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Kathabar Dehumidification Systems

Kathabar Dehumidification Systems, Inc., the world leader in industrial humidity control, has manufactured dehumidification equipment for more than 75 years. The name "Kathabar," which is derived from Greek words meaning clean or pure air, describes what Kathabar equipment does best. The primary use of Kathabar is to provide precise and energy efficient air temperature and humidity control. Kathabar maintains the process or space at the required condition regardless of weather or process variations.

Over the last 75 years, the design of Kathabar equipment has been continually evolving. Advances in heat/mass transfer technology and construction materials have been incorporated. New product lines have been developed to serve the changing needs of industrial, institutional, and commercial users as well as to reflect changes in the cost and availability of energy.

Energy cost and availability issues have resulted in the development of the Twin-Cel air-to-air enthalpy recovery system. Today, KDS offers you the unbiased choice between liquid and dry desiccant systems to best meet your needs.

Kathabar KBD Series

The latest product of this design evolution, the Kathabar KBD Series, is designed to provide additional benefits for dehumidification applications better suited to dry desiccant equipment. These benefits include the following:

- Simple, independent control of temperature and humidity
- Large range of airflow capacities up to 60,000 CFM
- Factory-integrated packaging capability
- Controls and automation integration to any desired level
The KBD dry desiccant systems operate on the principle of adsorption of water vapor from the air. The adsorbent (or desiccant) used is silica gel. The silica gel is formed on an inorganic substrate. The desiccant and substrate are arranged in a wheel-shaped rotor matrix having thousands of small, parallel air passages extending through its thickness.

The desiccant rotor is housed in a cabinet that is separated into process and reactivation sections. In the process section the air to be dried passes through the rotor and the silica gel adsorbs some of the moisture from it. The dehumidifying process heats the air, so the air leaving the rotor is drier but warmer.

To drive the adsorbed moisture out of the desiccant, the rotor slowly rotates into the reactivation section, where a second, heated airstream passes through the rotor. The hot air heats the desiccant, driving the water out of it. The moisture-laden reactivation air is usually exhausted outside. The reactivated desiccant rotor rotates back into the process section to provide continuous drying of the process air.

In many applications the process air is cooled before entering the desiccant rotor to enable the KBD unit to produce dryer air. When precooling is needed, this cooling coil is usually included with the KBD unit.

Because the process air is warmed while passing through the desiccant rotor, it may be too warm to suit the use requirements. If so, a final cooling coil is required, and is usually included with the KBD unit.

The reactivation airstream may be heated by electricity, steam, hot water or natural gas, depending on the application and available utilities. The air heating devices and its controls are usually included with the KBD unit.
Dry Desiccant Dehumidifier Module

- Desiccant rotor made of inorganic substrate with silica gel desiccant formed in situ
- Unit housing of 14 and 16 gauge galvanized steel
- R-13 insulation standard, others optional
- Stainless steel inner liner optional
- 30% pleated air filters standard, with draft gauges
- Manual volume control dampers standard, for both process and reactivation
- Process and reactivation rotor draft gauges standard
- Electric, gas, steam, and hot water reactivation heaters available
- PLC-based controls with color touch-screen operator interface standard
- Unit base of welded structural channel

Dry Desiccant Dehumidifier Package

- Combine dehumidifier module and auxiliary modules to meet your specific requirements
- Dimensional data for dehumidifier and auxiliary modules shown on pages 6 & 7
Standard & Optional Auxiliary Modules

1 Housing (all)
   **Standard:** 2” double wall, R-13 injected foam insulation, galvanized outside skin and frame, galvanized inner liner
   **Option:** Stainless steel inner liner

2 Mixing Box
   **Standard:** No dampers
   **Option:** Dampers, actuators, hoods, stainless steel dampers

3 Pre & Post Filters
   **Standard:** 30%, 55%, 95% HEPA filters
   **Option:** Carbon filters, biocidal filters

4 Heating Coil
   **Standard:** Steam, hot water
   **Option:** Gas, electric

5 Cooling Coil
   **Standard:** Chilled water, glycol, DX, ammonia
   **Option:** CO₂ and all other exotic refrigerants

6 Coil Materials
   **Standard:** Aluminum fins, copper tubes
   **Option:** Copper fins, aluminum tubes, stainless steel

7 Bypass
   **Standard:** Mini bypass, with or without actuator
   **Option:** Full face and bypass with actuators

8 Fans
   **Standard:** DWDI fans
   **Option:** Plug and plenum fans

9 Packaged Refrigeration
   **Standard:** DX package condensing unit
   **Option:** Chilled water and ammonia package unit

10 Location
    **Standard:** Indoor rating
    **Optional:** Outdoor rating
Module Dimensions

Use these module dimensions to estimate the overall size of your KBD package.

