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HILL AIR FORCE BASE, UTAH

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BASE FACILITY STANDARD  
HILL AIR FORCE BASE, UTAH

1. This Base Facility Standard is intended to call out and make the users aware of facility standards that are peculiar to Hill Air Force Base. These particular standards have developed over the years to fit the climatic conditions, the work force, the existing physical nature, the typical missions, and other considerations of this Base. It is not the intent to take precedence over any Air Force Regulations or the Hill Air Force Base Comprehensive Plan, but it is the intended to be used to supplement these publications.

## 2. Special Considerations:

- 2.1 Base Location: Hill Air Force Base is located approximately 30 miles north of Salt Lake City, Utah and the Salt Lake City Airport.
- 2.2 Construction Season Limitations: Earth work can normally only be accomplished from 15 March to 15 November. Paving is normally accomplished from 15 May through 1 October. Structural work may generally be accomplished on a year round basis, but it must be protected from temperature extremes. Built-up roof construction is generally limited to the period from 15 May through 15 October.
- 2.3 Soil and Foundation Considerations: Typical soils range from sand to silty sand with thin discontinuous layers of silty clay and clayey silt being common. Potable wells have a static water level of approximately 500 feet below the surface. However, the perched water may be encountered at more shallow depths. The average soil pH is approximately 7.8. The soil resistivity ranges from 2,000 to 15,000 ohms/cm. Spread footings are the typical structural foundation. All footings shall be at least 3 feet below grade.
- 2.4 Skilled Labor and Construction Material Availability: All types of skilled labor are available in the Ogden/ Salt Lake City metropolitan area.
- 2.5 General Security Requirements: See Appendix A.
- 2.6 Construction Permits: Contractors shall be required to obtain an approved Base Civil Engineering Work Clearance Request from the Project Manager prior to starting any construction work.
- 2.7 Borrow and Disposal: Unless otherwise designated, all borrow shall be obtained off base at the contractor's expense. Clean excavation including soil/concrete, asphalt and wood may be separated and disposed of in one of the appropriate cells in the government landfill at the north end of Hill AFB. All other building demolition materials will be legally disposed of by the contractor at an off-base landfill.
- 2.8 Marker Ribbon and Tracer Wires:
  - 2.8.1 Contractor shall provide and install a trace wire of #6 insulated copper within one foot of all new utilities (except metallic or electrical lines) placed underground at Hill Air Force Base.
  - 2.8.2 If length of new utility is 500 feet or less contractor shall install one terminal box of 2 ½" diameter pipe at each end of the wire marking the utility location.
  - 2.8.3 If length of new utility is greater than 500 feet, contractor shall place terminal boxes at 500 feet intervals.
  - 2.8.4 Terminal boxes shall have a metal screw-on type lid mounted flush with pavement or raised above the existing ground elevation, as determined by the project manager. (Handley Industries or approved equal).
- 2.9 Construction Identifications signs: All construction identification signs, including those on the Corps of Engineers (COE) projects, shall have Dakota brown lettering on an adobe background. For COE jobs, a red castle on the sign is acceptable.

- 2.10 Explosive Safety Site Plan Compliance: For projects within the Quantity Distance (QD) zone and in other hazardous areas, explosive safety site plans (ESSP) are developed to ensure that the proposed project is compatible with the other operations within the area. The design of the project must comply with the required separations shown on the ESSP and other criteria determined by the Weapons Safety Office (SEW). Any changes to the criteria set forth on the approved ESSP must be resolved by the Base Master Planner, (CECX, Mr. Bert Whipple) and the Weapons Safety Office prior to completion of the design.
- 2.11 Asbestos: An asbestos survey will be required for any project that requires renovation or demolition. Any Asbestos removal will be coordinated with BioEnvironmental Engineering, Civil Engineering's Asbestos Operations Officer and Environmental Management Asbestos Program Manager. Removal will be done by Qualified Civil Engineering Personnel, IDIQ Contract (CERZA Contractor) or through the Base Asbestos Qualified contractors.

3. Civil Considerations:

3.1 Airfields:

- 3.1.1. General: Airfield pavements shall be designed in conformance with current Air Force Manuals and directives. Airfield pavements shall be designed for medium strength pavement loading unless specific circumstances dictate.
- 3.1.2. Design Parameters:
- 3.1.2.1 Air Field Type: medium load
  - 3.1.2.2 Subgrade soil group- F2 (CBR 8-15).
  - 3.1.2.3 Frost Depth design- 35 inch depth
  - 3.1.2.4 Freezing index- 595 degree days.
  - 3.1.2.5 Portland cement concrete pavement flexural strength- 700 psi at 90 days.
  - 3.1.2.6 Portland Cement concrete slab size 15 feet X 15 feet minimum, 20 feet X 20 feet maximum except where matching existing structures.
  - 3.1.2.7 Asphalt cement ductility- 50 at 32.9 degrees F.
  - 3.1.2.8 Fuel proofing- Rubberized coal tar shall be placed over all bituminous concrete where fuel spills are anticipated.
  - 3.1.2.9 Slurry seals - Slurry seals shall not be used on asphalt pavements.
  - 3.1.2.10 Shoulder areas- shoulder areas shall be designed for vehicle water loads.
  - 3.1.2.11 Miscellaneous- All airfield design and construction must consider Federal Aviation Regulation, Part 77, Imaginary Surfaces; and comply with AFI 32-1026 criteria.
- 3.1.3 Recycling: Bituminous concrete recycling shall be considered for each project where bituminous concrete is to be demolished.

3.2 Roads and Parking Lots:

### 3.2.1 Typical Maintenance Work:

- 3.2.1.1 Crack Filling: Rubberized asphalt crack sealing will normally be accomplished by in house forces.
- 3.2.1.2 Cold planing: Cold planing will be used to correct surface irregularities and to match curb and gutter elevations prior to overlaying.
- 3.2.1.3 Heat scarifications: Heat scarification will be used to insure bonding of bituminous overlays where considered necessary by the Pavements Engineer, especially for thin overlays.
- 3.2.1.4 Slurry seals: Slurry seals will be used as one option to seal low volume surface roads.
- 3.2.1.5 Open graded plant mix seal coat: This seal coat will be used as one option to seal all roads and parking lots.
- 3.2.1.6 Coal tar treatment: Coal tar seals will be used to seal bituminous concrete in fuel spillage areas.
- 3.2.1.7 Overlays: Bituminous overlays will be used to rehabilitate bituminous concrete. It will normally be placed a minimum of 1 ½" thick. It will be the option of the Government's pavement Engineer as to whether any existing bituminous concrete will be removed prior to placing the overlay.
- 3.2.1.8 Traffic control in construction areas: The contractor will provide and maintain all construction traffic control devices. These devices and their layout will conform to Part VI of the Manual of Uniform Traffic Control Devices or the Utah State Department of Transportation equivalent. The traffic control plan will be submitted to the Base Traffic Engineer prior to implementation.

### 3.3 Potable Water:

- 3.3.1 Well drilling: All future wells shall be drilled by using the reverse rotary drilling method.
- 3.3.2 Pipe: Water pipe 4" through 12" dia shall be PVC -AWWA C 900. All pipe 12" dia and greater shall be AWWA C 901. Tracer wire and warning tape shall accompany any new water pipe installed.
- 3.3.3 Pipe depth: Water piping shall be installed a minimum of 4 feet below grade. Fire protection lines shall be installed a minimum of 5 ½ feet below grade
- 3.3.4 Pressure gages: Pressure gages shall be placed at the outlet of all well pumps; at the inlet and outlet of all pressure reducing valves, pressure sustaining valves and altitude valves; and at any other location where knowledge of pressure would be beneficial.
- 3.3.5 Valves: Valves shall be placed at all locations where it would be desirable to isolate the system for maintenance and repair. The number of valves shall not be kept to a minimum as a cost cutting measure. Valves will be placed in conjunction with fire hydrants.

3.3.6 All new water lines and appurtenances will comply with the standards set forward in the Utah Safe Drinking Water Regulations.

3.4 Non-Potable Water:

3.4.1 General: The Base has the right to utilize 139 acre feet of non-potable irrigation water every year. This water is available for use from 15 April to 15 October each year. It is piped part way across the south boundary of the Base, entering at the southeast corner of the Base. A booster pump has been provided.

3.4.2 Available pressure: The available pressure ranges from 40 to 50 psi without the booster pump and between 60 to 80 psi with the booster pump operating. Approximately 400 gpm must be flowing before the booster pump can be operated to prevent cycling.

3.4.3 Place of use: This non-potable irrigation water shall be used wherever possible along the south border of the Base, especially in large areas that can be irrigated with high flowing heads, such as athletic field and parks. Housing area lawns and the Child Care Facility shall not be irrigated with this water because of the possibility that children will ingest the water.

3.4.4 Irrigation systems: Design and construction of irrigation systems shall comply with the 75<sup>th</sup> Civil Engineer Squadron OI 99-2 entitled Sprinkler System Installation, Operation and Maintenance.

3.5 Sanitary, Storm and Industrial Waste Sewers:

3.5.1 The minimum and maximum velocity shall be design in accordance with AFM 88-11 Volume 1 and AFM 88-5, Chapter 4, whichever is applicable for each case. The designer will consider the maximum flows during the early years of use to ensure that self cleaning velocities are achieved. All industrial waste pipe shall be double walled high density polyethylene (HDPE) with a low rate of thermal expansion, polypropylene or an other approved, chemically resistant pipe.

3.5.2 Horizontal Distance to water lines: Sanitary or industrial waste sewer lines shall not be closer than 10 feet horizontally from a water line, except where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe. Then the horizontal spacing may be reduced to 6 feet. When is it necessary to install the pipes closer than directed above, the sewer pipe shall be encased in concrete at least 4 inches thick.

3.5.3 Transverse Distance to Waterlines: Where gravity flow sanitary or industrial waste sewer lines cross above or below waterlines, the sewer lines shall be encased in concrete at least 4 inches thick for a distance of 10 feet on each side of the crossing. When the sewer line is acceptable pressure pipe, non concrete encasement is required, but the sewer line shall have no joint closer (horizontally) than 3 feet.

3.5.4 Plastic pipe: Plastic pipe shall not be used for storm or sanitary sewers larger than 12 inches in diameter or when the fluid temperatures are expected to exceed 100 degrees F, or for industrial waste sewers.

3.5.5 Pipe laying: Lay sewer pipe proceeding upgrade with the spigot end of the bell and spigot pipe in the direction of flow. Place the tongue end of tongue and groove pipe pointing in the direction of the flow.

