/m³
Total Oil	< 0.1 mg/m³
Particulates	Class 2 according to ISO 8573-1:2010

[1]ISO 8573-1 is not a specific breathing air standard but a general standard describing compressed air purity.

Current standards in use range from OSHA-mandated workplace requirements for Grade D breathing air to Medical Air mixture levels set forth in USP 29 from the United States Pharmacopoeia (USP). While most of the standards contain limits for forms of contamination such as gases, dewpoint, and hydrocarbons, they do not contain well-defined guidance on allowable limits for microbes or spores. Notably, most of the recommendations are comparable and traceable to current OSHA, NFPA and/or ISO standards (see table on page 2). Additionally, the lack of a common limit for microorganisms prompts many professionals to refer to the limits established for cleanroom classifications per ISO 14644-1.

DELIVERING MEDICAL AIR

Without formal production standards in place, we recommend – at a minimum – following established industry best practices, which may include:

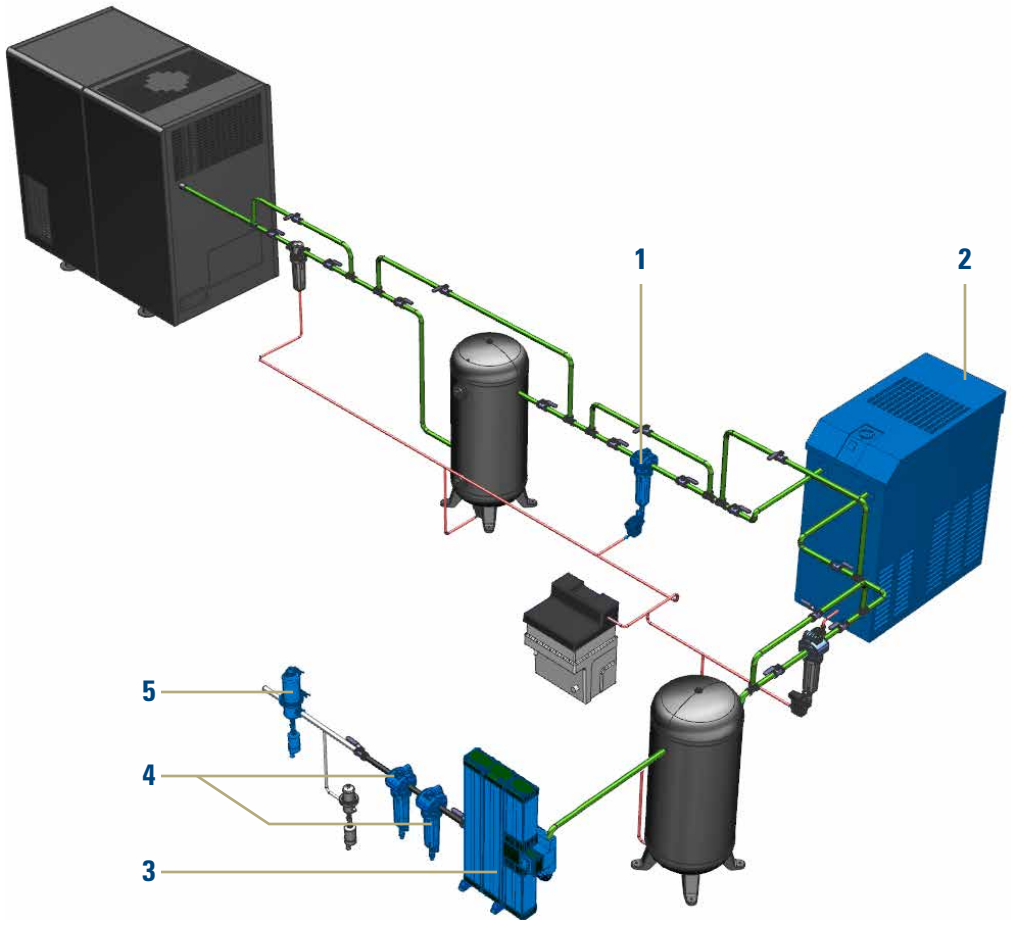
Step 1: Prefilter — Removes bulk liquid oil and water to protect refrigerated dryer. (DF filter with M-grade coalescing filter element)

Step 2: Refrigerated dryer — Suppresses dew point by cooling, condensing and draining away water. (Buran dryer)

Step 3: Desiccant dryer — Removes water vapor through adsorption, creating a dry environment to prevent bacterial growth conditions and can be configured to remove CO, CO_2, SO_2, NO and NO_2. (Ultrapure 2000 dryer)

Step 4: Carbon filtration — Removes hydrocarbon vapors and odors. (DF filter with A-grade adsorption filter element)

Step 5: Sterile filter — Validated filter for removing bacteria and bacteriophages. (PG-EG with PT N sterile filter element)



SUPPORTING PROCESS AND PRODUCT INTEGRITY

Extensive Product Portfolio

- Process air, steam and liquid filtration products
- Performance engineered to sanitary guidelines
- Wide range of filtration media for any application
- Housings, elements, and parts in-stock, ready to ship

Advanced Technology

- Optimized filtration performance and efficiency
- Extensive research and development capabilities
- Advanced design and testing capabilities
- Over 1,000 engineers and scientists worldwide

Unrivaled Support and Expertise

- Expert technical specialists available as resource
- Comprehensive pre- and post-sale support
- Extensive filter analysis and trouble-shooting
- 100 years of successful global manufacturing

Registered ISO 9001:2008 Quality Management System

Standard No. 10-04* 3-A

Member of CAGI Compressed Air & Gas Institute

Member of IDFA

Member of fpsa Food Processing Suppliers Association PROUD MEMBER

Member of MWFPA

Certified CE

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