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Dry Desiccant Controls

Kathabar offers controls capabilities unique in the desiccant dehumidification market. The standard control system is based on a Koyo DL-06 series PLC and a Maple Systems Silver Series color touch screen HMI.

**PLC Options Include**
- Allen Bradley:
  - MicroLogix
  - SLC
  - CompactLogix or ControLogix
- Square D Modicon Momentum
- G.E. Fanuc 90-30
- Siemens 505

**HMI Choices Include**
- A-B PanelView
- CTC Powerstation
- Automation Direct E-ZTouch

**Standard Displayed Variables**
Operating status of:
- Process air fan
- Reactivation air fan
- Rotor drive motor
- Reactivation air inlet and discharge air temperature
- Reactivation heat percentage

**Optional Displayed Variables**
Outside air temperature and humidity
Return air temperature and humidity
Process air inlet temperature and humidity
Process air discharge temperature and humidity
Cooling coil discharge temperature and set point
Cooling coil control valve percentage
Heating coil discharge temperature and set point
Heating coil control valve percentage
Bypass damper percentage
Process air filter pressure drop
 Reactivation air filter pressure drop
Rotor air pressure drop
Fan VFD percentage

KDS also offers communications interfaces for building or process control systems.

**Interfaces can be provided for:**
- Ethernet
- Metasys
- Modbus
- Profibus
- DH+ communications protocols

**FIG. 3**
Typical HMI Display
Dry Sample Specifications

Scope Description
Contractor to furnish and install a factory-assembled and tested desiccant-based air handling unit as described on the project drawings, equipment schedules and other documents. Provide all fans, filters, dampers and controls required for automatic operation of the desiccant air handling unit.

Warranty
The desiccant based air handling unit and its associated parts shall be warranted by the manufacturer against all defects in material and workmanship for a period of 18 months from shipment or 12 months from startup, whichever occurs first.

Submittals
Manufacturer shall provide detailed submittal drawings showing the arrangement of the unit with dimensions, electrical and utility connections and locations and performance data required to assure compliance with the plans and specifications. This shall include performance data for fans, coils, dampers, controls and all other major components of the desiccant air handling unit. At time of shipment, provide three (3) operating and maintenance manuals including a final set of drawings and spare parts lists.

Factory-assembled Desiccant-based Air Handling Unit

GENERAL CONSTRUCTION:
The air handling unit shall consist of a base, a desiccant dehumidifier module, and any other modules required to meet the plans and specifications. The desiccant dehumidifier modules and auxiliary modules shall be assembled to the base and to each other using mechanical fasteners. The integrated unit shall be suitable for [indoor] [outdoor] installation.

UNIT BASE:
The base shall be made of welded structural steel channel sized for mid-length deflection of no more than 1/360 of the base length when the air handling unit is lifted from its ends.
DEHUMIDIFIER MODULE:
The dehumidifier module housing shall be of welded construction using 14 and 16
gauge galvanized steel. Interior surfaces of the housing shall be insulated with closed-cell
flexible foam insulation having a minimum (R13) insulating value. The interior
surfaces of the reactivation portions of the housing shall be insulated with minimum 2”
thick rigid fiberglass insulation with aluminum foil facing.
[The dehumidifier housing shall have an inner skin sheet of 20 gauge (galvanized)
(stainless) steel.]
The desiccant rotor shall consist of corrugated glass fiber media with silica gel
desiccant formed in situ to form a monolithic structure. The media shall be contained in
a segmented aluminum housing supported by a central shaft and bearings. The faces
of the rotor shall be machined smooth for maximum seal life.
The desiccant rotor shall be supported in a frame of welded stainless steel
construction. The frame shall support a fractional horsepower gear motor to drive the
rotor via a chain and sector sprockets attached to the perimeter of the rotor. The
frame shall also support air seals to separate the process and reactivation airstreams.
The seals shall be made of silicone rubber and designed for a life of 40,000 hours of
continuous operation.
The reactivation heat source shall be electric, gas, or steam as specified on the project
drawings and schedules. The reactivation heat shall be of sufficient capacity to ensure
the complete and continuous reactivation of the desiccant during summer or winter
operation of the dehumidifier and to satisfy the design performance requirements.
Electric heaters shall include a high temperature safety shutoff requiring a manual
reset. The sensor shall be located between the heater section and the rotor inlet. A
fault light located on the operator’s panel shall be signaled. A [solid state relay] [SCR]
proportional reactivation heater control system shall be provided in order to provide
energy conservation.
Direct fired gas reactivation shall include gas burner, combustion air blower, flame
safeties, gas train with modulating gas valve, and the necessary controls to regulate
the reactivation temperature as required and to comply with all applicable safety
regulations.
Steam heating coil shall be housed in an insulated enclosure to ensure maximum
operation and personnel safety. Coil shall be the non-freeze steam distributing type
mounted with stubbed connections. Coil to have single point connections for steam
and condensate. Steam specialties such as control valves and traps shall be provided
by the installing contractor [by the dehumidifier manufacturer].
The reactivation air inlet shall be provided with a side-access filter frame and [pleated
30% disposable] [cleanable metal 30%] filters. For units installed outdoors, the
reactivation air inlet shall be provided with a weather hood and bird screen.
The reactivation air fan shall be direct drive, single width, single inlet, and shall be
provided with [a manual balancing damper] [a variable frequency drive] for controlling
reactivation airflow. For units installed outdoors, a weather hood shall be provided for
the fan discharge.
Auxiliary Modules

