PAPER PRESERVATION

Protecting paper newsprints and manuscripts

Edition IVX

Paper Collections

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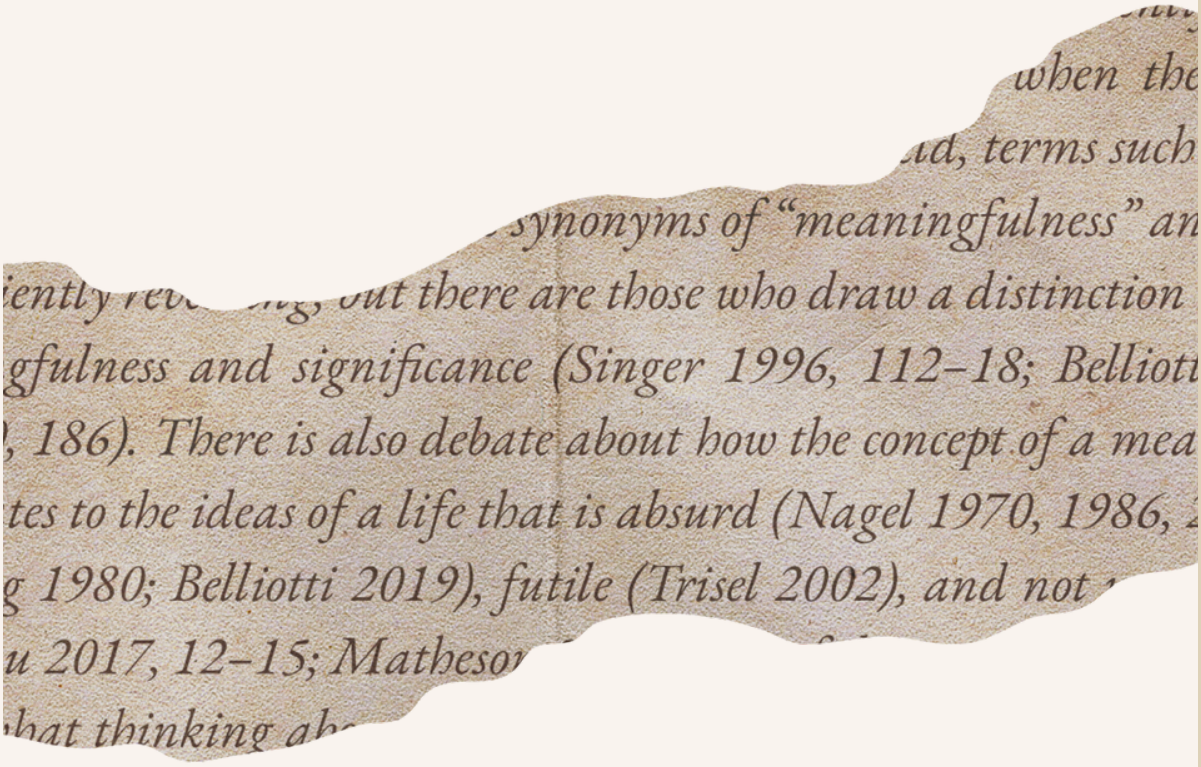
CONTENTS



INTRODUCTION

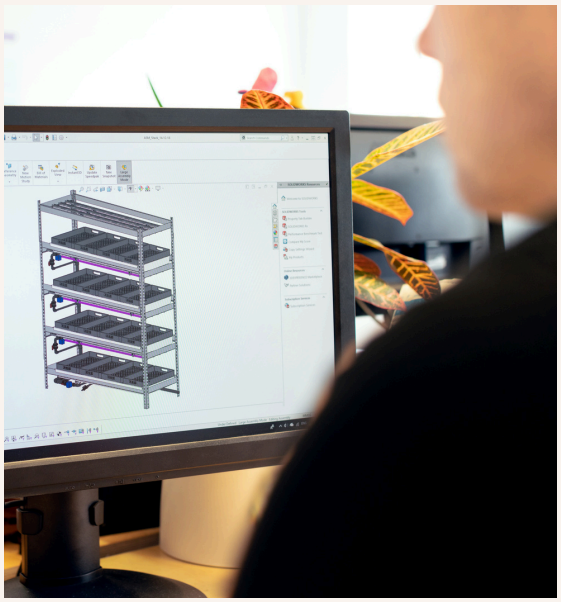
Preserving paper collections begins with controlling the environment. Paper is highly sensitive to temperature, humidity, light, and air quality; each variable directly affects its lifespan and legibility.