- 3.5.6 Manhole ladders: Manholes shall be provided with a ladder of approved materials when the depth from the top cover to the invert of the main sewer line exceed 12 feet.
- 3.5.7 Mixing type of sewers: Only sanitary sewage shall be discharged and carried away in sanitary sewer lines. Only industrial sewage shall be discharged and carried in industrial sewage lines. Only storm drainage can be discharged and carried in storm sewer lines.
- 3.6 Industrial Waste Treatment: The industrial waste treatment plant decontaminates waste from the aircraft maintenance areas of the Base. The contaminants include toxic metals, complexing agents, and organic compounds. The waste is collected in over 4 miles of dedicated sewer mains. The entire system is approved by the Environmental Protection Agency. No new toxicants can enter the system and the system can not be enlarged or expanded without notification and approval. All structural load assumptions shall be noted on the first sheet of the structural drawings. Drawings are seldom lost or destroyed but calculations often are misplaced.
- 3.7 Structural:
- 3.7.1. Soil Bearing Capacity: Major structures at Hill Air Force Base, Little Mountain Test Facility, or the Utah Test and Training Range shall have specific foundation studies performed. Minor structures at Hill AFB may use an allowable soil bearing pressure of 3000 psf. Check with the Base Civil Engineer for allowable pressures at Little Mountain Test Facility or Utah Test and Training Range.
- 3.7.2. Stair Tread Minimum Live Loads: The minimum live loads shall be 100 psf and a 300 lb concentrated load at the location of maximum stress (not simultaneous with the uniform live load.) The minimum concrete depth shall be 2 inches if filled pans are used. Design of metal stairs shall conform with the Metal Stair Manual published by the National Association of Architectural Metal Manufacturer's.
- 3.7.3. Design Frost Penetration: The design frost penetration shall be 36 inches for structures.
- 3.7.4. Concrete compressive strength: A minimum concrete compressive strength of 3000 psi at 28 days shall be for all applications except exterior slabs, which shall have a minimum compressive strength of 4000 psi at 28 days.
- 3.7.5. Reinforcing Steel Strength.: A minimum yield strength (Fy) of 60,000 psi shall be used for reinforcing steel.
- 3.7.6. Floor slab Contraction Joints: Contraction joints for slabs on grade shall be located so that the area between joints is square. If a square area between contraction joints is not possible, the length of the rectangular area will not exceed one and one fourth (1 ¼) times the width. The depth of the contraction joints will be equal to at least one-fourth (1/4) of the slab thickness.
- 3.7.7. Procedure for attaching equipment and other objects to existing roof trusses, joints, beams, and other members of the roof structure: Use clamps instead of drilling or welding. Approval for attachment of equipment or other object from the existing roof structures will be given by the Base Structural Engineer prior to installation of these loads.

- 3.7.8. Compaction: For cohesive soil, compact to a minimum of 95 percent of CE55 density under structures, building slabs, steps and paved areas. For cohesionless soil, compact to a minimum of 100% of CE55 density.
- 3.7.9. Steel Fabrication and Erection: Drill or punch all holes in steel members. Never allow holes to be burned with a torch.
- 3.7.10. Structural design loads for buildings and other structures shall be developed using the American Society of Civil Engineers (ASCE) Standard ANSI/ASCE 7 except for seismic which shall comply with ETL 00-5. Basic wind speed shall be 90 mph, Exposure C category. Ground snow loads shall be developed using the State of Utah design criteria. The airfield elevation of 4788 feet above sea level produces a ground snow load value of 47 psf.

### 3.8 Traffic Engineering:

- 3.8.1 Speed Limit: The Base Speed limit is set at 25 mph on the main arteries unless otherwise noted.
- 3.8.2 Lane Widths: All traveled lanes will be 12 feet in width. Where curb and gutter is not provided, a 3 foot wide paved shoulder will be provided. Storm drain grates will be selected to avoid presenting a hazard to narrow tires. Car pool and bus stop drop off lanes will be included were needed.
- 3.8.3 Parking: Parking stalls will be 9 feet wide measured normal to the vehicle and 13 feet wide for a handicapped stall. Allow 30 feet of road width between rows of parking stalls and an 18 feet for stall depth. All new parking lots shall have curb and gutter placed around the perimeter. A 30 inch wide curb and gutter section will be used. Curbed islands and landscape planters will not be used if they make snow removal too difficult.
- 3.8.4 Traffic signs and striping: All traffic signs and striping will conform to the standards contained in the Manual of Uniform Traffic Control Devices. Striping will be included in all new projects and included when restriping is required. Sign posts will be constructed of a 2 inch by 2 inch steel tube section. The tubing will be mated with steel tube section that is driven into the ground. This will allow for the rapid repair of damaged sign posts.

## 4. Architectural considerations:

### 4.1 Architectural Compatibility:

- 4.1.1 General: The Hill Air Force Base Architectural Compatibility Standards Brochure dated January 1997 will be followed as a guide.
- 4.1.2 Colors: All exterior building finish colors will conform to the above standard. The colors are taken from the Federal Specification 595. All exteriors will be Federal Paint number 30099, Dakota Brown; and 23617, Greystone. No building will have more than one color trim unless allowed by the Architectural Compatibility Officer. Factory pre-finished siding and roofing can match the manufacturer's standard, available color selection as long as the color matches the above colors as closely as possible. All selections are subject to the approval of the Base Architectural Compatibility Officer.
- 4.1.3 Facades: The majority of the permanent facilities at Hill AFB are brick. This standard should be maintained Any other materials used shall complement the brick in making an

aesthetically pleasing, traditional statement. Choices should conform to the Base Architectural Compatibility Standards. All new and remodeled facades will blend with and complement the permanent construction of the installation.

- 4.2 Definitive Design: Refer to the AFMC Facility Quality Program Manual as a guideline for Air Force Standards.
- 4.3 Interior Design:
  - 4.3.1 Carpets: Carpets will contain a definite pattern and shall be suitable to the function area. All carpeting will meet the flame spread rating required in the Life Safety Code.
  - 4.3.2 Sound Attenuation: Any building design requiring reduction of exterior generated noises will be done in accordance with the Uniform Building Code, Chapter 35. Also consult the Hill Air Force Base Air Installation Compatible Use Zone Report, amended April 1982, for further sound attenuation guidance.
  - 4.3.3 Non combustible material: The installation of exterior finish material shall comply with the requirement that at least 75 percent of the total interior wall surface of any one room must be of non-combustible material, Class B. This material must have a flame spread of 75 or less. Wood paneling will not be used. Wall carpeting will have a smoke development rating of 25 or less.
  - 4.3.4 Concealment: All wiring, piping, and ductwork will be concealed whenever possible.
  - 4.3.5 Interior Graphics Systems: An interior graphics system will be used where appropriate to control message size and complexity, to establish a specific lettering style, establish a color scheme, and enhance the overall interior environment.
  - 4.3.6 Systems Furniture: Systems furniture should be considered for installation in large open areas to condense personnel and optimize space utilization. It should not be used to cover window spaces or exterior fin tube heating. The cubicles should be appropriately for the use intended but under no circumstances should be less than 48 square feet. All systems furniture shall be equipped with eight conductor electrical circuits. (three hot conductors, three neutral conductors, one ground conductor, and one isolated ground conductor.)
- 4.4 Handicapped design: Any new building design and major remodel projects will comply with the appropriate codes and requirements to make the facility compatible for use of the handicapped. Handicapped design is not normally required in the upper floors of a facility that houses a totally military work force, but the ground floors will be made accessible.
- 4.5 Keying: Master keying shall be ASSA V-80600 Series with six pin tumbler removable cores. All locks will be furnished with removable core cylinders. The cylinder will be capable of being removed through the face of the knob by means of a control key. Keys and cores shall be shipped directly to the Base Civil Engineering (BCE) Lock Shop, 75 CEG/CEZRC, 7302 Wardleigh Rd, Hill AFB, UTAH 84056-5223. All locks shall be grand master keyed into the base system and shall be sub-mastered as specified by the BCE locksmith. All submittals and shop drawings referring to keys and keying shall be submitted to the Civil Engineering project manager and subsequently to the BCE locksmith for coordination and approval. The contractor shall furnish two keys per lock. Recommended source is Clark Security Products, Salt Lake City, Utah 84115. The P.O.C. is Chuck Engels @ (800) 453-6430.
- 4.6 Sign Policy: All signs shall be in accordance with Air Force Pamphlet 88-40.

- 4.7 Insulation: Blow-in insulation shall not be installed above grid ceilings and clean rooms. Insulation should be installed at the roof rather than the ceiling wherever possible. This will reduce the possibility of freezing lines in the attic space.
- 4.8 Painting: All large items of exterior, electrical or mechanical equipment shall be painted Federal Paint Number 23617; Greystone, or 30099; Dakota Brown, unless a screen is provided for the equipment. This includes, but is not limited to transformers, large electrical switches, and HVAC units, including exterior conduit systems. All architectural coatings must comply with the VOC limits established by the EPA in the Architectural Coatings Rule published under the authority of the Clean Air Act.
- 4.8.1 General: Painting for new surfaces will consist of a prime coat and two top coats. Semi-gloss paint will be used in high traffic, interior areas. Treat any waste associated with removal of lead paint will be treated as a hazardous material. Removal of red lead on structures shall comply with the procedures detailed in local, state and federal regulations and procedures. If repainting is required, the surface will be spot primed and one finish coat will be applied. Spray painting is limited to water tanks; fuel tanks; interiors of unoccupied buildings; the underside of docks; overhangs of 800 series buildings or any other job where the massiveness and intricacy precludes brush or roller application. Any spray painting will be done with an airless spray gun. Do not specify spray painting if over-spray will damage aircraft, vehicles, equipment or other facilities. Fire hydrants. PIV's , bollards, etc., shall be painted Dakota Brown.
- 4.8.2 Concrete Exterior Surfaces: These surfaces shall not be painted except to prevent water penetration, unless specifically approved by the Base Civil Engineer.
- 4.9 Canopies: All canopy designs will be approved by the Architectural Compatibility Officer.
- 4.10 Windows:
- 4.10.1 General: Because unique conditions at Hill Air Force Base such as close proximity to a runway and high canyon winds, the following conditions will apply:
- 4.10.1.1 All windows shall be heavy commercial class 40, (HC-40).
- 4.10.1.2 All windows and sash shall be capable of accepting 1" thick glazing units.
- 4.10.1.3 All window frames and sash shall be thermally broken.
- 4.10.1.4 All windows will be capable of withstanding a 90 mph wind velocity.
- 4.10.2 Windows in administrative areas: In any facility not cover by Historic Preservation concerns windows will be "projected in" tilt sash style with bronze glass and a bronze anodized finish.
- 4.10.3 Dormitory windows: Provide single hung, non-tilt windows with bronze tinted glass and bronze anodized finish.
- 4.10.4 Housing Areas: These windows will be sliders, single hung style or projected in windows with clear glass and a clear anodized finish.
- 4.11 Dormitories and Billeting Facilities: The design of these facilities will follow the guidance provided by AFMC, Guidelines for Facilities Excellence, 1996.

4.12 Gable and rain gutters: Provide gables at all entrances unless it is specifically unfeasible or has a canopy. Provide rain gutters only at entrances without gables, and at no other location.

4.13 1200 Zone Rest rooms: Alterations of 1200 Zone buildings will standardize the location of the rest rooms in the center of the buildings.

4.14 Roofs:

4.14.1 General: Roofing may utilize conventional or unconventional materials.

4.14.1.1 Headquarters AFMC. The use of single ply roofing will be further restricted to ethylene propylene diene monomer (EPDM), fully adhered, and will be placed no higher than a single story height. (to minimize wind lift).

4.14.1.2 Conventional Roofing: Most projects will utilize conventional roofing materials for new and repair projects. Conventional materials are Built Up roofing, asphalt shingles, or standing seam metal roofs. When specifying BUR, a 20 year guarantee is required and the installing contractor must be certified by the BUR manufacturer before their bid can be accepted.

4.14.1.3 Unconventional Roofing: Unconventional roofing such as single ply, sprayed on membrane, or modified bitumen must be approved by HQ AFMC prior to use. If large areas of roof standing seam roofing are required by any project, the design will provide gable entrances over all entranceways to prevent sheets of snow from sliding off and injuring personnel or damaging equipment in the fall zone.

4.14.2 Drainage: Sloped roofs will be used in lieu of flat roofs when possible. Hill AFB is located in a cold region, and because of past experience with ice and snow damage the use of external gutters will be limited to entryways with no roof gable. Roof gables will be used to the maximum extent possible. Drainage will be provided with a roof designed to slope away from personnel activity. The use of roof overhangs that extend over sidewalks is encouraged. Metal roofs will not have internal guttering. Horizontal roof drains in unheated attic spaces will be kept to a minimum to prevent freeze-ups.

4.14.3 Corrugated Cement Asbestos Roofs: These type roofs occur on a considerable number of roofs in the West area of Hill AFB. When it necessary to repair this type roof it will be overlaid with plywood and asphalt shingles. The majority of the asbestos roofs have been encapsulated. If the contractor need to mount new equipment or disturb the roof, great care should be taken to not disturb the asbestos.

