

# MILCON P210, SOF RIVERINE & COMBATANT CRAFT OPS FACILITY (SBT-22), STENNIS SPACE CENTER, MS

## Site/Civil/Architectural Basis of Design – Pre-Final Submittal, May 15, 2009

Early start construction at the site has been successful following the outline established in the Factor A – Technical Solutions, and Basis of Design - 12/8/08, copies attached.

### Site Preparation

#### Clearing and Fill

- The site has been cleared of trees and existing organic materials.
- Proof-rolling and removal of existing non-conforming materials completed.
- Storm Water Pollution Prevention Plan measures and requirements are in place.
- Satisfactory existing soils have been reused and relocated with select materials installed to specification.
- Minimum finished floor elevation has been established by the Mississippi Emergency Management Agency as 14 feet above sea level. Actual Finished Floor Elevations will be 16 feet above sea level as required to promote proper site drainage.

#### Temporary Drainage Measures

- Existing ditches have been utilized as per Storm Water Pollution Prevention Plan.
- The balance of the site has been rough graded with most new drainage features installed. The new drainage system has performed well in recent heavy rains.

#### Piped and Other Utilities

- Water system, fire loop, and sewage collection have been designed and detailed.
- Temporary power has been coordinated with Stennis/Nasa and installed.

#### Storm Drainage

- Stormwater drainage plan has been improved to better handle existing off-site drainage patterns.
- Gutter and downspout system has been coordinated with the Building Manufacturer and detailed on the plans.

#### Paving and Hardscaping

- Pedestrian and vehicular circulation has been refined based on User input.
- Locations for exterior equipment have been determined and detailed.

#### Land Structures

- Post -Tensioned foundations have been deleted in favor of conventional reinforced foundations.
- Early start construction is proceeding with building slab foundations.

#### Interior Layout and Function

- Interior function discussed in the previous Basis of Design documents has evolved to the ultimate layout as detailed in this Pre-Final Submittal.
- Final Armory layout determined.
- Cage Area has raised pads, improved gang shower and drying area, and laundry area.
- Office/Operations has incorporated User requirements for additional work stations.
- Boat Storage Building 2442 has had rear elevated access deleted with interior catwalk and internal catwalk access stairs.

#### Exterior Envelope

- Metal wall panel, soffit, and split face block selection has been coordinated with User.
- "R" values have been met or exceeded in the design.

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The Site Plan and Building Design have evolved through the design process including PAK and CDW meetings to simultaneously better suit User needs and more closely conform to the RFP.

### Site Plan

Note: SWPPP has been submitted and has received a satisfactory review.

Traffic flow to the site has been studied with various options explored:

- POV access is now from Lower Gainesville Road.
- POV parking and future parking has been redesigned.
- "LEED" preferred parking is indicated.
- Construction access points have been proposed.
- Construction activity areas have been defined.
- Site clearing limits have been adjusted to minimize impact.
- Landscaping locations have been refined to enhance security and provide ease of maintenance.
- Standoffs have been maintained and specifically improved at vehicle entrance.
- Parking for oversized government vehicles has been provided.

User input has helped refine daily personnel flow:

- Preferred facility views, both outward and approaching the site have been established.
- Foot traffic from parking and between buildings has been better accommodated.
- Pad locations for antenna, chiller, condensers, transformers, and generator are proposed.

### Land Structures

Operations & Maintenance Building

Overall dimensions have not changed, but interior layout dimensions have been fine tuned to better suit User needs and conform to good construction practice. Major elements of floor plan flow have been changed to suit input from Users:

- Exterior "Sailor" entrance to the Operations Facility from parking and boat storage functions is now centralized for convenience of access to Cages, Staging, or Operations. Vertical circulation has moved across the building to coincide with the "Sailor" entrance.
- Exterior "formal" entrance has been defined to coincide with preferred approach from the site vehicle access point.
- Entrance canopy at "formal" entrance has been extended to enhance weather protection and become a stronger visual element.
- Clerestory windows have been moved from the Operations area of the building to the Staging area of the building to conform with the RFP.

Interior function of the facility continues to be refined:

- User has updated Armory layout, specifically cage arrangement and room furnishings.
- Toilet rooms and shower facilities have been refined based on User input.
- Design staff has met on site to further define all office and furniture layout.

### Boat Storage Building

Ongoing discussions with the User are resulting in further detailing of the design of the critical raised platforms to access the boats:

- Concrete versus steel.
- Mesh partitions.
- Personnel entrances.

## **EXECUTIVE SUMMARY**

Broadmoor appreciates this opportunity to provide NAVFAC Southeast the **SOF Riverine and Combatant Craft Operations Facility** as outlined in the RFP. We have developed an approach and assembled a team which can assure the delivery of the proposed project to **NAVFAC Southeast**.