**MODULE CONSTRUCTION:**
Modules shall be made with 16 gauge galvanized channel posts and panels secured with mechanical fasteners. All panels, access doors, and ship sections shall be sealed with permanently applied bulb-type gasket. Shipped loose gasketing is not allowed. Panels and access doors shall be constructed as a 2-inch nominal thick; thermal break double wall assembly, injected with foam insulation for an R-value of not less than R-13. The outer panel shall be constructed of G90 galvanized [G60 painted galvanized] steel. The inner liner shall be constructed of G90 galvanized [304 solid stainless] steel. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, maximum 5 inches of positive or negative static pressure. Deflection shall be measured at the midpoint of the panel height.
The casing leakage rate shall not exceed 0.5 CFM per square foot of cabinet area at 5" static pressure.
Module to module assembly shall be accomplished with an overlapping, full perimeter, insulated, internal splice joint sealed with bulb type gasketing on both mating modules to minimize on-site labor and meet indoor air quality standards.
Access doors shall be flush mounted to cabinetry [with inspection viewing window] with minimum of two six inch long stainless steel piano-type hinges, latch and full size (4.5" minimum) handle assembly. Door shall swing outward for unit sections under negative pressure (inward for unit sections under positive pressure). Doors limited from swinging inward (such as side access filter sections) on positive pressure sections, shall have a secondary latch to relieve pressure and prevent injury upon access.
Coil drain pans shall be made from 304 stainless steel with cross break and double sloping pitch to drain connection.

Supply/Return Fans
Provide DWDI fan. Fan assemblies including fan, motor and sheaves shall be dynamically balanced by the manufacturer on all three planes and at all bearing supports.
Bearings shall be self-aligning, grease lubricated, ball or roller bearings with extended copper lubrication lines to access side of unit.
Fan and motor shall be mounted internally on a steel base. Provide access to motor, drive, and bearing through hinged access door. Fan and motor assembly shall be mounted on [rubber-in-shear] vibration isolators inside cabinetry. [Provide VFD for fan motor.]
**Electrical and Control**

Wiring termination: provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

Provide [marine light] [marine light and GFI receptacle] in [fan] [each] section mounted and wired to a junction box and on-off switch mounted on the outside of the cabinet.

Fan motors shall be 1800 rpm, open drip-proof (ODP). Motors shall be high efficiency to meet EPAct requirements. Electrical characteristics shall be as shown in schedule.

Electric and control panel cabinet shall be to NEMA 12 [NEMA 4] standards, factory mounted on the unit and shall include:
- UL or CSA approved components
- Lockable fused disconnect switch
- Motor starters with contactors
- PLC controller with color touch screen operator interface
- Controls package as per specifications
- System run/fault indications
- Interconnecting wiring of components

**Cooling and Heating Coils**

Provide access to coils for service and cleaning. Enclose coil headers and return bends fully within unit casing. Unit shall be provided with coil connections that extend a minimum of 5" beyond unit casing for ease of connection. Coils shall be removable through side and/or top panels of unit without the need to remove and disassemble the entire section from the unit.

**WATER COILS:**

Certification – acceptable water coils are to be certified in accordance with ARI Standard 410 and bear the ARI label. Coils exceeding the scope of the manufacturer’s certification shall be acceptable provided the manufacturer is a current member of the ARI certification programs and the coils are rated in accordance with standard 410.

Headers shall be made of seamless copper tubing to assure compatibility with primary surface.

Fins shall have a minimum thickness of 0.0075" of aluminum plate construction. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins.

Coil tubes shall be 5/8 inch seamless copper, 0.020" [0.025"] [0.035"] [0.049"] nominal tube wall thickness, expanded into fins, brazed at joints.