4.14.4 Heat Tape: Heat tapes are to be avoided whenever possible. They are a maintenance problem, and most often do not receive routine maintenance at Hill AFB due to the lack of funds and maintenance personnel.

4.14.5 Plywood Decking: Fire retardant treated plywood (FTR) is banned on all new and re-roofing projects. This type of plywood deteriorates when used as roof decking. Untreated exterior glued plywood will be used for decking.

4.14.6 Roof Penetrations: All roof penetrations will be kept to a minimum. The Base roofing engineer will be consulted prior to calling for penetrations in new and existing roofs. This coordination will answer questions on existing roof warranties and recommended penetration details for both new and existing roofs.

#### 4.15 Landscaping:

- 4.15.1 General: An emphasis will be given to a desert motif using water resistant plantings and rock ground cover. Graded river rock will be used generally for this ground cover. Other rock cover such as lava scoria will be used in conjunction with the river rock to give texture and variety. All rock ground cover will be under-laid with weed barrier matting. Landscaping will emphasize the architectural lines and features of adjacent buildings and areas, and will be designed to require little or not pruning. Landscaping will be designed with year-around consideration for human comfort. Passive solar cooling methods will be considered such as deciduous tree shading on the east, south and west exposures.
- 4.15.2 Shrubs and Trees: Shrubs and trees will be the most drought resistant varieties, and where possible will be placed without irrigation sprinklers. Large trees will be planted with enough space to facilitate growth and trimming, which will normally dictate that they be planted at least 20-feet apart.
- 4.15.3 Slopes: All slopes shall be no steeper than 3 to 1. Provide slope protection using recent technology for all slopes.
- 4.15.4 Lawns: Where lawns are used, they shall be provided with irrigation sprinklers, and will be sodded not begun from seed, except for dry land seeding applications. Irrigated lawns shall consider incorporation of a river-run rock or lava rock perimeter to preclude water over spray of sidewalks and pavements.
- 4.15.5 Restoration of Native Ground Cover: All native ground cover that is disturbed by construction and not scheduled for landscaping shall be re-seeded with drought resistant grasses and legumes. Mixtures of dry land alfalfa, fairway crested wheat grass and Indian rice grass will be used in good sandy, loam soils. Use sand drop seed with fairway crested wheat grass in gravelly soil. Machine drilling on generally level to mildly sloping ground is preferable. Hydro-seeding should only be used on 3 to 1 slopes. This native ground cover seeding should take place in April, May, September and the first half of October only.

#### 5. Electrical Considerations:

##### 5.1 Exterior Distribution:

- 5.1.1 Primary Voltage: The Primary voltage at Hill AFB is 12,000 volts, not *12,470* volts.
- 5.1.2 Transformers: All new transformers must be loop feed with 12000 volt primary, dead front, bushing wells with inserts installed, three gang operated on/off loadbreak switch, bayonet fusing, elbow arrestors, top oil temperature gages, liquid level & pressure vacuum gages, drain valve and two each 2-1/2" Taps above and below normal. This will assure that the user voltage can be regulated within proper limits. All transformer manufacturers selected will have an authorized rewind shop within 50 miles of Hill Air Force Base.
- 5.1.2 Buried High Voltage Cable: All buried high voltage cable (over 600 volts) shall be placed in conduit with a minimum of 3-inches of concrete encasing around the conduit. Depth of burial shall be 36 inches below grade. A 4-inch wide, yellow plastic marker tape with the words "Danger-Buried High Voltage Cable" will be placed directly over the high voltage line, and no more than 6-inches below finished grade. Maximum spacing between manholes or equipment shall be 500 feet.

- 5.1.3 Only RGS 90 degree elbows and RGS conduit will be used when making the transition from underground to overhead high voltage power line.
- 5.1.4 Support Structures: All power poles, steel support structures and their foundations will be rated for a 100 mph wind load.
- 5.1.5 All new high voltage cable shall be 15 EV, 133 percent insulation, shielded, with E P insulation.
- 5.1.6 Watt-hour meters shall be installed on all facilities requiring new service and modifications to existing facility power requirements. See Energy Considerations/Meters paragraph 7.3.
- 5.1.7 Exterior equipment shall not be placed near the drip lines of roof overhangs or rain gutters.
- 5.2 Interior Distribution: Do not use aluminum conductors or bus bars inside any facility at Hill AFB. Only copper conductors and bus bars should be used.
  - 5.2.1 All new building wiring systems shall be designed using 277/480 volts unless uneconomical to accomplish and shall be in rigid conduit or central open raceways.
  - 5.2.2 Lighting shall be installed using 277 volts if available.
  - 5.2.3 Do not use any polystyrene lenses in light fixtures.
  - 5.2.4 Use energy saving light fixtures in new designs.
  - 5.2.5 In office buildings or other buildings that will have a considerable amount of computer equipment installed, or will have systems furniture:
    - a. Run oversized neutral conductors from the transformer to service equipment, and from service equipment through the distribution panels to the branch circuit panels (double sized neutral conductors are recommended).
    - b. From the branch circuit panel boards, run eight conductor circuits (three hot conductors, three neutral conductors one ground conductor, and one isolated ground conductor) to all receptacle outlets, including those receptacle outlets in pre-wired systems furniture.
    - c. Run all other circuits as per the National Electric Code requirements.
- 5.3 Exterior Lighting:
  - 5.3.1 Light Poles: All light poles and foundations will be rated for a 100 mph wind load.
  - 5.3.2 Type of Lights: Use high pressure sodium vapor lights for exterior lighting wherever possible.
  - 5.3.3 Photoelectric Controls: Use photoelectric controls on exterior lighting where possible to save energy. Where practical fixtures shall be grouped together using contactors which are controlled by a single photocell.

- 5.4 Interior Lighting: Lighting level guidelines shall comply with the Illumination Engineering Society (IES) Handbook. See Section 7.5 for energy efficient interior lighting schemes.
- 5.5 Auxiliary Power: Use four-pole transfer switches when GFP schemes are used. By doing so, when power is switched from the utility to the backup generator, the neutral is also switched. This prevents problems in the ground fault detection circuit.
- 5.6 Power Continuation Conditioning and Interface Equipment (PCCIE):
- 5.6.1 Validation of Requirement: All requirements will be validated by each user through his major command. Civil Engineering does not validate requirements.
- 5.6.2 Design: The design of all PCCIE for Hill AFB is accomplished by SM-ALC/MM-1, McClellan AFB CA, 95652-5609~ DSN 633-6570. Communications:
- 5.7 Communications: See Appendix B.
- 5.8 Tempest: All tempest related problems will be referred to the Base Tempest Officer.
- 5.9 Special Protection for Rotating Electrical Equipment: Three-phase electrical motors will have phase failure and ground fault-protection when such protection costs are equal to or less than one-fourth the cost of the motor. This protection will be in addition to all protective devices required by the National Electric Code. Where there are a number of smaller three-phase motors within a particular building, the building will be protected at the service entrance with phase failure protection.
- 5.10 Fire Alarm Detection System:
- 5.10.1 All new systems shall use Class "A" initiating device circuits, signaling line circuits and notification circuits.
- 5.10.2 All new fire alarm control panels shall be capable of receiving, annunciation and transmitting alarm, supervisory and trouble signals.
- 5.10.3 Notification appliances shall have a 3 pulse temporal pattern (90-99dB, 75-110 candela).
- 5.10.4 Do not specify Notifier, Simplex, Grinnell, Thorn, Autocall or Edwards fire alarm control panels.
- 5.10.5 Provide audio/visual notification appliance in all public areas.
- 5.10.6 Install fan shutdown circuits. For large air handlers, provide duct smoke detectors powered by the fire alarm control panel. The fire alarm control panel will shut the air handler down if smoke is detected
- 5.11 Fire Alarm Reporting System
- 5.11.1 At Hill AFB the radio fire alarm transceiver shall be a Monaco BT2-8NB (16 zone) or BT2-8NB (32 zone) compatible with the Base Station's existing Monaco D-700 Radio Fire Alarm Monitoring Systems. The transceivers shall operate on a frequency of 141.000 MHz. Provide a tamper switch on the transmitter housing and Fire Alarm Control Panel which will transmit a Monaco Tamper Message when the switch is tripped. Provide antenna and lightning protection as recommended by Monaco. Each transmitter and interface device shall be the manufacturer's current commercial product completely

assembled, wired, tested at the factory, and delivered ready for installation and operation. Monaco D-700 central receiving stations are located in Bldg 9 & Bldg 1151.

5.11.2 At UTTR the radio fire alarm transceiver shall be a Monaco BT2-4 (16 zone) or BT2-4 (32 zone) compatible with the existing Monaco D500 central receiving station. The transceivers shall operate on a frequency of 138.925 MHz. Provide a tamper switch on the transmitter housing and Fire Alarm Control Panel which will transmit a Monaco Tamper Message when the switch is tripped. Provide antenna and lightning protection as recommended by Monaco. Each transmitter and interface device shall be the manufacturer's current commercial product completely assembled, wired, tested at the factory, and delivered ready for installation and operation.

5.11.3 At Little Mountain the radio fire alarm transceiver shall be a Monaco BT2-4 (16 zone) or BT2-4 (32 zone) compatible with the existing Monaco D-500 central receiving station. The transceivers shall operate on a frequency of 138.925 MHz. Provide a tamper switch on the transmitter housing and Fire Alarm Control Panel which will transmit a Monaco Tamper Message when the switch is tripped. Provide antenna and lightning protection as recommended by Monaco. Each transmitter and interface device shall be the manufacturer's current commercial product completely assembled, wired, tested at the factory, and delivered ready for installation and operation.

## 6. Mechanical Considerations:

### 6.1 Heating: Ventilating and Air Conditioning (HVAC):

6.1.1 HVAC Specific Requirements: All new and major renovations must comply with Federal Energy conservation requirements as specified in CFR 435. More details are available in ETL 94-4. One of three methods, described in 10 CFR 435 must be used to meet energy compliance standards:

- a. The Prescriptive/System alternative allows only limited flexibility with few design tradeoffs in the design criteria. This method requires manual calculations or use of a simplified approved computer program, and is used primarily for small, simple facilities where minimal design effort is required to meet energy criteria.
- b. The Building Energy Cost Compliance alternative (not used by the Air Force) uses computer simulation to evaluate design based on annual energy costs.
- c. The Building Energy method allows greater flexibility to meet the requirements for complex or multi use facilities and must use an approved computer simulation program.

6.1.2 Ventilation: Outdoor air flow shall be provided as directed with the most recent ASHRAE standards. Currently the requirement is for 15 cfm per building occupant. All rest rooms will have the exhaust system ducted to the outside of the building. Volume flow rate shall be 2 cfm per square foot of floor area and must provide a means to provide make-up air. Restroom ventilation will also be linked with the lighting system.

6.1.3 HVAC Control Systems: All control systems shall be direct digital control (DDC). All damper and valve actuators shall be electronic with a control signal of either 0-10 VDC or 4-20ma. Pneumatic Devices shall not be used unless required for interfacing to existing devices in remodeled areas.