With the mandate to provide “**best value**” to the Navy for its riverine operations on the Stennis Space Center campus, we have evaluated the program documents and have outlined in **Factor A** our **Technical Solution**. We have based this solution on the information available at this time. Upon award, a comprehensive analysis of the functionality, location and aesthetic will continue to assure the project meets or exceeds the user’s requirements, delivering the best possible design and construction techniques for this facility.

In this document we will present the team to accomplish these goals. Broadmoor’s core team for these DBOC projects is intact and will be providing the oversight necessary for the design of this project as well as providing interior design services. We have expanded our professional team with the addition of **Dammon Engineering, Inc.**, architects and engineers. Dammon will facilitate the conceptual design and engineering through the production of construction documents for the project. Mechanical engineering will be provided by **Professional Engineering Services**, in partnership with **Gallo Mechanical**. Electrical engineering will be provided by **Schlafly Engineering, LLC** in partnership with **HTE Contractors, Inc.**

Broadmoor will also present in **Factor B** its **Management Approach** to guarantee the successful delivery of this project. We have enjoyed a mutually advantageous partnership with the Navy on many projects for over twenty-five years and will continue to work to deliver an exceptional service. Our management practices have been developed to facilitate the unique requirements of Navy procurement methods in order to provide a completely responsive service. This partnership has proven successful and continues to develop on every project we provide to the Navy.

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### **FACTOR A – TECHNICAL SOLUTIONS**

The following narratives are divided into architectural and engineering disciplines and will provide an overview of our approach to the diverse requirements of the new operations facility. Where pertinent, we will address specific items as they relate to the site conditions and location. Even with the short time available, much research and study has been made to provide the Navy with the most effective facility in its efforts to affect a higher level of mission readiness and training for future missions in our region and around the world.

The design approach as well as products intended for incorporation into our proposal and as represented in the attached drawings and documents are in no way intended to take exception to the technical requirements of the RFP. If in your formal review of our proposal, it is determined that we have in any way technically deviated from your written expectations, we fully intend to conform to the requirements of the RFP and as further defined by all subsequent amendments.

#### **SITE/CIVIL BASIS OF DESIGN**

The scope of the Civil/Site work is comprised of several distinct categories of work as outlined in the RFP and as further developed by the Broadmoor/Dammon Team.

One aspect of note relates to the filling of the site. Based on analysis of the geotechnical reports and our familiarity with local soils conditions, our team is developing a design strategy based on significantly re-grading the site to fill the natural drainage ravine which currently runs through the building site with compacted native soil excavated from other areas of the site. Our plan will establish a new surface drainage pattern which will take the site water around the building site and into the existing discharge locations in the Pearl River canal. Our proposal drawings indicate slab on fill in accordance with the geotechnical reports. However, topographic conditions at the site will require extensive filling at the building sites which was apparently not accounted for in the RFP geotechnical report. Therefore we will utilize the services of a local geotechnical firm to help establish the final site fill and soil compaction plan. There is a possibility that a pile foundation may be more economically viable, but that is not anticipated at this time. A final plan will be developed as soon as we have access to the site for our engineers and geotechnical consultant to complete their analysis.

## Site Preparation

### Clearing and Fill

The site shall be cleared of all trees and excess grass and then prepared for construction by implementing the following site grading and fill methodology.

- At Roads and Parking Areas, remove any existing soft topsoil to expose the existing sub-base material. Establish new subgrade elevations by placing relocated fill material and compacted to specification. Road surfaces will be either asphalt paving with crushed stone base or reinforced concrete paving in accordance with the RFP.
- Building Pads shall be placed on four feet of select imported fill materials under the slab. The construction of the ground floors is further described in the drawings.
- The Lawn Areas will be filled with suitable excavated material and topped with existing top soil to elevations developed for surface drainage. Site finished grading will entail shaping to the final Site Grading and Drainage Plans and then seeding or sodding as called for in the RFP.

### Temporary Drainage Measures

Existing ditches will be cleaned out and extended as needed for drainage during construction. All excess excavated dirt will be stockpiled on site and used in the final grading of the site.

The balance of the site will be rough graded to eliminate low spots and establish positive drainage during construction. Temporary culverts will be provided at roads and surcharge locations as required to drain site. Erosion control measures will be employed to protect existing improvements and surrounding properties.

### Piped Utilities

#### Water

- The domestic water system will be extended from an existing POC along Endeavor Blvd. to the Operations/Maintenance Building. If required, water lines can be extended to the Helipad from the drive in the Wash Rack area.
- The existing fire water loop from Endeavor Blvd. will be extended to the Ops./Maint./Storage Complex Area in conjunction with the domestic system

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above. This will include the installation of fire hydrants at locations providing the coverage required by the governing codes and to support the new building fire suppression systems.