When relative humidity rises, cellulose fibers absorb moisture and expand, creating waves and distortions. When air is too dry, the same fibers lose flexibility and become brittle. High temperatures accelerate acid hydrolysis, and light exposure triggers oxidation and yellowing.

Cobeal designs and installs environmental systems that maintain the tight control paper collections require: stable 35–45% relative humidity, 21–23°C temperature, low particulate and pollutant levels, and gentle, balanced airflow. Our dehumidifiers, filtration systems, and precision sensors work together to create a self-regulating microclimate that keeps documents flat, strong, and chemically stable.

With Cobeal's systems in place, paper archives can remain stable for generations.

ENVIRONMENTAL SETPOINTS



Stable environmenal conditions are the foundation of paper preservation. The most critical variables are relative humidity and temperature: each influencing the other. When humidity drifts, cellulose fibers expand or contract. When temperature rises, chemical reactions accelerate, speeding oxidation and acid hydrolysis that weaken the sheet.

For long-term preservation, paper collections perform best at **35-45% RH** and **21-23ºC**. Within this narrow band, fibers remain stable and chemical decay slows significantly. More important than the absolute values is the consistency: avoiding daily or seasonal swings that strain the material over time.

Cobeal's systems are engineered to maintain these targets continuously, under independent temperature and humidity control loops, supply-air dew point regulation, and precision reheat. Our close-control air-handling units manage latent and sensible loads simultaneously, while integrated dehumidifiers keep humidity stable even under varying outdoor conditions.

AIR QUALITY

Air quality is one of the quietest but most critical factors in paper preservation. Pollutants such as sulfur dioxide, nitrogen oxides, acetic acid, and formic acid react with the cellulose in paper, causing yellowing, brittleness, and chemical weakening. Even at low concentrations, these gases accelerate the natural aging of paper and fade printed inks.

Cobeal's systems address this through multi-stage filtration: HEPA filters remove fine particulates, while deep-bed activated carbon and permanganate media scrub reactive gases before they reach the collection. Gentle positive pressure prevents unfiltered air from entering storage rooms, and continuous sensors verify pollutant stability in real time.

Clean air preserves more than just appearance. It preserves the integrity of the entire collection.

LIGHTING

01 Light exposure accelerates oxidation and yellowing, especially in lignin-containing newsprint and coated papers.

02 Ultraviolet and high-intensity light cause irreversible fading of inks and dyes.

03 Cobeal designs low-UV lighting systems and shields to reduce cumulative light dose without compromising visibility.

04 Motion or time-controlled fixtures ensure light is present only when needed, minimizing photochemical stress.

05 Stable temperature and RH under Cobeal's systems prevent light-induced heat from compounding chemical damage.

CHEMICALLY

Paper ages from the inside out. It's cellulose fibers slowly break down through **acid hydrolysis** and **oxidation**: two chemical reactions driven by temperature, humidity, and airborn pollutants. Acids weaken molecular bonds, while oxidation darkens the paper and makes it brittle. Once these processes begin, they cannot be reversed—only slowed.

Cobeal's environmental systems address both causes. By maintaining stable 21–23°C temperature and 35–45% relative humidity, we minimize the moisture and heat that accelerate hydrolysis. Our multi-stage filtration captures sulfur dioxide, nitrogen oxides, and organic acids before they can react with the cellulose. Together, these measures create a low-reactivity atmosphere that keeps paper chemically balanced and physically strong. Every degree and percentage point matters.

Cobeal's precision control transforms chemical risk into long-term preservation.

STANDARDS & GUIDANCE

ISO 11799:2015

Specifies the characteristics of repositories used for the long-term storage of archive and library materials. It covers the siting and construction and renovation of the building and the installation and equipment to be used both within and around the building.

BS 4971:2017

The British standard gives guidance on managing and protecting collections for the long term through both preventative and remedial actions. Environmental control, storage enclosures, collection care policies, and modern media criteria are covered.

ISO 18934:2011

Suggested guidelines for four temperature and humidity macro-environments for archives that contain a variety of recording media, based on the corresponding ISO storage standards for those media. Note nitrate-based films represent a fire hazard and need to be stored in accordance with applicable national fire protection standards.

COBEAL SOLUTIONS

Cobeal builds environmental systems that merge engineering precision with preservation science. Each design begins with the specific needs of the collection: paper type, room geometry, and local climate. Cobeal's engineered solutions maintain uniform temperature, humidity, and air purity across every cubic meter of space.