- 6.1.3.2 The DDC System shall be installed according to the attached I/O summary chart for the mechanical systems listed below. The Input/Output summary sheet will apply to all equipment included in the project design control scheme, whether equipment is existing, modified, or a provision of the project
- a. Chillers and associated pumps
  - b. Boilers and associated pumps
  - c. Air handlers and any associated VAV boxes
  - d. Computer Room AC Units (CRAC)
  - e. Exhaust Fans
  - f. Packaged Heating/cooling equipment
- 6.1.3.2 All building DDC for HVAC equipment shall be 100% compatible with the existing base-wide Energy Monitoring and Control System (EMCS). The existing system is a Dorsett's, Inc. INFO-SCAN/MicroScan system manufactured by Dorsett's, Inc., 100 Woodlyn Drive, Yadkinville, NC 27055, Phone (800) 331-7605.
- 6.1.3.3 The DDC components used for HVAC control shall be the Dorsett's, Inc. MicroScan DDC products and shall be completely integrated into the EMCS in building 15. All communications connections will be made by the Contractor to government furnished communications media at the nearest telephone panel. Connection is via a dedicated 4 wire circuit modem link. All pair assignments will be furnished by the Government. Modems shall be integrated into the DDC equipment panels and provided by the DDC equipment manufacturer.
- 6.1.3.4 The EMCS integration shall include complete installation of all hardware and software. This shall include but not be limited to an INFO-SCAN database conforming to the I/O schedule, INFO-SCAN dynamic graphic displays, and all applications programming necessary to accomplish the specified sequences of operation. All points required for operation shall be provided in software and hardware.
- 6.1.3.5 The Contractor shall perform a complete point-to-point test of the completed DDC/EMCS installation. The test shall be conducted by measuring each analog value with a test instrument twice as accurate as the device being measured. The test equipment shall be certified traceable to NIST standards. Each value shall be calibrated in either hardware or software to the specified accuracy. All outputs shall be exercised on/off or full scale analog to verify operation of each channel and device. All digital inputs shall be tested by exercising the connected device such as a freeze-stat, smoke detector or differential pressure switch, with a simulated input condition. Pressure switches for filter status shall be calibrated to the specified pressure using a magnehelic gauge. All test results shall be recorded and documented by the contractor and included in the Operation and Maintenance Manuals furnished to the Government.
- 6.1.3.6 The contractor shall provide a portable testing and troubleshooting device for use with the completed DDC/EMCS. The portable device shall be supplied with the Dorsett's, Inc. Micro-Term DDC software complete with the project's database and communications software/hardware required to communicate to the DDC/EMCS system. The device shall be delivered to the EMCS Operations office in building 15 upon completion of system testing and training.
- 6.1.3.7 The contractor shall provide eight hours of training for the building operations, HVAC maintenance and EMCS operations personnel. The training shall be

performed after installation of the system is completed and tested. The training shall consist of instruction on the operation of the system, maintenance of the system and troubleshooting problems with the hardware and software. Instruction topics shall also include operation of the portable test device and the EMCS central installation.

6.1.3.8 The telephone number for the EMCS Operations Manager (Mr. Steve Nalder) is (801) 777-3988.

6.2 Steam Distribution: When possible, locate steam and condensate lines above ground. When the lines must be placed in an underground system, they should be installed in a utility trench. Install steam meters on all new facilities or when steam mains to existing facilities are replaced. See Energy Considerations/Meters paragraph 7.3.

6.3 Natural Gas Lines: All buried gas pipe will be polyethylene, rated for the pressures expected. Polyethylene valves will be used. All risers must be anodeless. Tracer wire will be provided on all lines and will be tied of at all risers.

6.4 Commissioning: A section in the specification will detail commissioning procedures. All applicable checklists will be included with 1500 Mechanical Specifications as required by ETL 90-10.

6.5 Asbestos: All buildings proposed for renovation or demolition must be physically surveyed for asbestos containing materials. The asbestos survey must be conducted by Hill AFB Bioenvironmental Office personnel. Suspect asbestos containing building samples must be collected by a Utah Department of Air Quality (UDAQ) certified inspector. The survey will be scheduled through the Bioenvironmental Office. Asbestos removal must be coordinated through the Civil Engineering Asbestos Shop. Asbestos removal is not always necessary. Encapsulation may be considered. Removal is only required when the material potentially could be disturbed during the course of the project; however, the overall scope of the project and potential problems for postponing abatement should be considered. Any contractor involved in asbestos removal must be licensed by the State of Utah and pre-qualified by the Hill AFB Bioenvironmental Office.

6.6 Liquid Fuels Storage and Distribution:

6.6.1 Tanks: Fuel storage tanks will be aboveground with a concrete lined containment area. Exceptions to this will be approved by OO-ALC/EM. If tanks must be placed underground they will be double walled Plasteel (steel inner wall and fiberglass coated steel for the outer wall) and have leak monitoring equipment installed which meets all Environmental Protection Agency (EPA) requirements.

6.6.2 Piping: All underground fuel piping will be double walled pipe. The carrier pipe will be schedule 40 black steel and the outer layer will be fiberglass.

6.6.3 Valves: All valves in liquid fuel systems will have fire rated seals to shut off bubble tight in case of fire.

6.6.4 Grounding: Fuel system grounding will comply with the National Fire Protection Association (NFPA) 30, Flammable and Combustible Liquids Code.

6.6.5 Tank Cleaning. Cleaning of fuel storage tanks will comply with AFM 85-16, Chapter 11.

6.7 Fire Protection: Fire protection systems will be designed and installed in accordance with Air Force Regulations and National Fire Protection Association (NFPA) standards. All sprinkler systems will be hydraulically designed as per NFPA 13. All aboveground sprinkler piping shall be Sch 40 black steel pipe, Sch 40 galvanized steel pipe, or Type 'K' copper tubing. All control valves (PIV's) require a tamper switch. Each riser will have a separate flow switch for each floor level and each riser. Buried fire protection water service lines shall be buried at least 5 1/2-feet below grade. Fire sprinkler piping will be located in a heated area or in an insulated attic where temperatures are assumed not to drop below 40 degrees F. HALON type fire suppression system shall not be used. Use CO<sub>2</sub> system where needed.

6.8 Plumbing:

6.8.1 General. Acceptable materials for service connections be ductile iron, type K copper, and PVC plastic pipe. Acceptable materials for interior piping include type L copper. A back-flow preventer will be installed on all sprinkling systems, and before any industrial process plumbing; except for non-potable water systems. Water lines shall be inside the buildings thermal envelope. Pipes, and driving fountains shall not be placed in or on outside walls to prevent freezing. Avoid placement near outside air vent opening.

6.8.2 Plumbing Fixture Requirements: Plumbing fixture requirements by number of occupants are found in AFMAN 32-1070, Chapter 4.

6.8.3 Horizontal roof drains shall be kept to a minimum to prevent freeze-ups.

6.8.4 Provide sufficient space end access for maintenance of fixtures and plumbing.

6.9 Compressed Air:

6.9.1 Economic Analysis: A life cycle economic analysis will be done to determine if the compressed air system should be comprised of smaller individual compressors at each work site or facility, or should be a centrally located larger compressor.

6.9.2 Moisture and Contaminant Removal: The design of a compressed air system will include a means to properly remove moisture and contaminants from the system. This includes after coolers, air dryers, filters, automatic drain on the storage receiver, drain valves at all points, etc.

6.9.3 Other Considerations: Additional items which will be Considered for a compressed air system are:

- a. The compressor should be sized for anticipated future expansion.
- b. Noise suppression will be provided to keep compressor noise within Occupational Safety and Health Administration (OSHA) limitations.
- c. The feasibility of using exhausted heat from the compressor for space heating or heating domestic water.
- d. Vibration isolation including flexible connections between the compressor and its associated piping, and isolation mounts for the compressor.

- 6.9.4 Piping: Piping used for compressed air systems will be schedule 40 black steel or copper pipe. If the piping is to be placed underground it will have a factory installed 50 mil polyethylene coating, and will be cathodically protected.

6.10 Corrosion Control:

- 6.10.1 General: Corrosion control of Base facilities includes four basic areas.

- a. Cathodic protection
- b. Water treatment
- c. Protective coating
- d. Material selection

- 6.10.2 Cathodic Protection: Cathodic protection is required for the following items:

- a. Any ferrous material that comes in contact with the earth. This includes but is not limited to the exterior surface of underground pipes.
- b. The interior surface of water storage tanks.

- 6.10.3 Water Treatment: The following items will be included as part of water treatment for HVAC facilities:

- a. Conductivity meters and chemical feed equipment for condenser water systems on chillers (Open loop system with cooling tower).
- b. A pot feeder for closed loop hydronic systems (both hot and chilled water systems).
- c. Conductivity metering and chemical feed equipment for boiler water.
- d. A bleed-off line with an adjustable flow meter on evaporative coolers. This includes direct as well as multiple stage evaporative cooling units.
- e. All systems requiring water treatment will be designed with sampling ports for the analysis of water conditions.

- 6.10.4 Protective Coating. Protective coatings will be applied to the following items:

- a. Exterior surface of underground ferrous pipes.
- b. Exterior and interior surface of all storage tanks, both above and below ground.
- c. Steel structures such as towers and equipment support stands, etc.

- 6.10.5 Material Selection. Proper selection of materials for a given application can reduce or prevent corrosion. The following are items which are commonly encountered:

- a. Schedule 80 black steel pipe is to be used on condensate return lines. The

corrosive environment of the steam condensate eats away at the inside of the pipe. The extra thickness of the schedule 80 as compared to the schedule 40 pipe allows added life.

- b. Use type "K" copper pipe if the copper pipe is to be used for applications above 120 degrees F.
- c. Polyethylene pipe will be used for low pressure natural gas lines along with polyethylene valves.
- d. A dielectric union or isolating flange will be used between pipes of dissimilar metal.

6.11 Equipment Placement: Do not place equipment near the drip line of roof overhangs or rain gutters. Place equipment where sliding snow from roofs will not fall on equipment and damage it.

## 7. Energy Considerations:

7.1 General: Energy efficiency will be considered in the early stages of each project design. Designs will use life-cycle costing analysis to determine the lowest life-cycle costs when selecting fuel type mechanical systems and equipment electrical systems and equipment, and architectural systems. Consideration will be given to part load efficiencies as well as full load efficiencies when selecting mechanical and electrical equipment. Particular attention will be given to choosing energy efficient heating, ventilating and air conditioning equipment.

7.2 Insulation: Insulation values will conform with Engineering Technical Letter (ETL) 94-4. The composite R-values of 19.2 for ceiling/roofs and 4.76 for gross walls may be used as a starting point; however, R values may vary (higher or lower) dependant upon the Design Energy Usage (DEU). For bidding purposes R-30 for ceilings/roofs and R-19 for opaque walls may be used as maximum values. Hill AFB is in Weather Region 6. ETL 94-4 should be consulted for typical building construction.

7.3 Meters: All new buildings and major renovations will have electrical, water, and if applicable steam and/or natural gas meters installed.

7.3.1 All utility meters shall be 100% compatible with the existing base-wide Energy Monitoring and Control System (EMCS) for remote collection of data. Recorded values for Electricity (kwh & kw), Natural Gas (cfpm), Steam (klbs), Water (gals) will apply. The existing system is a Dorsett's, Inc. INFO-SCAN/MicroScan system manufactured by Dorsett's, Inc. 100 Woodlyn Drive, Yadkinville, NC 27055, Phone (800) 331-7605.

7.3.2 The consumption data shall be completely integrated into the EMCS in building 15. All communication connections will be made by the Contractor to government furnished communications media at the nearest telephone panel. Connection is via a dedicated 4 wire circuit modem link. All pair assignments will be furnished by the Government.

7.3.3 The EMCS integration shall include complete installation of all hardware and software if necessary. This shall include but not be limited to an INFO-SCAN database conforming to the I/O schedule, INFO-SCAN dynamic graphic displays, and all applications programming necessary to accomplish the specified sequences of operation. All points required for operation shall be provided in software and hardware.

7.3.4 The Contractor shall perform a complete point-to-point test of the completed EMCS Installation. The test shall be conducted by measuring the digital input pulse value with a test instrument twice as accurate as the device being measured. The test equipment shall be certified traceable to NIST standards. The value shall be calibrated in either hardware or software to the specified accuracy. Digital input pulse signal shall be tested by exercising the connected metering device with a simulated input condition. All test results shall be recorded and documented by the contractor and included in the Operation and Maintenance Manuals furnished to the Government.