### Sewerage

- A sanitary sewer collection system will be installed to collect the sanitary waste from the Operations/Maintenance Building with a new lift station, wet well and force main to the existing POC, Lift Station No. 33.

Note: Utilities for the Wash Rack will be as per provided plans.

### Storm Drainage

Stormwater will be handled via a combination of overland sheet flow, surface channels, and underground piping which will direct the flow towards the existing and newly developed drainage patterns in each respective work area.

Runoff from the building roofs will be collected by gutters and down spouts which will discharge onto splash blocks, surface channels, or underground piping depending on their location.

### Paving and Hardscaping

As outlined in the RFP, roadways and parking areas will be either concrete or Asphalt paved. Generally concrete paving will be at the service areas around the boat maintenance and storage buildings, with asphalt paving for the POV parking area and road to the boat launch. The type of vehicles traveling each area will be taken into account in the final paving design.

Our paving sections will contain multiple layers including compacted existing sub-base, compacted fill, and compacted stone base material for both the asphalt and concrete paving areas. This design will be in accordance with the geotechnical report and provide the required life and performance over the existing soft soils at the project site.

Sidewalks serving the Complex will be concrete paved as described in the RFP. Sidewalks providing accessible paths to the building entrances will meet ADA criteria.

## **BASIS OF STRUCTURAL DESIGN**

### Land Structures

#### *Operations & Maintenance Building*

The Operations Building consists of a two story facility with office area over utilitarian functions on the first floor with plan dimensions of 58' x 148', with an attached single story Boat Maintenance wing of 67' x 102'. All structural framing will be provided by a pre-engineered metal building manufacturer. The Maintenance Building foundation will consist of conventionally reinforced two way slab, and a post tensioned foundation for the Operations Building, with the two foundations dowelled together. The second floor framing of the Operations Building will consist of a concrete slab on metal deck and structural steel beam / bar joist system. Structural steel columns will support the floor framing. Overall the roof framing will consist of purlins on metal building rigid frame with a standing seam metal roof. The lateral force resisting system will consist of braced frames. The Armory will be enclosed with CMU walls and concrete floor and ceiling in accordance with the requirements of the RFP.

#### *Boat Storage Building*

The framing and foundation of the Storage Building will be similar to the Maintenance Building above.

## **BASIS OF ARCHITECTURAL DESIGN – OPERATIONS BUILDING**

### Interior Layout and Function

The ground floor of the Operations Building is multi-faceted in uses:

- Entry/Control/Circulation
- Cages/Showers/Toilet Rooms
- Armory
- Mech./Elec./Utility

The second floor of the Operations Facility is focused on office and operations as follows:

- Unit Offices
- Commander Offices
- Training
- River Operations Control
- Circulation/Utility

Spaces for mechanical and electrical equipment is available on both floors with additional equipment space over the Armory.

Our design team has developed a full understanding of the requirements for each of these functions as outlined in the RFP. The room sizes and adjacencies will be maintained as the final documents are developed, however some reconfiguration may be necessary to integrate the structural system, establish an effective arrangement of natural/clearstory lighting, and assure proper circulation and fire egress.

The requirements for finishes, casework, accessories and contractor furnished furniture and equipment for each of the various spaces are understood and will be provided for. Highly specialized items – operable partitions, security, overhead cranes, armory requirements, etc. – will be properly specified and carefully detailed. We understand the special requirements for the SIPRNET construction including mechanical and plumbing openings, entry door and accessories, sound transmission criteria and intrusion detection.

### **Exterior Envelope**

Broadmoor/Dammon's exterior wall design satisfies the critical need of providing an effective Weather-Thermal-Air Barrier while complementing existing adjacent SOF facilities. In our climate, preventing intrusion of moisture is of utmost importance in protecting the health of the occupants, preventing damage to the building and assuring the proper functioning of the HVAC systems.

The exterior walls will be comprised of 6" reinforced concrete masonry with a 6' veneer on the first floor of split face masonry to compliment the existing buildings. Above the veneer galvanized furring members will be applied to the exterior face for attachment of the metal wall panels. The wall system will be engineered to satisfy the wind load criteria. The metal wall panels will be secured to the furring members using concealed fasteners and backed by insulation per the RFP. Care will be taken to ensure proper placement of gaskets and sealants. Integrated trims and flashing will be installed. Other finished will be per the RFP.

The Schedule of Finishes from the RFP is already shown on the packet drawings.

Wherever the underside of occupied spaces at the second floor is exposed to outside air, the assemblies will include thermal insulation and vapor barrier provisions. The soffits at these areas will be of pre-finished composite metal panels. The sun protection canopy at the South elevation and the columns supporting it will be clad in an aluminum composite panel system.

