**Scope of Work**

**FACILITY ENGINEERING STANDARDS TEMPLATE**

***This template is for creating a new facility engineering standard or change to an existing standard. The originator of this document should complete the areas indicated in red.***

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1. **General**

This standard applies to all *(Customer Name)* elements.

Facility Engineering Standards are periodically revised to reflect changes in

design practices, technology and lessons learned on projects.

The design and application of the facility engineering standard shall comply with the current adopted edition of all applicable city, county, state, and federal codes and standards.

The facility engineering standard shall be applied in a manner to assure that the maximum benefit is obtained for the costs expended. Safety and reliability shall not be compromised as a cost saving measure. The methods of analysis and design shall follow established principles of professional engineering practices. Value Engineering is encouraged during the development of the design work.

This facility engineering standard shall consider the *(Customer Name)* Global Supply Chain for competitive procurements.

1. **Scope and Applicability**

Provide a defined scope of work for facility engineering for proper installation monitoring and quality standards for air filtration. A proper filtration program is a critical consideration as it is relate to JACO compliance, standards and cost containment. This standard is to be strictly adhered too and is to be applied across *(Customer Name)*.

1. **Definition and Acronyms**
   1. Industry Abbreviations
      1. **AC** – Air Conditioning
      2. **ACH** – Air Changes per Hour
      3. **AHU** – Air Handling Unit
      4. **ANSI** - American National Standards Institute, [www.ansi.org](http://www.ansi.org)
      5. **ARI** - Air-Conditioning and Refrigeration Institute, [www.ari.org](http://www.ari.org)
      6. **ASHRAE** - American Society of Heating, Refrigeration and Air Conditioning Engineers, [www.ashrae.org](http://www.ashrae.org)
      7. **ASME** – American Society of Mechanical Engineers, www.asme. org
      8. **ASTM** - American Society for Testing and Materials
      9. **fpm** - Feet per minute; a measurement of air velocity used in calculating cfm requirements.
      10. **FV** – Face Velocity
      11. **HEPA** - High-efficiency particulate arrestor (also high efficiency particulate air)
      12. **HP** – Horsepower
      13. **HVAC** - Heating, Ventilation, and Air Conditioning
      14. **IAQ** – Indoor Air Quality
      15. **IEST** - Institute of Environmental Sciences and Technology, www.iest.org
      16. **Kw** – Kilowatt 34
      17. **kWh** – Kilowatt Hour
      18. **MERV** - Minimum efficiency reporting value
      19. **nm** - Nanometers, one-billionth of a meter
      20. **VAV** – Variable air volume
      21. **VFD** – Variable Frequency Drive
   2. Industry Definitions
      1. **μm** - Micrometer or micron, one-millionth of a meter
      2. **Arrestance** - Ability of a filter to capture a mass fraction of coarse test dust.
      3. **cfm** - Cubic feet per minute. This is a general measure of volumetric flow rate. Fans are normally rated in terms of CFM. In order for fan ratings to have meaning, they must be tested under identical, rigidly controlled conditions.
      4. **Challenge Concentration** - Airborne concentration of the hazardous agent entering the sorbent.
      5. **Collection Efficiency** - Fraction of entering particles that are retained by the filter (based on particle count or mass).
      6. **Composite Efficiency Value** - Descriptive rating value for a clean filter to incrementally load different particle sizes.
      7. **Dust Spot Efficiency** - Measurement of a filter’s ability to re-move large particles (the staining portion of atmospheric dust).
      8. **Dust Holding Capacity** - Measurement of the total amount of dust a filter is able to hold during a dust-loading test.
      9. **Electrostatic Attraction** - Small particles attracted to fibers, and after being contacted, retained there by a weak electrostatic force.
      10. **Electrostatic Filter** - A filter that uses electrostatically enhanced fibers to attract and retain particles.
      11. **Energy** - Energy has units of force multiplied by distance. It is commonly referred to as “work”. If you weigh 200 pounds and climb straight up a ten foot ladder, you do 200\*10 foot-pounds of work. In metric units, the common units are called “joules”. One joule equals one Newton-meter. In metric units, if you weigh 850 Newtons and climb straight up a 3 meter ladder, you do 2550 N-m of work. Energy divided by time is called “power”.
      12. **Filter Bypass** - Airflow around a filter or through an unintended path.
      13. **Filter Face Velocity** - Air stream velocity just prior to entering the filter.
      14. **Filter Performance** - A description of a filters collection efficiency, pressure drop, and dust-holding capacity over time.
      15. **High Efficiency Filter** - Primarily used to collect particles <1 micrometer.
      16. **Large Particle** - Particles greater than 1 micrometer in diameter.
      17. **Life-Cycle Cost** - Sum of all filter costs from initial investment to disposal and replacement, including energy and maintenance costs.
      18. **Low Efficiency Filter** - Primarily used to collect particles >1micrometer.
      19. **Mechanical Filter Collection Mechanism** – Governs particulate air filter performance.
      20. **Particulate Filter** - Collects particles only—mechanically or electrostatically.
      21. **Particle Size Efficiency** - Descriptive value of filter performance loading based upon specific particle sizes.