Our system's integrate close-control air handling, high-efficiency dehumidification, and multi-stage filtration, all governed by real-time sensor feedback.

Airflow is balanced to prevent localized drying or condensation, while intelligent reheat and dew point control maintain stable humidity through seasonal change.

What distinguishes Cobeal is verification. Every installation includes continuous monitoring and data logging to prove compliance with preservation standards. The result is a controlled environment that performs as predictably as a lab instrument: keeping collections flat, clean, and chemically stable for decades to come.

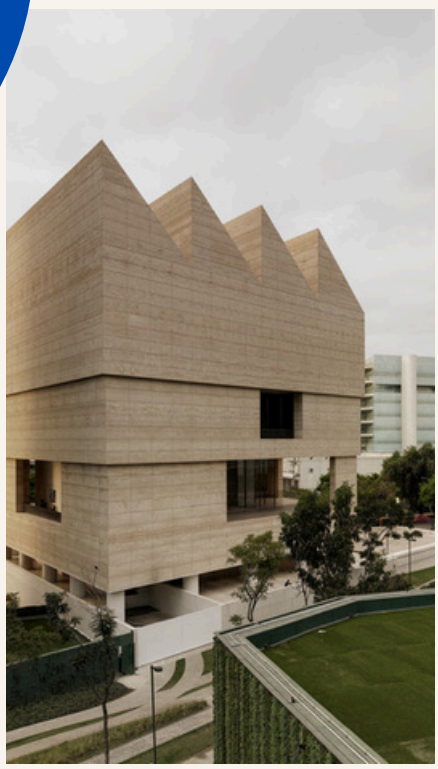
OPERATING TARGETS

Control Parameter	Target Range
Temperature	21–23 °C (±1 °C)
Relative Humidity	35–45 % (±3 %)
RH Drift (Daily)	≤ ±1 % per 24 hrs
Airborne Particles	≤ 10 µg/m³ ($PM_{2.5}$ equivalent)
Gaseous Pollutants	SO_2 < 5 µg/m³ NO_2 < 10 µg/m³

Cobeal uses a **network of integrated environmental sensors:** usually positioned at shelf height, return air, and supply air points. Thresholds are pre-programmed with PLC systems. Our systems are **closed-loop environmental** controllers that respond in real time to maintain setpoint equilibrium. Dimensional and chemical stability are *direct outcomes* of mechanical control precision.

HVAC

Airflow Design	Uniform, low-velocity airflow distributes temperature and humidity evenly across storage zones, preventing microclimate variation.
Temperature Control	Dual-stage cooling and reheat stabilize room conditions within ±1°C to prevent thermal stress on paper fibers.
Humidity Regulation	Integrated dehumidifiers and dew point sensors maintain 35–45% RH, eliminating daily and seasonal fluctuations.
Pressure Management	Slight positive pressure keeps pollutants and unfiltered air from entering archival spaces.
Filtration Sequence	MERV 13 pre-filters and HEPA finals remove fine particulates before air recirculation.
Dew Point Control	Active dew point monitoring prevents condensation on cold surfaces or inside enclosures.
System Redundancy	N+1 configuration for compressors, fans, and reheat coils ensures continuous, uninterrupted operation.
Data Logging & Alarms	Sensors record conditions in real time; deviations trigger alerts and automatic corrective adjustments.



FILTRATION & SCRUBBING

1

Airborne particulates—dust, fibers, and microscopic debris—damage paper surfaces and attract moisture. Cobeal systems use MERV 13 pre-filters and HEPA final filtration to remove these particles before air recirculation, keeping archival environments visibly and chemically clean.

2

Reactive gases such as sulfur dioxide, nitrogen oxides, and organic acids accelerate yellowing and fiber decay. Activated-carbon and permanganate filters inside Cobeal units absorb these pollutants, maintaining a low-acid atmosphere essential for long-term stability.

3

Filtration is monitored and verifiable. Sensor feedback and pressure-drop tracking confirm filter performance, ensuring airflow remains stable and pollutant levels stay below preservation thresholds—proof that the air protecting each collection is as carefully engineered as the system itself.

CONCLUSION

Every collection tells a story of its time, its people, and its purpose. Protecting that story requires more than storage; it requires precision. Temperature, humidity, and air composition are conditions Cobeal has mastered for over six decades.

We engineer the environments that make preservation possible. From dehumidification and air filtration to sensor-based control and real-time data verification, our systems create measurable stability that keeps archives intact and legible for generations.

If your institution is expanding or upgrading its collection storage, our team can design a tailored solution that meets both conservation standards and operational needs.