The entrances and openings will be of anodized aluminum/painted steel as scheduled with tinted low-E insulating glazing meeting the Large Missile Test standards. Entrance

units will be detailed for the appropriate frequency of traffic and outfitted with the necessary hardware and accessories.

Our windows will be provided to compliment the metal panel system. Frames are of extruded aluminum and glazing at the windows is the same as at the entrances. Interior aluminum sills are provided as part of the window system and match the finish of the frames.

Other exterior doors will be as called for in the RFP in hollow metal doors and frames with internal insulation, weather stripping, hardware and accessories to insure against air and water intrusion and to provide for proper emergency egress and security. Vision panel glazing will meet the missile impact criteria of the window glazing.

The roofs at all buildings will be galvalume and the roof assembly will provide a minimum "r" insulating value as noted in the RFP. Emphasis will be given to the detailing of roof penetrations and any equipment supports. All metal flashing, trim, gutters and downspouts will be galvanized/galvalume to match adjacent structures.

### **Interior Construction**

At the ground floor, all interior partitions will be of durable concrete masonry units. At the upper floor interior wall partitions will be of steel stud construction with gypsum wallboard. Where required by IBC or NFPA, fire rated partitions will be provided, including properly rated doors and fire stopping of penetrations. All interior stud partitions will include acoustical batts.

At toilet spaces, walls will be faced with porcelain tile.

Interior ceilings will generally be of acoustical lay in panels other than at toilet facilities and painted structure areas.

Floors throughout will be as cited in the RFP Schedule of Finishes shown on the packet drawings, including porcelain tile, quartz vinyl tile, carpet tile, and concrete.

Fire stair enclosures and construction will be in accordance with the IBC and NFPA. Handrails will be of anodized aluminum and all exposed steel components will be painted.

Throughout the Operations Building interior, the accessories, casework, signage and specialty items listed in the RFP will be provided. The contractor's responsibility for the outfitting of the project is understood.

## BASIS OF MECHANICAL DESIGN

### General:

This section describes the general Basis of Design for the Mechanical systems serving the future **Riverine and Combatant Craft Operations Facility at Stennis Space Center**. The mechanical systems described herein include the plumbing and HVAC systems only. The intent of this description is to adequately and accurately describe the design intent, and prove compliance with the system requirements outlined in the RFP.

The project intent is to meet or exceed LEED® Certified requirements. As such, certain design approaches, system configurations, and equipment selections have been tailored to increase operating efficiencies while minimizing operational costs and system complexities.

### Mechanical HVAC

The building shall be served by a central chilled water plant designed specifically for the Riverine Facility. The primary component shall be a single high-efficiency, air-cooled chiller with multiple compressors. The system shall be designed for 100% of the anticipated calculated load, but shall include multiple compressors to enhance redundancy within the refrigeration system. The final system designs shall be predicated on the following conditions:

#### *Outdoor Design Conditions*

Cooling Season:	92°F DB / 82°F WB
Heating Season:	31°F DB

#### *Indoor Design Conditions:*

Conditioned Spaces	
Cooling Season:	75°F DB / 50%RH
Heating Season:	68°F DB

Ventilated / Heated Spaces	
Cooling Season:	95°F DB
Heating Season:	55°F DB

The system shall include a variable primary pumping scheme, which allows the chilled water flow to modulate in response to real-time fluctuations in HVAC cooling load. This capability will significantly enhance the energy consumption characteristics of the facility while increasing the useful life of the pumping equipment. Due to the anticipated small

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system volume, a buffer tank shall be included to minimize hard starts / stops by the chiller equipment. The chilled water system shall include chemical treatment for rust, corrosion, and scale inhibition.

Air-side system design shall incorporate the use of central station modular air handlers with variable speed fans (controlled by variable frequency drives). Fan speed shall be adjusted in real time in order to deliver only the amount of air required to adequately condition the subject spaces. The building shall be divided into several zones, predicated on common use, exposure, or specific environmental control requirements. Each zone shall be served by a dedicated VAV (variable air volume) terminal unit with electric reheat. The Communications Room shall be served by a dedicated DX split system sized specifically for the internal load requirements of the space, including equipment, lights, personnel, etc.

Based on the calculated loads for each zone, the electric heat option provides greater system flexibility, reduced operating and maintenance costs, and increased reliability versus a centralized heating hot water boiler system. The heating load for the proposed building is minimal, and the building will require simultaneous heating and cooling throughout portions of the year. Conditions would be common where a natural gas boiler system (comprised of pumps, boilers, controls, etc.) would require operation to satisfy an extremely small heat or reheat load within a small zone or office. In order to eliminate these gross inefficiencies, electric heaters shall be integrated into the VAV boxes to provide heat (and reheat, where required) to each individual zone without the need for operation of a central heating plant.