7.3.5 The telephone number for the EMCS Operations Manager (Mr. Steve Nalder) is (801) 777-3988. The Base Utility Manager (Mr. Dave Abbott) can be reached at (801) 777-5944.

7.4 Energy Consumption Studies: All new buildings and major renovations will have energy consumption studies completed prior to design completion.

7.5 Lighting: Lighting systems will be designed to allow reduction of lighting levels by appropriately banking lighting circuits or providing separate switching of inner and outer lamps in three and four tube fluorescent fixtures. Consideration will be given to the use of energy efficient lighting systems including ballasts, lamps and fixtures. Consideration should also be given for any task lighting that might be provided by systems furniture, and overhead lighting should be reduced accordingly. Consideration will also be given to task specific work conditions and lighting levels (foot candles) and be in accordance with the Illuminating Engineering Society (IES) Lighting Handbook current edition.

7.6 Make-Up Air: Where large quantities of make-up air are required, heat recovery will be considered and implemented if life-cycle cost analysis shows it to be cost effective.

7.7 Coordination: All designs will be coordinated with the Base Energy Manager in CEOM who will also answer energy related questions.

## 8. Computer Aided Design and Drafting (CADD) Considerations:

8.1 General: All drawings will be digitized and must be delivered in printed form and on machine-readable media. The number, and type of materials for printed copies required for construction documents as-built and other uses will be specified by Hill AFB. All changes made to the design during construction must be posted in the electronic files. Section 3 of the [Air Force Logistics Command \(AFMC\) CADD Standards Manual](#) defines the levels to segregate information in all discipline drawings. Appendix 3 shows standards developed by the Corps of Engineers for sheet organization, layout and binding. Appendix C delineates cell libraries (drawing symbols). Hill AFB in-house design teams and contract architect-engineer firms will use these guidelines when producing a set of plans.

### 8.2 Machine Readable Requirements:

8.2.1 Drawing Format. Drawings can be produced on AutoCad or MicroStation. Drawings will be in DWG, DGN, IGES or DXF format. Files submitted in any of the systems are acceptable.

#### 8.2.2 Media Format.

8.2.2.1 Compact Disk. Machine-readable data may be submitted on a Compact Disk.

Must be compatible with latest CD writers and readers. Each CD must have an external label indicating the format, density, company/organization name and creation date.

8.2.2.2 Diskette. Machine-readable data may be submitted on 3 ½" inch floppy diskette. The disk format will be either Intergraph UNIX or MS-DOS, and 360K or 1.2 MEG density. Each diskette must have an external label indicating the format, density, company/organization name, creation date, and diskette volume label and number.

8.2.2.3 Zip Disk. Machine-readable data may be submitted on an Iomega Zip Disk. The disk must be formatted for IBM compatibles. Each Zip Disk must have an external label indicating the format, density, company/organization name and creation date. Zip Disks are acceptable but not the preferred media format.

8.2.3 Documentation. A documentation handbook must be submitted with the machine readable media. This handbook will contain the specifics of the database, the file names, reference file names, stroked plotter files, and cell library names. All other pertinent information used in constructing and managing the drawings and database, shall also be included.

8.2.4 Project Management. Development and manipulation of drawings and reference files along with file naming methodology shall be used as defined in Section 1 of the AFMC CADD Standards Manual.

8.2.5 Attribute Data. Attribute data must be furnished in standard ASCII format.

## 9. Cost Estimating:

9.1 General: All cost estimates will be based on recent documented bid data or the latest edition of Building Construction Cost Data as published by the Robert Snow Means Company, Inc. All estimates for the Military Construction Program (MCP) will be based on the latest edition of the Military Pricing Guide or as directed by the Civil Engineer. Use 15 percent overhead and 10 percent profit.

9.2 Procedures: All estimates except for change orders and the Minority Contract Program (SBA) will be prepared on an Air Force Logistics Form 35 and will be based on unit costs. Single line item estimates will not be used. All estimates for change orders and the 8A Program will be prepared in detail on an Air Force Form 3052, and will include labor hours, material, and bonding costs.

## 10. "Other Considerations":

10.1 Space Allocations: Hill AFB has adopted space allocation limitation of 115 s.f. per person in administrative areas.

10.2 Ban on Use of OLDs: Effective 01 July 1992, the Air Force is banning the use of ozone layer depletion substance. These are generally found in HALON type fire suppression systems and in air conditioning refrigerants.



**DEPARTMENT OF THE AIR FORCE**  
**75TH SECURITY FORCES SQUADRON (AFMC)**  
**HILL AIR FORCE BASE, UTAH**

MEMORANDUM FOR GENERAL SECURITY REQUIREMENTS

FROM: 75 SFS/SFO and 75 CEG/CEC

SUBJECT: General Security Requirements for Contractors/Contracts at Hill AFB and its Off Base Sites.

1. All contractors will coordinate with their contracting officer and/or contracting engineer:
  - a. Concerning obtaining the paperwork for their contractors identification badge AFMC Form 496.
  - b. In order to gain access to a restricted area. The contractor must submit the necessary paper work for a security clearance, through prescribed channels. If additional information is necessary contact your contracting officer/engineer for further guidance.
  - c. In order to gain access to a controlled area the contractor must under go a local files check. This request is submitted through the contracting officer/engineer for the project, to 75 SFS/SF.
2. Report to Pass and Registration, West Gate Visitor Center to obtain vehicle pass.  
Note: All vehicles will comply with State of Utah inspection, emission standards, and insurance requirements prior to requesting vehicle decals.
3. Any digging or work, which may affect the communication lines/alarm system lines, removal or changing of security fixtures respectively for the base, must be cleared through
  - a. 775 CES/CEZS, Mr. Gary Cordon, Base Civil Engineering, ext. 7-2177
  - b. 75 SFS/SFOXS, Mr. John Jenkins ext. 7-5532

A notice of intent, minimum of one week prior to commencement of work, will be on file with the respective offices.

4. Any construction, which may affect the base traffic flow pattern, must be coordinated through 75 SFS/SFOJ, ext. 7-8086.
5. Any facility construction or remodeling which affect any enhanced security measures must be coordinated with the owner/user and the Security Forces, one week prior to commencement of work. Point of contact is 75 SFS/SFOSF, Ms. Knowley, ext. 7-7133.
6. It is the responsibility of the contractor to secure all property within the construction site. If government property is included the contractor must secure it also, and notify the contracting officer/engineer as soon as possible.

7. If during any contract course of work it becomes necessary for the contractor to enter any unmanned base entry gate, they must first contact 75 SFS/SFO at ext. 75531. If the contractor assumes custody or control of a particular gate they will ensure:
  - a. Only cleared contractor personnel for that respective project gain access to the base through that gate.
  - b. Lock and Key Control will be established in such a manner as to clearly define an audit trail of who have keys to the gates and the times the gates are opened and closed, 24 hours a day.
8. All newly remodeled or new construction of facilities must adhere to current standards set forth for resource protection, antiterrorism, information security and industrial security requirements in:
  - a. AFI 31-101, The Air Force Installation Security Program, (OPR: 75 Security Forces)
  - b. AFI 31-210, The Air Force Antiterrorism/Force Protection Program Standards, (OPR: 75 Security Forces)
  - c. AFI 31-401, Information Security Program Regulations, (OPR: 75 Security Forces)
  - d. AFI 31-601, Industrial Security Program Management respectively. (OPR: 75 Security Forces)
  - e. Further guidelines are included in Military Handbook 1013/1A, Design Guidelines for Physical Security of Fixed Land-Based Facilities or the Civil Engineering Facility Manuals (OPR: 75 Security Forces and Civil Engineering)
9. The guidelines for antiterrorism should include as a minimum: **NOTE:** Coordinate with 75 CE for Antiterrorism facility requirements.
  - a. **A clear zone around the building of at least 25 meters**
  - b. Any landscaping within the above mentioned area should not be of such nature as to provide hiding places for devices utilized by terrorists such as briefcase bombs, boxes etc;
  - c. It is recommended that all dumpsters/trash pickup areas be located at least 25 meters from the building. All bushes/shrubbery adjacent to the building should be of such a nature as to prevent pedestrian traffic, thorny bushes, roses etc;
  - d. It is recommended that the layout of the building provide easy shutdown of the building if it becomes necessary during exercise and real world situations. Entrances should be laid out to accommodate constant surveillance by owner/user.
  - e. Any buildings, which will house assets, which are classified, contain funds, precious metals, Arms, Ammunition or Explosives or controlled substances must have an initial and follow-up security standard inspection prior to operation.
10. Intrusion Detection System: If a IDS system is necessary it must include sufficient levels of protection as per AFI 31-101 or AFI 31-401 for the respective asset. It must also include the following features:
  - a. All IDS equipment must include line supervisory capability equal to the value, sensitivity and technical sophistication of the resource.

b. The alarm system must have dedicated communication cable pairs for transmission of the encoded system. Refurbished or freight damaged equipment can not be used. All equipment and parts must be new, in their original container.

c. The alarm system must be able to register any malfunction positively, and have a malfunction rate that does not exceed one malfunction per each 24 hours, for each sector or protected zone.

d. The alarm system must be able to protect large or small areas with little modification and cost difference.

e. When acquiring an alarm system it must include an all-encompassing maintenance contract or a written agreement must be signed with the base civil engineering alarm maintenance personnel. The agreement must stipulate their agreement to maintain the system.

f. All motion devices must include dual detection capability, with both passive infrared and microwave sensors, providing the area with complete volumetric protection.

g. The alarm system must be programmable/compatible with the existing base alarm system. All hookups must be completed prior to the final survey. This includes all necessary bridging, wiring, conduit, tamper provisions, and computer programming to insure connection and successful communication of the building to Building 1219, Security Forces Central Control. After verification by 775 CES, that the system is ready, a 72-hour test must be accomplished with 75 SFS/SFOXS, Mr. Jenkins. A final survey of the building will be accomplished at this time prior to normal operation starting.

h. Lightning protection for the complete alarm system is necessary to protect the system from lightning strikes and extreme power surges.

i. All alarm systems will utilize an Automated Entry Control System, which will report the event and individual initiating the event, to the security forces alarm monitor.

**NOTE:** Per AFI 31-101, paragraph 25.10. "In addition to IDE protection for unattended storage of funds, accounting and finance cashier cages will be equipped with a duress alarm. The ISC may determine the need for additional duress alarms."

11. The following equipment is required for locks, hasps etc:

Padlocks: Key Accuated

Low Security: MIL SPEC P-17802

American 200 or 5200 Series

Medium Security: MIL SPEC 43951

S&G 826 Series, Models A,C, and D,

High Security: MIL SPEC 43607

S&G 833

S&G 831B

Hi-Shear LK 1200

Tufloc Model X-60 Series

Hasp: Natick Hasp, MIL SPEC H-43905, For Secret Classified

NAPEC 0950 Hasp, MIL SPEC H-20181, For Secret Classified

High Security Hasp NSN 5340-00-158- 0019/DLA 500-85-C- 0303

Built In Combination Locks, Authorized Group 1R:

Mas-Hamilton X-07, Electronic Lock

S&G 8400 Series, (Butter Fly, Key Change)

S&G 8500 Series, (Push in dial, key change)  
Mosler MR/MRK 302  
LaGard 1980-ARL (key change version)

NOTE: Built In Combination Locks not recommended for exterior doors in extreme change in weather conditions. (Four Season Areas)

12. If it becomes necessary to establish a free zone for the contractor the installation commander must approve it in writing. The free zone must have clear defined boundaries. The contractor and other authorized personnel recommend. The free zone must be closed during non-duty hours. The boundaries of the free zone must be under surveillance by the OPR for the area or designated responsible activity. See AFI 31-101, paragraph 3.7. for further guidance.