      22. **Pressure Drop** - The difference in static pressure measured at two locations in a ventilation system. A measure of airflow resistance through a filter.
      23. **Power** - A measure of how quickly work is performed. Work divided by time equals power. Electrical power in DC devices is simply voltage multiplied by current.
      24. **Static Pressure** - Static pressure (abbreviated SP) is the uniform force exerted equally in all directions by a liquid or gas. It does not include any force from motion or acceleration of the liquid or gas. It is akin to the potential energy of a system.
      25. **Total Pressure** - Total pressure is the sum of static and velocity pressure. Not including temperature changes, it is the sum energy potential of liquid or gas.
2. **Technical Description -Filter Specifications** 
   1. MERV 8 Pleated Air Filter
      1. Air filters shall be medium-efficiency ASHRAE pleated panels consisting of cotton and synthetic media, media support grid and enclosing frame with integral channel for side-access application.
      2. Sizes shall be noted on drawings or other supporting materials.
      3. Construction
         1. Filter media shall be a cotton and synthetic blend, lofted to a uniform depth of 0.15” and formed into a uniform radial pleat.
         2. A welded wire grid, spot-welded on one-inch centers and treated for corrosion resistance, shall be bonded to the downstream side of the media to maintain the radial pleat and prevent media oscillation*.*
         3. An enclosing frame of no less than 28-point high wet-strength beverage board shall provide a rigid and durable enclosure. The frame shall be bonded to the media to prevent air bypass and include integral diagonal support members on the air entering and air exiting side to maintain uniform pleat spacing in varying airflows.
      4. Performance Guarantees
         1. The filter shall have a Minimum Efficiency Reporting Value of MERV 8 when evaluated under the guidelines of ASHRAE Standard 52.2-2007. It shall also have a MERV-A of 8 when tested per Appendix J of the same standard. DHC must be equal or exceed 180 Grams when tested under the same standard.
         2. Initial resistance to airflow shall not exceed 0.27” w.g. at airflow of 500 fpm.
         3. The filter shall be classified by Underwriters Laboratories as UL Class 2.
         4. Manufacturer shall provide evidence of facility certification to ISO 9001:2000.
         5. Manufacturer shall guarantee the integrity of the filter pack to 2.0” w.g.
         6. The manufacturer shall provide a written Performance Guarantee ensuring the filter has the highest energy savings in its class of product, and will maintain its particle capture efficiency for a period of 6 Months and will not exceed 0.80a”wg. when tested at 500 FPM
         7. Supporting Data - Provide product test report including all details as prescribed in ASHRAE Standards 52.2, including Appendix J.
   2. MERV 11,13,&14 Non Support Pocket Filter
      1. Air filters shall be high efficiency extended surface pocket style filters consisting of high loft air laid micro fine glass media formed into tapered pockets, an [acrylonitrile](http://en.wikipedia.org/wiki/Acrylonitrile) [butadiene](http://en.wikipedia.org/wiki/Butadiene) [styrene](http://en.wikipedia.org/wiki/Styrene) (ABS) plastic header, ABS plastic pocket retainers, and bonding agents to prevent air bypass and ensure leak free performance.
      2. Sizes shall be as noted on drawings or other supporting materials. Performance values for evaluation purposes shall be based upon 24-inch by 24-inch by 22-inch MERV 14-10 pocket.
      3. Construction
      4. Filter media shall consist of high-density air laid lofted micro fine glass media that is chemically bonded to a permeable media support backing forming a lofted filter blanket.
      5. Individual pockets shall contain a minimum of 40 stitching support points per square foot of media area. All stitching centers shall be sealed using a foam-based sealant that shall remain pliable throughout the life of the filter. The sides and ends of each pocket shall be sewn with a chain-link over lock stitch.
      6. Pockets shall be formed into tapered pleats, supported by controlled media space stitching, to promote uniform airflow across the surface of the media. At any point, the sizes of the upstream and downstream passages shall be proportional to the volume of filtered air. The pockets shall also be conical, or tapered from top to bottom to minimize media contact against the interior of the HVAC system.
      7. Support members shall include an ABS plastic header and ABS plastic pocket retainers. Individual pocket retainers shall be assembled from matching halves that snap together to provide rigid and durable frame support. The plastic pocket retainers shall include anchor ports allowing for visual confirmation of pocket retention.
      8. A filter-to-filter sealing gasket shall be installed on one of the vertical members of the filter header.
      9. Performance
         1. The filter shall have a Minimum Efficiency Reporting Value of MERV 14 per ASHRAE Standard 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size. It shall have a MERV-A of 14 when tested under Appendix J of that standard.
         2. Initial resistance to airflow shall not exceed 0.45, w.g. at 2000 cfm.The filter shall be capable of withstanding 10.0” w.g. without failure of the filter. DHC must exceed 280Grams when tested under the current standard
         3. The filter shall have an Energy Cost Index (ECI) value of five stars.
         4. The filter shall be listed by Underwriters Laboratories as UL Class 900.