The central control system shall monitor all applicable conditions within the building, and provide system control to automatically maintain appropriate temperature conditions within each zone. User-level interface (thermostats) shall provide a range of setpoint adjustment; the range shall be controlled by the master central system. Each central station AHU shall utilize a CO2 sensor to implement a Demand Control Ventilation (DCV) strategy, which allows the reduction of outside air delivery during times when the building is sensed to be partially occupied. The Armory zone shall include active humidity control in order to preserve the contents of the space during high ambient humidity conditions. The central system shall interface seamlessly with the existing Stennis Siemens® APOGEE® system.

The Boat Maintenance wing of the facility shall be served by heating and ventilation systems only. Such systems shall be comprised of electric resistance unit heaters and roof-mounted centrifugal exhaust fans, thermostatically controlled with user-level override.

The Boat Storage Building shall be served by heating and ventilation systems only. These systems shall include electric resistance unit heaters and roof-mounted centrifugal exhaust fans on automatic thermostatic controls.

## Plumbing Systems

The plumbing systems shall consist of all necessary fixtures, valves, piping, connections, and trim to form complete and functioning systems. All fixtures shall be selected based on low-consumption performance characteristics that meet or exceed the LEED requirement for a minimum 30% reduction in water consumption. Water heating shall be accomplished by utilizing a central electric water heater with a minimum energy factor rating of 0.93. A re-circulating hot water return system shall be used to ensure prompt delivery of hot water at each fixture while minimizing energy consumption based on piping heat loss.

Fixtures shall be based on the following characteristics:

### *Water closets:*

Low-Consumption flush valve vitreous china (Accessible where required)

### *Urinals:*

Low-Consumption flush valve vitreous china (Accessible where required)

### *Wall-Mounted Lavatories:*

White vitreous china with 8" center-set gooseneck, low-consumption faucet (Accessible where required).

### *Showers:*

Pressure-balanced valves and trim, accessible personal hand-shower and support bars where required.

### *Service Sinks:*

Floor-mounted cast terrazzo style mop sink with drop front, mop hanger, and bumper guard.

### *Kitchen / Break Room Sinks:*

Self-rimming stainless steel sink with 8" center-set high arc gooseneck low-consumption faucet with wrist-blade handles.

### *Shower / Eyewash Stations:*

Pedestal supported combination shower and eyewash per applicable safety standards, including tempered water supply.

### *Drinking Fountains:*

Dual-height push-button, wall-mounted, water coolers.

All wall mounted fixtures shall be supported from the floor using adjustable floor-mounted fixture supports. Wall hangers shall not be used.

The incoming water service shall be protected by using an approved reduced pressure principle (RPP) backflow preventer per AWWA guidelines. All connections between the potable supply and the mechanical HVAC water systems shall be through an approved RPP backflow preventer per AWWA.

All mechanical rooms and heads shall have wall hydrants for cleaning operations. Several wall hydrants shall be installed along the building exterior at a minimum of every 175'.

Piping specifications shall be as follows:

Underground Sanitary Waste: Schedule 40 PVC with solvent weld joints.

Above Ground Waste and Vent: No-hub service weight cast iron pipe and fittings.

Internal Roof Drainage: None Required.

Compressed Air Systems (Non-Medical Use): Galvanized steel with screwed fittings OR Type L copper with soldered fittings.

Domestic Water Supply: Type L copper with soldered fittings.

Chilled Water Piping: Schedule 40 Steel (larger sizes) or Type L copper with soldered fittings. Connections between dissimilar metals shall be prohibited.

Dielectric unions or flanges shall be used where applicable.

The Boat Maintenance Building shall be served by a continuous trench drain and area floor drains discharging into an oil-water separator prior to release to the sanitary sewer system.

In the Boat Maintenance wing of the main facility, the area shall be served by a shop air compressor with refrigerated dryer, aftercooler, and filter. Piping shall be routed through the bay with a minimum of 2 drops, which shall include a filter pressure regulator and quick-disconnect for attachment of operator tools.

#### **Additional Project Specifications:**

#### **Contractor Qualifications and General Conditions**

This section includes general administrative criteria for execution of the work of Division 15, including Contractor's Qualifications, Quality Assurance, Codes and Standards, Permits and Inspections, Equipment and Materials, Storage and Handling, Rough In of Mechanical Installations, and Coordination with Other Trades.

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Work accomplished under this Division shall be done in accordance with the laws and statutes of the local authorities having jurisdiction, and the Contractor shall be licensed under the laws and regulations of those same authorities.