Soldered U-bends shall be provided having a minimum tube wall thickness of 0.025".

Coil connections shall be O.D. sweat copper with connection size to be determined by manufacturer based upon the most efficient coil circuiting. Vent and drain fittings shall be furnished on the connections, exterior to the air handler.

Coil casings shall be a formed channel frame of [galvanized steel] [304 stainless steel]
**REFRIGERANT COILS:**
Certification – acceptable refrigerant coils are to be certified in accordance with ARI Standard 410 and bear the ARI label. Coils exceeding the scope of the manufacturer's certification shall be acceptable provided the manufacturer is a current member of the ARI certification programs and the coils are rated in accordance with standard 410. Coils designed for use with Refrigerant [R-22] [R-134a] [other]. Fins shall have a minimum thickness of 0.0075" of aluminum plate construction with full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded to the fins. Refrigerant coils shall be provided with round seamless 5/8" O.D. copper tubes on 1-1/2" centers staggered in the direction of airflow. All joints shall be brazed. Sweat type copper suction connections shall be located at the bottom of the suction headers for gravity oil drainage. Coils shall be uniformly circuited in a counterflow manner. Pressure type liquid distributors used. Coils shall be tested with 315 pounds air pressure under warm water, and suitable for 250 psig working pressure.

**STEAM COILS:**
Certification – acceptable steam coils are to be certified in accordance with ARI Standard 410 and bear the ARI label. Coils exceeding the scope of the manufacturer's certification shall be acceptable provided the manufacturer is a current member of the ARI certification programs and the coils are rated in accordance with standard 410. Fins shall have a minimum thickness of 0.0075" of aluminum with full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded to the fins. Steam coils shall be provided with round seamless 5/8" O.D. copper tubes [0.020" [0.025"] [0.035"] [0.049"]] tubes. Tubes on two-row coils are staggered in the direction of airflow. All joints shall be brazed. Steam coil headers shall be made of nonferrous materials using seamless copper tubing with intruded tube holes. Both the supply and return headers shall be completely encased by the coil casing. Coil shall be pitched in the unit to assure positive condensate drainage. Steam coils shall be furnished as uncased to allow for thermal movement and slide into a pitched track for drainage. Orificed baffle plates shall be installed in the supply connection to ensure proper diffusion of entering steam. Steam coils shall be tested with 315 pounds air pressure under warm water and suitable for 150 psig working pressures.

**Filters**
Filter section shall be furnished with filter racks and guides with hinged and latching access doors for side loading and removal of filters. Filter media shall be UL 900 listed, Class I or Class II. Prefilters shall be flat arrangement with 2" deep pleated panel filters rated at 30% dust spot efficiency. Two-stage filters shall be cartridge type arrangement with holding frames suitable for prefilters and final filter media and blank-off sheets, cartridge media filters with [60-65] [80-85] [90-95] percent dust spot efficiency. Cartridge filter media is 12" deep and housing is designed for side loading of filters. Filter section shall be supplied with minihelic gauge to read pressure drop across each filter bank for scheduling filter replacement. Gauge shall be recessed into the cabinet.
Additional Sections
Mixing box section shall be provided with factory mounted low leak airfoil blade outside and return air dampers of galvanized steel in a galvanized frame. Dampers shall be hollow core airfoil blades, fully gasketed and have continuous vinyl seals between damper blades. [Outside air inlet shall be provided with weather louver] Access section shall provide access between components and shall be a minimum of 30” [24"] deep. Access doors shall be made of galvanized steel for flush mounting, with gasket, latch and full size (minimum of 4.5") handle assembly. Diffuser section shall be mounted on leaving side of supply fan section providing uniform air distribution across downstream components. Perforated diffuser plate shall be secured over blast area of fan to disperse airflow. [Inlet] [Discharge] plenum section shall be provided as the [first] [last] section in the direction of airflow. The plenum shall provide single or multiple [top] [end] [bottom] openings. [Face and bypass] [Bypass] section shall be provided to modulate airflow through and around the dehumidifier wheel. Dampers shall be an integral part of the unit assembly. Dampers shall be of low leak design, opposed blade, with vinyl bulb edging and stainless steel edge seals, galvanized steel frame, and axles in self-lubricating nylon bearings.

Dampers
DAMPER LEAKAGE:
Leakage rate shall be less than two tenths of one percent leakage at 2 inches static pressure differential. Leakage rate tested in accordance with AMCA Standard 500.

Installation
Contractor to install in accordance with plans and specifications and manufacturers recommendations.
Unit manufacturer shall provide factory start up assistance in the field to make units fully operational and to train operating personnel. Installing contractor to contact manufacturer when installation is complete and ready for start up.