         5. Manufacturer shall provide evidence of facility certification to ISO 9001:2008.
      10. Performance Guarantee
          1. The manufacturer shall provide a written Performance Guarantee ensuring the filter has the highest energy savings in its class of product, and will maintain its particle capture efficiency throughout its service life, and remain in service for a period of one year – no pre-filter required.
          2. Supporting Data - Provide product test reports, including all details as prescribed in ASHRAE Standards 52.2-2007.
          3. Supplier shall have the capability of performing an in-situ test once the filters are installed to verify efficiency and pressure drop performance. In-situ testing must strictly follow ASHRAE Guideline 26-2008
   3. Supported Rigid V Bank MERV 11,13,&14 filter
      1. Air filters shall be v-bank mini-pleated fiberglass disposable type with pleat separators, polyurethane pack-to-frame sealant, and polystyrene enclosing frame and have an ECI value of five stars.
      2. Sizes shall be as noted on drawings or other supporting materials.
      3. Construction
         1. Filter media shall be of micro fine glass fibers formed into uniform pleats with a spacing of 10 pleats per inch and a uniform pleat height of 24mm. Pleats shall be separated at 25mm intervals to ensure uniform pleat distribution and even airflow through the filter pack.
         2. Pleats media packs shall be assembled into a v-bank configuration with sufficient total media area to meet airflow requirements. The filter outlet shall be radial in shape with a maximum of 60% open area to maintain low-pressure drop and uniform airflow (20” by 20” shall be straight v style design).
         3. The media packs shall be bonded to the inside periphery of a polystyrene enclosing frame with a polyurethane sealant. The enclosing frame shall include top and bottom molded tracks as an integral part of the frame to ensure a proper seal.
         4. Media packs shall be recessed at least 1” from the header side of the enclosing frame to allow uniform airflow when a pre-filter is mounted directly to the enclosing frame. The header shall include a gasket on the vertical side to create a filter-to-filter seal in side-access housing applications.
         5. Rigid plastic end caps shall be mechanically fastened to the top and bottom of the media pack enclosing structure to ensure a rigid and durable filter.
         6. Carrying handles shall be an integral part of the filter frame and shall bridge from media pack to media pack providing additional filter support and filter rigidity. Handles shall include fastener connection locations for the application of spring mounting fasteners when the filter is applied in reverse flow applications.
      4. Performance
         1. The filter shall have a Minimum Efficiency Reporting Value of MERV 14 when evaluated under the guidelines of ASHRAE Standard 52.2-2007. It shall also have a MERV-A rating of 13 when evaluated under ASHRAE Standard 52.2-2007 Appendix J.
         2. Initial resistance to airflow shall not exceed 0.27 inches w.g. at airflow of 500 fpm for 24” x 24”, 24” x 12” and 24” x 20” sizes. On 20” by 20” respective pressure drops shall be 0.27 inches w.g. at airflow of 500 fpm. DHC shall exceed 500 Grams when tested under the current standard.
         3. Filter shall have a 5-Star rating when evaluated per Energy Cost Index.
         4. Filter shall be listed by Underwriters Laboratories as UL Class 2.
         5. The filter shall be capable of withstanding 10” w.g. without failure of the media pack.
         6. Manufacturer shall provide evidence of facility certification to ISO 9001:2000.
         7. Supplier shall have the capability of performing an in-situ test once the filters are installed to verify efficiency and pressure drop performance. In-situ testing must strictly follow ASHRAE Guideline 26-2008
         8. The manufacturer shall provide a written Performance Guarantee ensuring the filter has the highest energy savings in its class of product, and will maintain its particle capture efficiency throughout its service life.
         9. Manufacturer will provide a written Guarantee that the filter we be capable of remaining in service for a period of three years.
         10. Manufacturer will guarantee that the filter during the service life the filter will not exceed 0.70 wg. when tested at a face velocity of 500 FPM.
   4. HEPA Filter 2400 CFM V configuration
      1. Air filters shall be absolute grade HEPA filters consisting of pleated media packs assembled in a V-bank configuration, polyurethane sealant, anodized aluminum enclosure and seamless sealing gasket.
      2. Sizes shall be as noted on enclosed drawings or other supporting materials
      3. Construction
         1. Filter media shall be micro fiber glass formed into mini-pleat pleat-in-pleat V-bank design.
         2. The media packs shall be potted into the enclosing frame with fire retardant polyurethane sealant.
         3. An enclosing frame of anodized extruded aluminum shall form a rugged and durable enclosure.
         4. A poured-in-place seamless sealing gasket shall be included on the downstream side of the enclosing frame to form a positive seal upon installation.
         5. - Filter efficiency at 0.3 micron shall be (95%, 99.99%, 99.999%)\* when evaluated according to the IEST Recommended Practice for applicable type. Each filter shall be labeled as to tested performance.
         6. Initial resistance shall not exceed 1.0” w.g. at rated capacity. (0.50” w.g. for 95%)\*.
         7. Filter must be listed as UL 586 and UL 900 per Underwriters Laboratories