### ***CODES AND STANDARDS***

The work described in these Project Documents shall comply with the requirements of the local authorities having jurisdiction, as well as the following standards and codes:

ASHRAE 90.1 ("Energy Code")  
ASHRAE 62.1 ("Commercial Ventilation Code")  
ASHRAE 62.2 ("Residential Ventilation Code")  
NFPA 90A ("Mechanical Installation Code")  
ASHRAE 15 ("Mechanical Refrigeration Safety Code")  
IBC ("International Building Code")  
IMC ("International Mechanical Code")  
IFGC ("International Fuel Gas Code")  
IPC ("International Plumbing Code")  
NFPA 101 ("Life Safety Code")  
NFPA 13 ("Sprinkler Systems Code")  
NFPA 70 ("National Electric Code")  
ARI Ratings  
ASME Pressure Vessel Certifications  
LEED-NC Version 2.2

### ***PERMITS, FEES, AND INSPECTIONS***

Contractor shall arrange for and pay for all required inspections during the construction process, and shall closely coordinate with the work of other disciplines prior to receiving inspections and certifications. Contractor shall furnish original copies of all certifications and inspection reports to the Owner at Project Closeout.

### ***EQUIPMENT AND MATERIALS***

Each piece of equipment shall bear a nameplate indicating the manufacturer's name, product model number, serial number, listings and approvals (UL, ASME, etc.), and capacities. If possible, indicate on the nameplate stamp the Equipment Tag number or designation as listed in the Project Documents. If not possible, additional signage will be provided indicating such information and affixed directly to the unit or item in a location accessible and in plain view.

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Each item of equipment shall be the standard product of a manufacturer regularly engaged in the design, fabrication, production, and certification of that particular type of equipment. This shall in no way prevent custom equipment manufacturers from providing equipment specifically designed for the service and capacity described in the Project Documents.

### *STORAGE AND HANDLING*

Equipment and materials shall be delivered to the site in original packaging / containers, and shall be stored off of the ground in an area sheltered from the elements and damage from construction operations, and shall be readily available for access and inspection. Items susceptible to damage from moisture or temperature extremes shall be stored in a climate controlled location on or off of the site prior to installation.

Any equipment damaged during shipping, storage, or handling shall not be accepted.

### **MATERIAL AND INSTALLATION REQUIREMENTS**

This section includes piping, fittings, and valves that are common to several divisions of Work. The work and material described includes: sanitary sewer piping, storm sewer piping, water main piping, water distribution piping, drain piping (from equipment), isolation valves, balancing valves, and meters.

*PIPE AND FITTINGS - Provide pipe conforming to the following descriptions and standards:*

- Standard Weight Steel Pipe 2" and smaller: seamless or butt-welded, black or galvanized (ASTM A53)
- Scheduled Steel Pipe, seamless or continuous steel pipe, black or galvanized (ASTM A53, Grade A)
- Steel Pipe Nipples: seamless galvanized or carbon steel pipe (ASTM A733, A53, and A106)
- Ductile Iron Pipe: Mechanical and push on joints, with AWWA C104 cement-mortar lining, conforming with AWWA C151, Classes 50 and 51.
- Flanged Ductile Iron Pipe: with barrel conforming to AWWA C115 Class 150 or 300, or with cement-mortar lining conforming to AWWA C104.
- Cast Iron Soil Pipe: pitch coated, hub-and-spigot soil pipe and fittings (ASTM A74)
- Hubless (No-Hub) Cast Iron Soil Pipe: service weight cast iron soil pipe with clamped neoprene connections (CISPI 301)

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- Seamless ACR Copper Tube: Types K and L, ASTM B88, water tube, annealed temper.
- Hard Copper Tube: Seamless hard drawn copper tube, Type K, L or M, ASTM B88.
- Copper Drainage Tube: Type DWV, ASTM B306
- PVC Water Main: SDR/PR 160 hub-and-spigot with elastomeric gasket (ASTM D2672 and D3139)
- PVC Plastic Pipe: Schedules 40, 80, and 120 (ASTM D1785) and type DWV (ASTM D2665)

### *FITTINGS*

- Malleable Iron: black or galvanized, screwed or butt-welded fittings, 150 psi (ASTM/ANSI B16.3)
- Cast Iron: black or galvanized screwed drainage fittings (ASME/ANSI B16.12); recessed drainage pattern (ASME B1.20.1)
- Cast Copper Alloy Solder Joint Fittings: Equal to NIBCO (ASME/ANSI B16.18)
- Cast DWV Fittings: (ANSI B16.23)
- Wrought DWV Fittings: (ANSI B16.29)
- Wrought Copper and Bronze Fittings: (ANSI B16.22)
- Wrought Copper Drainage Fittings: (ANSI B16.23)
- Bronze Flanges: (ANSI B16.24, Classes 150 and 300)
- Steel Butt-Welded Fittings: (ANSI B16.9)
- Grooved Steel Pipe and Fittings: Equal to Grinnell "Gruv-Lok" or Victaulic
- Ductile Iron and Gray Iron gasketed fittings: AWWA C110 standard pattern or AWWA C153 compact pattern, 250 psig min pressure rating, with AWWA C104 cement-mortar lining and AWWA C111 rubber gaskets.
- Thredolets and Weldolets: Approved.