13. Any special security requirements needed for the contractor, should be coordinated through Mr. Mike Smith, 75 SFS/SFA, 7-5489.

14. No Foreign Nationals maybe employed by the contractor without first clearing through the Foreign Disclosure Office, ext. 7-6858.

**75<sup>th</sup> Communications Squadron**  
**DESIGN CRITERIA**  
**FOR PRE-WIRING**  
**AND OTHER**  
**TELECOMMUNICATIONS SYSTEMS**



**POC: MSgt. Michael A. Mayes**  
**75<sup>th</sup> CS/SCMP 777-4411**

75<sup>th</sup> CS Design Criteria for Pre-Wiring and Other  
Telecommunications Systems

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**Approving/Releasing Authorities  
75<sup>th</sup> Communications Squadron  
Design Criteria for Pre-Wiring  
and Other  
Telecommunications Systems  
(TAB-K)**

**Commander, 75<sup>th</sup> CS  
Robin A. Chadderdon, Lt Col, USAF**

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**Plans Flight  
75<sup>th</sup> CS/SCX**

---

**Plans & Requirements  
Rich Brown, GS-11  
75<sup>th</sup> CS/SCXP**

---

**Systems Flight  
Jay Sorensen, Maj, USAF  
75<sup>th</sup> CS/SCM**

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**Simplified Acquisition of Base Engineering Requirements  
75<sup>th</sup> CES/CECS**

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**Cable System Maintenance  
75<sup>th</sup> CS/SCMPC**

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**Telephone System Maintenance  
75<sup>th</sup> CS/SCMPT**

---

**Base Network Control Center**

**Rick Sheffield**  
**75<sup>th</sup> CS/SCBN**

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**75<sup>th</sup> Communications Squadron**  
**DESIGN CRITERIA FOR PRE-WIRING**  
**AND OTHER TELECOMMUNICATIONS**  
**SYSTEMS**

**1. Purpose:**

This document will be used by all Air Force Agencies and their contractors at Hill Air Force Base to plan, design, review and evaluate telecommunications cabling and distribution systems. It also includes pre-wiring new and remodeled facilities. Per AF Engineering Technical Letter (ETL) 87-9, pre-wiring shall be included in all facility construction, addition and alteration projects accomplished with Military Construction Projects (MCP) funding. In addition, the Base Communications-Computer Systems Officer (CSO), has determined that all minor construction and renovations funded locally with Operations and Maintenance (O & M) funds and all non-appropriated funds facilities shall comply with ETL 87-9, TB 95-03 and this document. Whenever a conflict is identified, the CSO shall make the final determination to resolve the conflict.

**2. General Scope:**

a. The facility design will provide concealment of the wiring systems. The design should contain adequate space for installation and maintenance of C-CS equipment and wiring, proper separation between unclassified and classified equipment, and flexibility of office layout in administrative areas. The base CSO will be the approving authority in ensuring that the most efficient wire distribution system is selected, consistent with facility size and function, current and projected C-CS requirements and be flexible for future additions or changes. Surface mounted conduit shall not be used except as approved by the CSO, in writing.

b. The installations shall be consistent with all known base installation criteria and shall support the current base blueprint document prepared by the 38 EIW at Tinker AFB, OK. Approval authority for the blueprint is the 75<sup>th</sup> Support Group and 75<sup>th</sup> Communications Squadron.

c. The user will present all communications requirements to the 75<sup>th</sup> prior to the 30% design review. The construction project manager will provide the 75<sup>th</sup> CS a complete set of design development documents to include a draft Requirements and Maintenance Plan (RAMP), draft drawings, the DD 1391, Military Project Construction Data, and a list of any deviations from the C-CS criteria, which must be approved by the base CSO.

**3. Personnel Certification Requirements:**

Contractor personnel qualifications are the responsibility of 75<sup>th</sup> CES and 75<sup>th</sup> CS. Each agency is responsible for the contracts they administer.

#### 4. Local Minimum Standards:

To minimize the long-term cost of the infrastructure, local standards are established and may only be changed when approved in writing by the CSO. These standards are intended to promote common skills among maintenance personnel throughout the base and to minimize the necessity for excessive on hand spare parts and varying test equipment:

1) For Base Fiber Optic Backbone Connections:

ATM Technology Connections - 36 Strand Single Mode (SM) Fiber 8.3/125 micron

2) For Base Fiber Optic Satellite Connections:

Switched Ethernet Connections - 12 Strand SM Fiber 8.3/125 micron

3) Minimum of 25 pair copper cable for new installations. All copper cable conductors shall be 26 AWG in cable sizes above 2100 Pair. All copper conductors for cables less than 2100 pair shall be not less than 24 AWG. All splices shall be spliced with crimp type connectors or modular splicing methods. All outdoor metallic Twisted Pair (TP) Cable will be filled core type, and meet Rural Utility Service (RUS) PE-39 or PE-89 specifications.

4) All wiring used for telecommunications outlets shall be four pair, 24 AWG, solid copper conductor, Category 3 for voice and Category 5 for data, UL tested and certified.

5) Whenever exposed in air circulation areas, only plenum cable may be used.

6) All new telecommunications outlets shall provide triple RJ45 type jacks utilizing TIA 568A wiring configuration (See attachments 1 and 2). Where existing cable has been installed to meet the requirement of "single line concept", the outlet density may be reduced, as approved by the CSO.

7) Information outlet spacing in office areas shall be based upon one jack for each 12 LF of perimeter wall space or one for each 50 Square foot of floor space whichever provides a higher outlet density. If systems furniture is utilized power poles are required. Power poles are required for every four cubicles. All other locations will be provided with outlet density as determined by the CSO.

8) Administrative telephone wiring will be based on the single-line instrument concept with individual cable running from the wall outlet to the Communications Equipment Room (CER) or Telecommunications Closet (TC) via the cross connect cabinet, if required.

9) All wall mounted wall phone jacks shall be 630B type receptacles.

## **5. Comprehensive Requirements:**

### **a. BUILDING COMMUNICATIONS DISTRIBUTION SYSTEM - Entrance Conduit, Duct Banks and Manhole (MH) System**

1) Specifics and guidelines are provided in attachment 10.

To facilitate both copper and fiber optics cable, two conduits will be required to each facility and/or manholes. One will be the multi-celled conduit and one will be a four-inch minimum schedule 40 PVC conduit.

2) All primary backbone conduits shall be installed in locations, as determined by the CSO, and shall provide adequate size and quantity to meet current and 100% growth for future requirements.

3) Whenever new construction or remodeling takes place, the design, installation and all related cost necessary to extend the conduit and manhole system to the new location shall be included in the project cost. Multiple service entrance locations will be required for all facilities housing command and control systems to provide redundant, survivable service.

4) A manhole with a multi celled conduit system with tracer and pull rope will be used for fiber optics cables. A four-inch minimum PVC conduit will be required for copper cable. 100% spare ducts will be installed for expansion and maintenance in all primary duct banks.

5) Manholes shall be installed for all connections to the existing cable plant as required to maintain a maximum manhole spacing of 475 feet. Additional manholes may be required to provide adequate control of connection and distribution of the cable plant. See attached detail sheet (attachment 5) for specific manhole construction criteria.

6) IAW T.O. 3I-W-3-10-12, power and communications cables will be separated by 12 inches (30.48cm) of well tamped, fine earth protection. The cable at the top of the crossing, whether power or communications cable, will receive the same additional protection (see item 8 below). Gas and water mains will be separated and protected by 3" of concrete or 12" of fine earth. In addition, if the cable crosses over the main, extend additional cable protection 3 feet from each side of the crossing. Where highway, railroad and runway crossings occur, cable at such crossings must be placed in underground metallic conduit. If steel pipe conduit is used, boring procedures will be followed that ensures protection of existing resources. Where PVC conduits are installed, a metallic tracer wire will be installed within the conduit or 6" above the duct bank to assist in future location efforts, with bonding to occur inside each manhole and at CER grounding frame.

7) Stub up fiber/copper lateral conduits 6" above finished floor level in the corner of the CER, adjacent to the telephone punch down board, continuous from the nearest manhole.

8) Provide 36" minimum cover for all conduit duct banks and 36" minimum cover for laterals measured to top of conduit. The 75<sup>th</sup> CS personnel will provide cable termination in the manhole and perform any necessary cross-connection in the CER.

9) When determined necessary to simplify installations, conduit will be curved to provide gentle sweeps, with a minimum radius of 10 feet, for a total bending radius not to exceed 180 degrees between manholes.

10) All conduits shall be sloped toward each opposing manhole at a slope of 3" per 100' of run to promote drainage of any accumulated liquids.

11) Handholes, when specified, will be nominally 4'x 4'x4' inner dimensions and will contain a grounding rod, cable rack supports, sump drain and pulling irons.

12) All conduits entering a building will have an approved fire stop plug to prevent fire or fumes from entering or exiting facility.

13) All main conduit runs will be encased in concrete.

14) All trash shall be removed from local work area(s) prior acceptance of the project.

**b. TELEPHONE ENTRANCE CABLE** - The contractor will provide copper cable, gel filled, IAW Rural Electrical Association (REA) standard PE-39 or PE-89 from main communications panel to the nearest manhole with sufficient pairs to provide each facility with required circuits plus 100 percent spare pairs, as determined by the CSO.

**c. COMMUNICATIONS EQUIPMENT ROOMS (CER)**

1) A CER will be provided for C-CS switching and transmission equipment. Adequate installation and maintenance space (see attachment 5), environmental control and power shall be included to support this equipment. No other building support equipment, including mechanical equipment, plumbing equipment and electrical panels, will be placed in the CER. Maintenance space and access space will not be utilized for any other purpose and will be free and clear of all obstructions to a height of 8'-0" to allow for adequate cooling and servicing of equipment.

**Storage is prohibited in the CER and Telecommunications Closet (TC).**

2) TC's have the same requirements as CER rooms (See attachment 5) and will be located so that the distance, measured along the routing path of the cable, will not exceed 300 feet, including vertical distances to wall telecommunications outlets. Where it is necessary to interconnect more than one remote TC to the primary CER, multi mode or single mode fiber optical cable will be used for LAN connectivity. A 1.25" innerduct will be used to connect the TC to the CER. If feasible provided a 4" conduit with innerduct installed inside or lay the innerduct in the raceway, with pull cord. For telephone interconnection, please coordinate with 75<sup>th</sup> CS/SCMP, ext. 777-6464/9446, for the determination of the number of pairs required.

3) Circuit connectivity from the telecommunications outlet to the TC closet or the CER will be provided through ¾" (min) conduit stubbed to 12" above the finished ceiling, complete with pull chords. A 12" wide by 4" deep cable tray above the ceiling may be used to connect rooms provided plenum type cable is used. When cable trays are provided, conduits will be extended to the cable tray and be terminated. The throughway or raceway will run above the ceiling, on the top of proper support structures, using the most direct route between the TC closet and the CER. Conduit fill will not exceed the 40% rule as stipulated in the National Electrical Code (NFPA 70).

4) 630B type wall jacks will be installed for wall mounted telephones in each CER, electrical/mechanical rooms and communications closets. Jacks will be mounted 60 inches above the finished floor.

5) Access to CER workspace should be provided to allow 24-hour access. Provide keys to room to CS for access to area if locked.

6) Environmentally controlled temperatures will be provided in the CER and TC rooms of not less than 40 degrees (F) or greater than 85 degrees (F).

7) LAN wiring will be terminated in a standard 19" rack mounted category 5 patch panel located in the primary communications room (CER) situated in a central location within the building (see attachment 6). If the cable distance is more than 300 feet, the LAN cable will terminate in a TC patch panel and provisions will be made to interconnect each TC to the primary CER.