         8. Manufacturer shall provide evidence of facility certification to ISO 9001:2008.
3. **Product Descriptions**
   1. MERV 8 Pleated Air Filter
      1. Product shall be Camfil 30/30 or equal.
   2. MERV 11.13,&14 Non Support Pocket Filter
      1. Product Shall be Camfil Hi-Flo ES or equal
   3. Supported Rigid V Bank MERV 11,13,&14 Filter
      1. Filters shall be Camfil Durafil ES or equal
   4. HEPA Filter 2400 CFM V configuration
      1. Camfil Filtra 2000 2400 CFM or equal
   5. Substitutions: All substitutions must be approved in writing by Ameristar Engineering prior to bidding. A written explanation and submission of all testing, documents and justifications must be submitted 2 weeks prior to bidding. Deviations from performance specifications and service requirements will cause immediate disqualification of substitutions. Ameristar reserves the exclusive right to deny or approve substitutions. Submissions will be evaluated on completeness of submissions as well as the substitutions ability to meet the specific criterion as outlined in this document.
4. **Execution**
   1. Service Enhancement Plan
      1. *Filter test bank trials will begin to establish validity of recommendations and appropriateness of changes relative to corporate quality standards.*
      2. Filter Manufacturer is required to test filters using a portable stand alone testing device capable of testing air filter pressure drop and measuring electrical usage in KWH. *(Hand held and installed metering devices are not acceptable)*.
      3. Cost Savings Data and reports will be accumulated into a local and corporate structure reviewed and approved by The *(Customer Name)*.
      4. Cost Savings will be expected to remain “continuous” throughout the remaining life of the relationship between Filter Manufacturer and The *(Customer Name)*. – Reporting of ongoing cost savings are to be provided every 3rd week of January and 3rd week of July each year of contract
      5. Total Filter Management- As part of a filter contract Filter Manufacturer and the Local Filter Manufacturer Distributor will agree to meet with *(Customer Name)*. Maintenance to establish a Total Filter Management program which will allow The *(Customer Name)* to receive filters on an establish and planned basis. The Total Filter Management Program is to include but is not limited to:
         1. Complete HVAC surveys to establish filter counts for all units.
         2. Filters deliveries coordinated with maintenance schedules.
         3. Bi-Monthly meeting to review T.F.M. effectiveness.
         4. Order entry, delivery, local service support, product testing.
         5. Detailed Cost savings analysis
         6. Changes and modifications will updated and communicated at all levels via Filter Manufacturer National Accounts – on going
         7. Order Entry, Fulfillment, Tracking, and Reporting
      6. Filter Manufacturer will provide a single source system for administering of ordering, billing, order tracking, and quarterly spend reporting.
      7. Local service requirements will be provided by a local stocking authorized Distributors located within 100 miles of the various *(Customer Name)* locations.
   2. Packaging and Identification
      1. Filter Manufacturer’s Local Authorized Stocking Distributors will agree to assure that packaging shall provide adequate protection against damage or deterioration during shipment and allow complete identification of both the filters and the shipping container.
      2. Filter Manufacturer’s Local Authorized Stocking Distributors will agree that shipping containers are marked with the following information:
         1. The name or trade name of the product.
         2. Name of manufacturer.
         3. Quantity of filters per carton
         4. Each filter will be marked with the following:
            1. Nominal and actual filter size.
            2. Name of product.
            3. Means of identifying air flow direction of the filter when installed.
            4. Underwriters’ Laboratories, Inc. official mark identifying a Class 2 classification.
            5. Name of manufacturer.
   3. Service Obligations
      1. Upon the request of the Facilities Manager, the supplier shall make on-site inspections where their products are being used. The purpose of these inspections is to ensure that filters are functioning properly, are installed correctly, and are applicable for the situation*.*
      2. If requested, brief reports shall be generated from each inspection noting the building, the air handler, and the *(Customer Name)* personnel contacted. The reports will provide a brief description of the conditions found, and shall be submitted to the Facilities Manager. A copy shall be submitted to the Facilities Director.
      3. Upon request, annual training sessions shall be provided. They shall include 2 to 4 hours of training in filter application, installation, maintenance, handling, etc.
   4. Product Availability
      1. Filter products including special sizes are to be delivered within 5-7 days of receipt of order
5. **References**
   1. ANSI/ASHRAE 52.3 1999 Method of Testing General Ventilation Air- Cleaning Devices for Removal Efficiency by Particle Size
   2. ANSI/ASHRAE Addendum b to ANSI/ASRAE Standard 52.2-2007 2008 Supplement Method of Testing General Ventilation Air- Cleaning Devices for Removal Efficiency by Particle Size
   3. UL 586 for HEPA Filters, *Standard for High-Efficiency, Particulate, Air Filter Units*
   4. UL 900 Filter Smoke & Combustibility Testing for Air Filtration Devices
   5. ASHRAE Guideline 26-2008 Guideline for Field Testing of General Ventilation Filtration Devices and Systems for Removal Efficiency In-Situ by Particle Size and