### *VALVES*

- Bronze Valves, 2" and less: threaded ends
- Ball Valves, 4" and less: blowout proof, 3-piece construction, standard or conventional port, chrome-plated brass ball, RTFE seats and seals, threaded or flanged end connections
- Ferrous Valves, 2 ½" and up: flanged ends
- Valve Temperature and Pressure Ratings: not less than system pressure specified
- Valve Sizes: same as upstream pipe size, unless indicated otherwise.
- Extended Valve Stems: Required on all insulated valves
- Valve Flanges: ASME B16.1 (cast iron), ASME B16.5 (steel), and ASME B16.24 (bronze)
- Valve Grooved Ends: AWWA C606
- Threaded: per ASME B1.20.1

- Valve Bypass and Drain Connections: MSS SP-45

### *MECHANICAL INSULATION*

This section includes pipe and duct insulation for mechanical installations. Products and methods outlined herein include: fiberglass ductwrap insulation, fiberglass pipe insulation, rigid cellular glass pipe insulation (closed cell polyurethane), Armaflex / Rubatex foam insulation systems, internal duct insulating fiberglass liner, water vapor barriers, sealants and coatings, and jackets for interior and exterior applications.

Insulation thickness and ratings shall comply, as a minimum, with ASHRAE 90.1 ("Energy Code").

All insulation material, including jackets and sealants, utilized on interior installations, shall have a Flame Spread Rating of 25 or less, and shall have a Smoke Developed Rating of 50 or less, when tested in accordance with ASTM E84.

Insulation materials must be clearly marked by the manufacturer that the requirements outlined above are met.

Insulation materials shall be brought to the site in original containers, shall be kept free from heat and moisture, and shall be clearly marked with maximum temperature ratings, type and grade, and Flame Spread / Smoke Developed ratings.

In areas where exposure to the elements is inevitable (rooftop applications), insulation, vapor barrier, and jacketing must be applied as quickly as possible to prevent degradation of metal duct and piping components.

### *INSULATION MATERIALS*

Mineral Fiber Board Insulation (duct and equipment): glass fibers bonded in thermosetting resin, complying with ASTM C612, Type IB, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

Mineral Fiber Blanket Thermal Insulation (duct): glass fibers bonded with a thermosetting resin, complying with ASTM C553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

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Flexible Elastomeric Insulation (piping): closed-cell, sponge or expanded rubber materials, complying with ASTM C534, Type I for tubular materials and Type II for sheet materials, with recommended adhesive and UV protective coating (for exterior installations).

Mineral Fiber Insulation (piping): glass fibers bonded with a thermosetting resin, complying with ASTM C547, Type I, with factory-applied all purpose vapor retarder jacket.

Cellular Glass (piping): inorganic foamed or cellulated glass, annealed, rigid, hermetically sealed cells, non-combustible, in compliance with ASTM C 552, Type II, Class 2.

### *Field Applied Jackets*

- Foil and Paper Jacket: ASTM C921, Type I, laminated, glass-fiber-reinforced flame retardant kraft paper and aluminum foil.
- PVC Jacket: High impact, UV resistant, 20 mil thick, roll stock suitable for shop of field cutting and forming. Adhesive as recommended by manufacturer and standard color as white.
- PVC Fitting Covers: High impact, UV resistant, 20 mil thick, factory fabricated for various fittings, elbows, tees, and valves. Adhesive as recommended by manufacturer and standard color as white.

Vapor Retarders: Mastics shall be as recommended by the manufacturer, and are compatible with insulation materials, jackets, and substrates.

All piping conveying fluids fewer than 70°F at any time shall be insulated with a vapor barrier jacket.

Apply piping insulation with longitudinal seams running along the length of the pipe.

Apply ductwork insulation with tight longitudinal seams and end joints. Overlap and bond seams and joints with vapor retarder mastic or pressure sensitive tape having the same physical properties as the insulation facing.

Seal all openings in insulation system (valve stems, hangers, supports, brackets, damper operators, actuators, etc.) with a vapor-retarder mastic, to provide a complete and continuous vapor barrier.

Do not compress insulation during installation to any less than 80% of its nominal thickness.

Where ductwork or piping passes through structural components (walls, slabs, roofs, etc.), continue insulation through the opening, unless prevented by presence of fire dampers, sleeves, couplings, etc. In the event of an obstruction, tightly butt insulation up against obstruction, and continue the vapor barrier up the termination of the insulation.