8) Four plex 110 VAC power outlet on a separate 20 Amp circuit with isolated ground, will be provided for use in powering telecommunications devices. An additional duplex convenience outlet will be located in the room to provide power to operate service and maintenance equipment. Switched lighting will be provided in all CER areas, adequate to allow work with small fiber items and miniature lettering devices.

9) A facility ground bus bar or ground point will be installed for cable sheaths, protectors and other equipment in accordance with T.O. 31-W-3-10-22. The ground will be directly connected to the building ground.

10) The 75<sup>th</sup> CS will terminate entrance cable inside the CER to Building Entrance Terminals (BET).

a. All BET's will be provided with 3-element plug in gas tube protective modules and will provide equal protection to REA-PE-80 specifications. (Minimum Required)

b. BET's used for the termination of outside Twisted Pair (TP) cables, 300 pair or less in size, will have a built in splice chamber with 710 type splice modules. Equipment side of the BET will use punch-down type connection to station equipment. BET's of this type will not be stacked more than three high.

c. BET's used to terminate cable sizes greater than 300 pair, will be of the 24 AWG stubbed 355 series type blocks with 3BIE type gas protectors ( Minimum Required) and be mounted in a vertical bus arrangement.

**d. WIRING AND TERMINATION**

1) Administrative telephone and data lines will be terminated on Cat 5 type 66-M150 connecting blocks with standoff and type 20 distribution spools. Blocks will be mounted on a 3/4 inch ACX plywood backboard mounted with smooth side out in the TC closet and CER. Terminations will be numbered according to room and jack number. Pairing and color-coding will be in accordance with EIA 568A or 568B standards (see attachments 1 & 2).

PIN NO.	COLOR	PIN NO.	COLOR
1	GREEN-WHITE	5	BLUE-WHITE
2	GREEN	6	ORANGE
3	ORANGE-WHITE	7	BROWN-WHITE
4	BLUE	8	BROWN

Distribution frames and interior conduits shall be of sufficient size to allow for 100 percent growth and not exceed the 40% fill rule stipulated in the National Electrical Code (NFPA 70).

2) WIRING:

a) The contractor will install all interior pre-wiring to include the CER, TC closets, with termination to CER.

b) Wiring for administrative (CAT 3 telephones) and office automation equipment will be unshielded twisted pair (UTP), category 5 cable, 24 AWG, will be Integrated Services Digital Network (ISDN) compatible and be installed by a category 5 certified installation

team. All installations require compliance with the Institute of Electrical and Electronic Engineers (IEEE) standard 802.3 for base band systems.

c) 75<sup>th</sup> CS will cross connect the interior blocks and splice the cable in the manholes when required.

3) MODULAR/MOVABLE EQUIPMENT AND CONSTRUCTION ITEMS: Work stations, systems furniture and modular walls/offices, will be pre-wired by the contractor and will provide sufficient flexibility to rearrange without modifications to the permanent TC or CER wiring system in the facility. Adequate quantities of suitable connectors and extension cables will be provided; permanent splices/connections will not be made.

5) WIRING IDENTIFICATION STANDARD: Each cable will be marked with an adhesive type strip marker at both ends, as noted in figure 6, which will clearly identify their room and outlet number. The outlet designation will be marked on the outlet cover plate, termination jack on the patch panel, or the termination block. A permanent type label affixed to the outlet jack cover is required. Hand written or manual labels are **NOT** permitted. Automated embossed labels are preferred, such as Brothers P-touch systems utilizing 1/4-inch labels, with 1/8-inch lettering.

#### **e. CROSS CONNECT CLOSETS**

1) Cross-connect closets will be provided for every 10,000 square feet of usable floor space. The closets will serve as a secondary interconnection point between the telephone modular jack outlets and the main communications frame in the CER. Wall and floor space will be provided for installation and maintenance of C-CS equipment such as frames or backboards. Such equipment will be concealed and secured like primary CER's and will not be installed in common use areas. The closets must be fully accessible and maintainable as outlined for CER room equipment.

2) All cable in the TC, cross connect closet and CER will be tagged by room and jack number. (See attachment 5) Cross-connect closets will not be used for LAN wiring. All LAN runs must be continuous from wall outlet to TC or CER.

#### **f. TELECOMMUNICATIONS OUTLETS**

1) In general office areas, a triplex modular Telecommunications outlet plate, with three each RJ-45 type, one for voice, data and LAN, will be provided approximately every 12' around the room perimeter or one outlet for each 50 square feet of net floor area, whichever provides greater density. All wall outlet components will be certified, as Category 5 and will be RJ-45 type wall jacks with a removable outer bezel that is color coded and labeled to identify the outlet usage (see attachment 1). When modular furniture is to be installed, modular triplex outlet jacks will be installed in each work area and in each area identified by the tenant unit for

administrative use. Each of the three outlet jacks shall be numbered by room and jack number. They will be wired with four pairs (eight conductors) according to the wiring diagram located on the side of the jack, by the contractor. (See attachments 1 & 5)

2) Telecommunications outlets will be mounted at 18 inches above the floor, to the centerline of the cover plate, unless approved by the 75<sup>th</sup> CS.

3) Communication conduits with an inside diameter of 1 to 1.5 inches will be installed during the framing of the walls in all new facilities and remodeled buildings. The communication conduits will stub out above the ceilings or below false floors into raceway/throughways. All conduits will have pull string installed in them.

#### **g. PERIODIC, FINAL INSPECTIONS, TESTING AND DOCUMENTATION**

1) All telecommunications cable will be certified and tested in accordance with EIA/TIA standards with written test results provided to the 75<sup>th</sup> CS. When deficiencies of any type are discovered upon testing, the installation contractor will make all necessary repairs, including replacement if necessary, at no cost to the government.

2) As-built drawings will be maintained throughout the construction phases. The drawings will be submitted to the 75<sup>th</sup> CS with the cable certification records upon completion of the work. The 75<sup>th</sup> CS will perform a final review of drawings and inspect the installation. The drawings will be forwarded to 38 EIW, Tinker AFB, OK, incorporating them into Communications-Computer System Installation Records (CSIR). Two copies of these drawings will be updated to final "as built" conditions by the construction contractor or installation team and submitted to the CSO. Also, submittal of one electronic copy of the as built drawing prepared in the most current version of AutoCAD, prior to the time of facility acceptance.

3) During construction, in-progress inspections by 75<sup>th</sup> CS personnel are required. For example, trenches will not be covered without an in-progress inspection to verify conduit size and quantity, cable type, and earth cover compliance with installation requirements. The installation activity/contractor is responsible for requesting in progress inspections before backfill, installation of sheet rock, during cable certifications, etc.

4) All installed cable (fiber and copper) will be tested in the presence of 75<sup>th</sup> CS personnel and test results provided to the CSO in printed and electronic format. All category 5 cables will be tested and certified to 155 MBps (100 MHz). UL testing standard for new cable, including fiber optic testing of single-mode and multi-mode cable, will be followed (attachment 9).

5) All contractor cable installations will be inspected and all defects discovered will be repaired at no cost to the government

**h. EMSEC/EMP and Classified Cabling Considerations:** Classified requirements may vary and will be taken of on a case by case basis. If units process classified message traffic or use STU-IIIs, coordinate all requirements with the 75<sup>th</sup> CS to ensure proper compliance measures are attained.

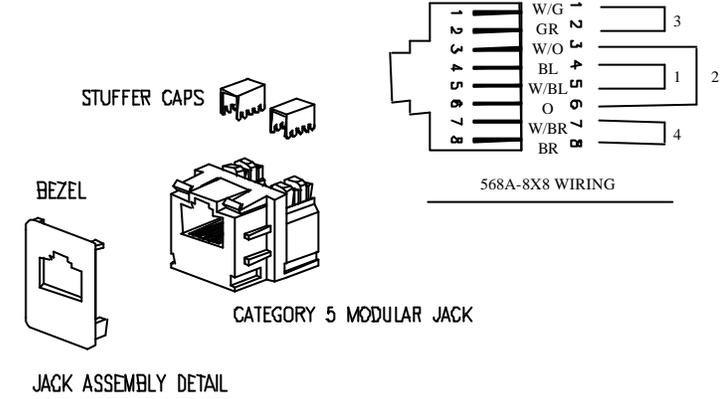
## **RELATED DOCUMENTS**

**The following documents are recognized within this document or are hereby recognized as a standard of good practice to be followed during the performance of the work.**

National Fire Protection Association	NFPA 70 National Electrical Code
Underwriters Laboratories	UL Standards for Cat 5 UTP Wire
Rural Utility Service	PE-39 Specifications for Filled Telephone Cable
	PE-80 Specifications for Gas Tube Surge Arrestors
	PE-89 Specifications for Filled Telephone Cable with Expanded Insulation
National Electrical Manufacturer's Association	NEMA
Air Force Documents	AFR 88-15 Criteria for AF Construction
	AF TB 95-03 Cabling and Distribution Systems
	AFSSI 7010 Emission Security Assessment
	AFSSM 7011 Emission Security Countermeasures Review
	ETL 87-9 Pre-wiring DOD Buildings Criteria and Standards for Construction
	TO 31-W-3-10-22 Telecommunications Engineering OPT
	TO 31-W-3-10-12 Outside Plant Cable Placement
	TO 31-1-75 General Maintenance Practices
	TO 31-10-24 Grounding, Bonding, and Shielding
EIA/TIA Standards	EIA/TIA 568 Commercial Building Wiring
	EIA/TIA 569 Pathways and Spaces
	EIA/TIA 570 Light Commercial/Residential Wiring
	EIA/TIA 606 Documentation Standards
	EIA/TIA 607 Grounding & Bonding Digital Systems
	TSB 36 Cable Requirements for Digital Systems
	TSB 40 Termination Components
	TSB 67 Cable Testing
	SP2840 Category 5 Component Specifications
International Electrical and Electronics Engineers Association	IEEE 802.6 MAN System requirements
	IEEE 802.8 Fiber Optic Advisory Board Standards
	IEEE 802.9 Integration of Voice and Data Systems

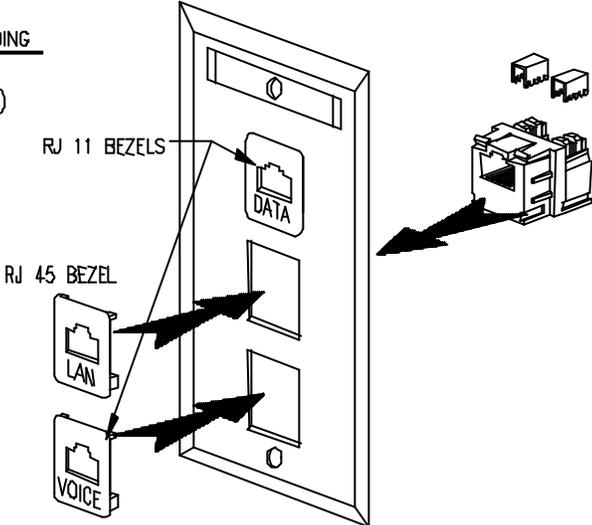
IEEE 802.10 LAN Security Measures  
IEEE 802.3U 100BaseT and 100BaseX Standards

Additional information may be obtained from the base C-CS activity or the applicable EI activity.