Resistance to Airflow

1. **Deviation**

Any deviations from the above prescribe procedures is cause for immediate revocation of contract.

1. **Savings**
   1. Within 180 days of receipt of contract, filter manufacture will provide a detailed Total Life Cycle Analysis using computer software based on known “field developed” pressure drop development curves of both competitive and Filter Manufacturer’s products for all of the *(Customer Name)* locations. Analysis is to be based on “real life field data” and site specific conditions. The purpose of TCO is to provide a filtration solution which optimizes; overall unit cost, maximizes energy savings, and minimizes labor. As part of an ongoing effort to develop cost Savings Opportunities Filter Manufacturer will agree to perform the following:
      1. Survey all *(Customer Name)* locations using local Filter Manufacturer’s Distribution and Regional Managers for support. All surveys will include the use of the tablet application – on going
      2. Life Cycle Cost Analysis will be run on all facilities – on going - anticipated completion in 4-6 months
      3. Recommendations for costs savings will be communicated to Local *(Customer Name)* Management, Local Filter Manufacturer’s Distribution, and Corporate *(Customer Name)* Management. – on going - anticipated completion in 4-6 months
      4. Filter test bank trials using a portable stand alone testing device capable of testing air filter pressure drop and measuring electrical usage in KWH. *(Hand held and installed metering devices are not acceptable)* will begin to establish validity of recommendations and appropriateness of changes relative to corporate quality standards & local Indoor air quality standards. – on going
      5. Filter Manufacturer is to make available a portable laboratory capable of remotely testing filter combinations in a simultaneous manner at appropriate bench mark sites. – on going - anticipated completion in 8-12 months
      6. Cost Savings Data and reports will be accumulated into a local and corporate structure reviewed and approved by *(Customer Name)* Management. – Delivered 3rd week of January and 3rd week of July each year of contract
      7. Cost Savings will be expected to remain “continuous” throughout the remaining life of the relationship between Filter Manufacturer and *(Customer Name)*.