### *INSULATION SCHEDULE*

#### Outside Supply and Return Air Ductwork

Material: Mineral Fiber Board  
Thickness: 1 ½" thick  
Jacket: Field Applied PVC  
Vapor Retarder: Yes

#### Interior Supply Air , Return Air, and Outside Air Ductwork

Material: Mineral Fiber Blanket  
Thickness: 1 ½" thick (R-4 minimum)  
Jacket: Foil and Paper  
Vapor Retarder: Yes

#### Domestic Cold Water, Hot Water, and Condensate Drain Piping

Material: Flexible Elastomeric or Mineral Fiber  
Thickness: ½" thick  
Jacket: Exposed Locations – PVC  
Concealed Locations – Foil and Paper or PVC  
Vapor Retarder: Yes

#### Transfer Air / Sound Traps

Material: 1" Fiberglass or Closed Cell Duct Liner with smooth matte-faced interior surface (in compliance with NFPA 90A)

#### Plumbing Waste Piping Above Rigid Ceilings and Horizontal Roof Drain Piping

Material: Flexible Elastomeric or Mineral Fiber (Ductwrap)  
Thickness: 1" thick minimum  
Jacket: Exposed Locations – PVC  
Concealed Locations – Foil and Paper or PVC  
Vapor Retarder: Yes

### Hydronic Chilled Water Piping

Material: Cellular Glass

Thickness: 1" thick

Jacket: Exposed Locations – PVC Indoor, Aluminum Outdoor  
Concealed Locations – Foil and Paper or PVC

Vapor Retarder: Yes

## HVAC SYSTEMS - DUCTWORK AND ACCESSORIES

This section includes general requirements for all equipment, material, and accessories for the HVAC systems, including: chilled water air handling units, ductwork, VAV boxes, grilles, registers, diffusers, balancing dampers, start-up and warranty requirements, and service warranty contract requirements.

Deliver equipment, ductwork, controls, actuators, safeties, grilles and registers, dampers, electrical components, and accessories in their original shipping containers, and store off of the ground and protect from extremes in temperature and moisture. Electrical and control components shall be stored in a climate-controlled area prior to installation.

Equipment or material damaged during delivery, storage, or handling will not be accepted. Replace damaged material or equipment with new.

All ductwork, except flexible fabric ductwork where specifically indicated, shall be of galvanized steel sheets of gauges and construction recommended by NFPA 90A and SMACNA for the pressure classification indicated, complete with all necessary angles, supports, reinforcements, and braces. All ductwork indicated is 2"SP pressure classification. Fiberglass "duct board" will not be used.

All round take-offs from rectangular ductwork shall be made by means of a "Genflex" Model SM-ID spin in fitting with integral butterfly damper and quadrant operator or equal.

Fire dampers, where ducts pass through fire rated partitions with a fire resistance rating of 1 hour or more, shall be U.L. listed, with fusible link rated for operation at 165 degrees F, equal to Ruskin Model DIBD-2. All fire and combination fire/smoke dampers shall be installed in accordance with their listing.

All changes in direct greater than 60° shall include single-thickness turning vanes.

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Rectangular take-offs in rectangular ductwork shall be made by 45° fittings with opposed blade balancing damper. Provide extended operator on damper to extend beyond the insulation and jacketing.

All outside air and return air ductwork shall be internally lined with minimum 1" matte-faced or foil-faced fiberglass duct liner. All supply ductwork shall be externally insulated with ductwrap, minimum 1 ½" thickness, with continuous vapor barrier. See Insulation section for additional information.

### *REGISTERS, GRILLES, AND DIFFUSERS (AIR DEVICES)*

Devices exposed to moisture (restrooms, kitchens, etc.) shall be all aluminum or stainless steel construction.

Air devices located indoors operating under normal circumstances shall be steel, aluminum, or stainless steel. All registers and diffusers shall come complete with opposed blade balancing dampers operable from the face of the device. Ceiling diffusers shall have removable core for serving, adjustment, and cleaning.

Coordinate border style and dimensions with ceiling construction prior to order devices. Provide mounting frame border for all hard ceiling applications. Provide lay-in type border for all lay-in ceiling applications.

Where flexible ductwork is used to connect to individual air devices, provide a factory insulated plenum (with 1" matte-faced fiberglass liner) with each air device.

### *INSTALLATION*

Ductwork and accessories shall be manufactured, assembled, and installed in strict accordance with published recognized standards, including SMACNA and NFPA 90A.

Furnish and install fire damper in accordance with the manufacturer's written instructions and the product's listing. Provide dampers where indicated on the plans, and whenever a duct passes through a fire rated partition of one hour or more. (Exception: Where ductwork is less than 100 square inches and extends no less than 5'-0" from the fire rated partition penetration, the fire damper may be omitted.)