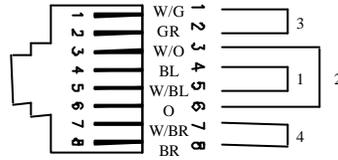
BEZEL COLOR CODING

- VOICE=WHITE(RJ11)
- DATA=GREY(RJ11)
- FAX=PURPLE
- MODEM=RED
- LAN10=GREEN
- LAN100=ORANGE
- LANATM=YELLOW



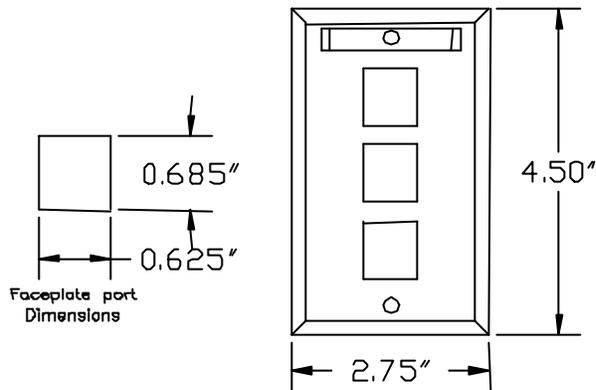
Standard Three Gang Wall Plate  
INFORMATION OUTLET WALL PLATE DETAIL

FIGURE 1  
Not To Scale

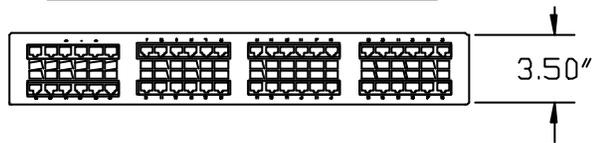


568A-8X8 WIRING

With clear plastic label window



Standard Three Gang Wall Plate  
(Single and Dual Outlet Plate Similar)  
INFORMATION OUTLET WALL PLATE DETAIL

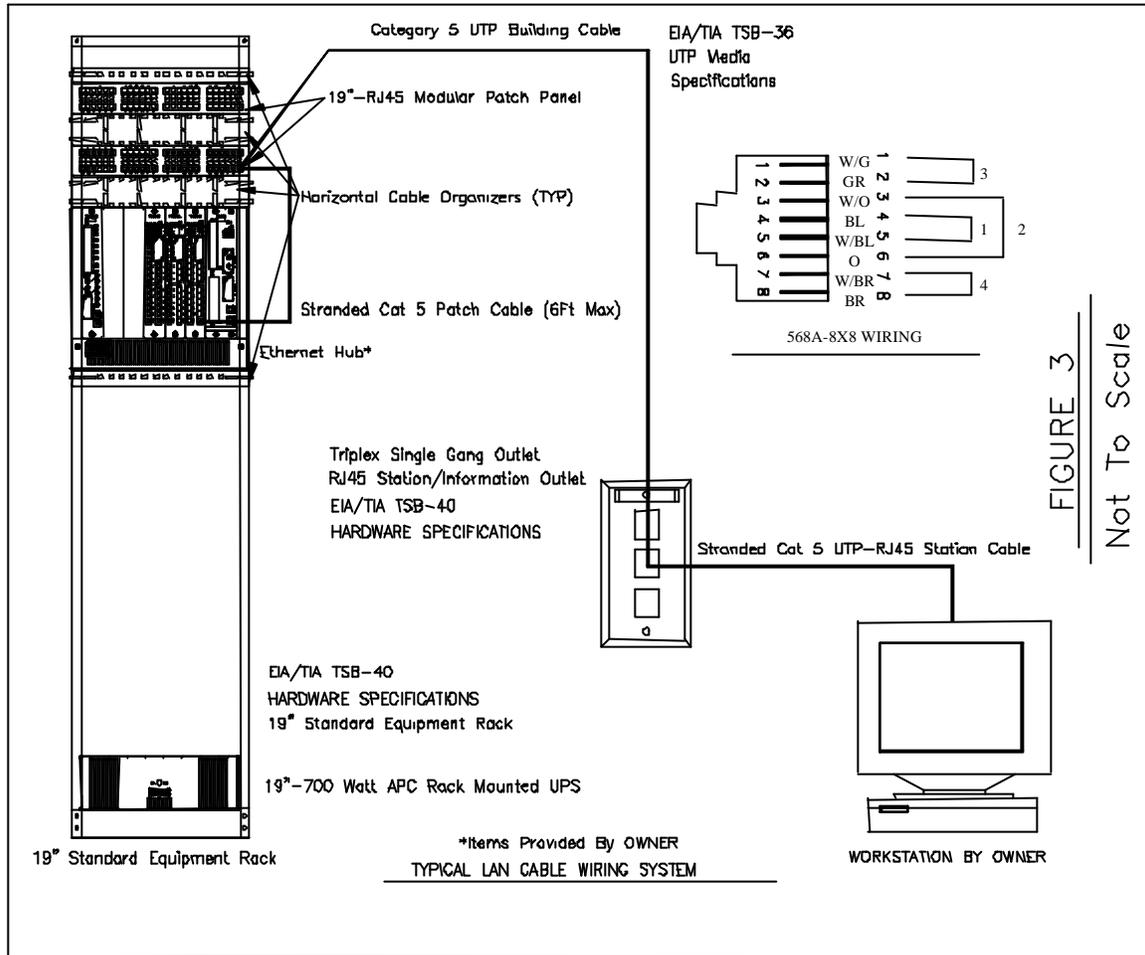


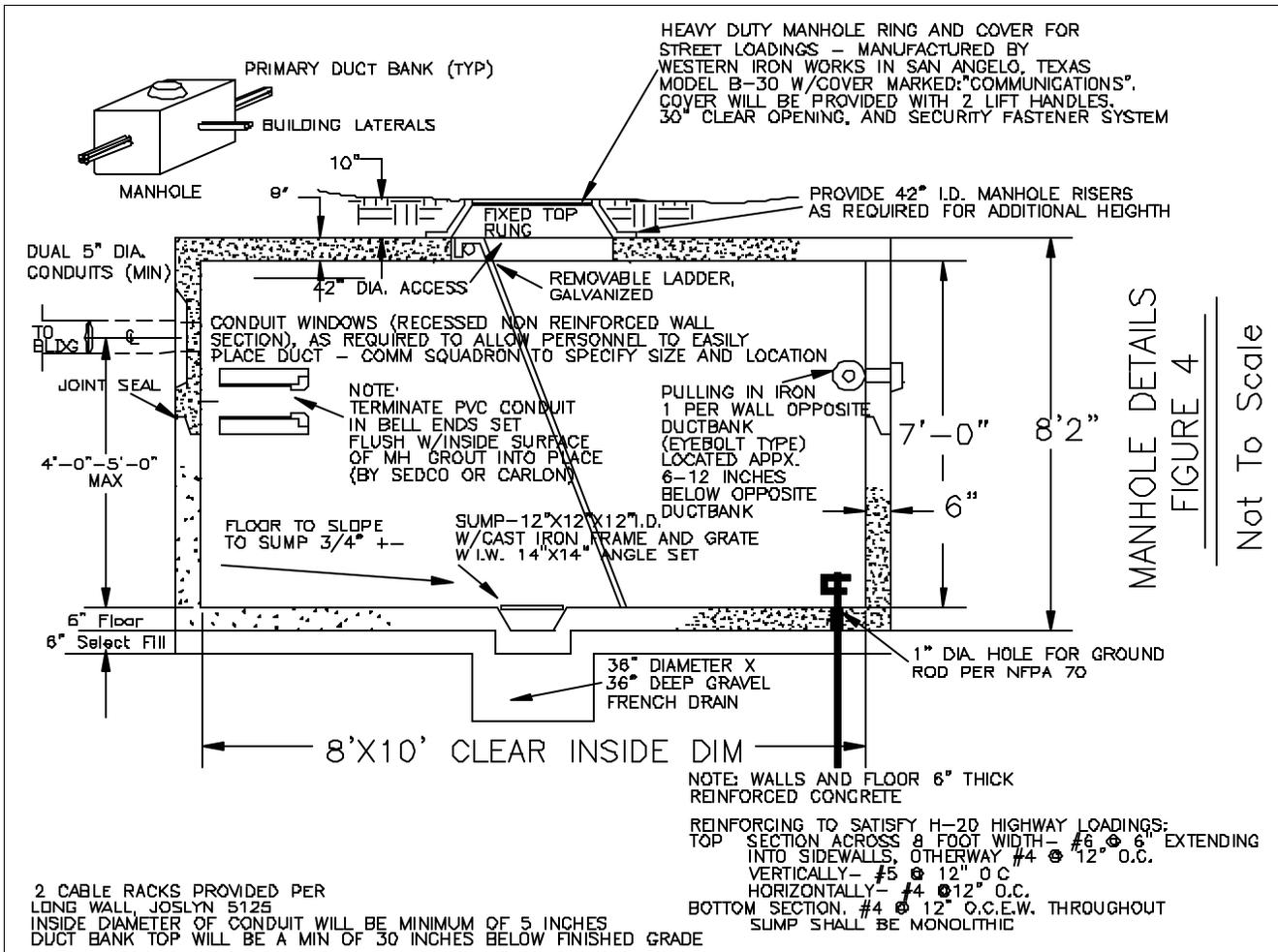
All Category 5 Patch Panels shall have 110 Interface On Back Side  
Panel width shall be as require to fit Standard 19" Equipment racks

48 PORT PATCH PANEL DETAIL

FIGURE 2

Not To Scale

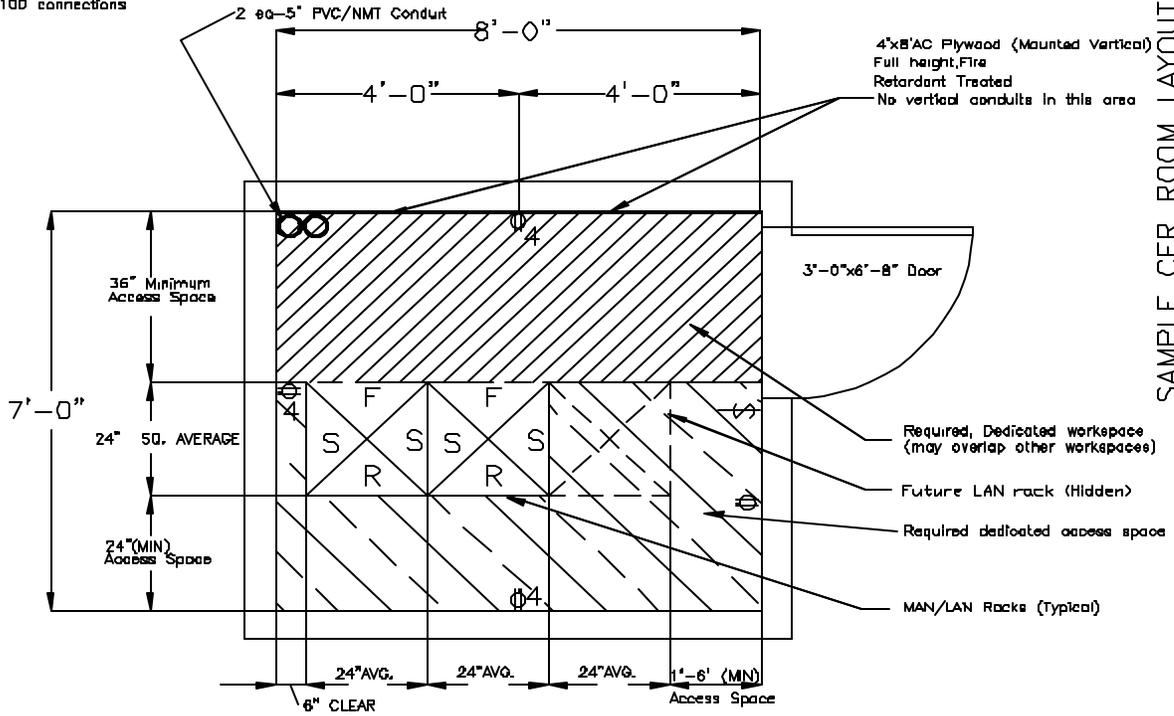




**COMMUNICATIONS EQUIPMENT ROOM CRITERIA (CER)**

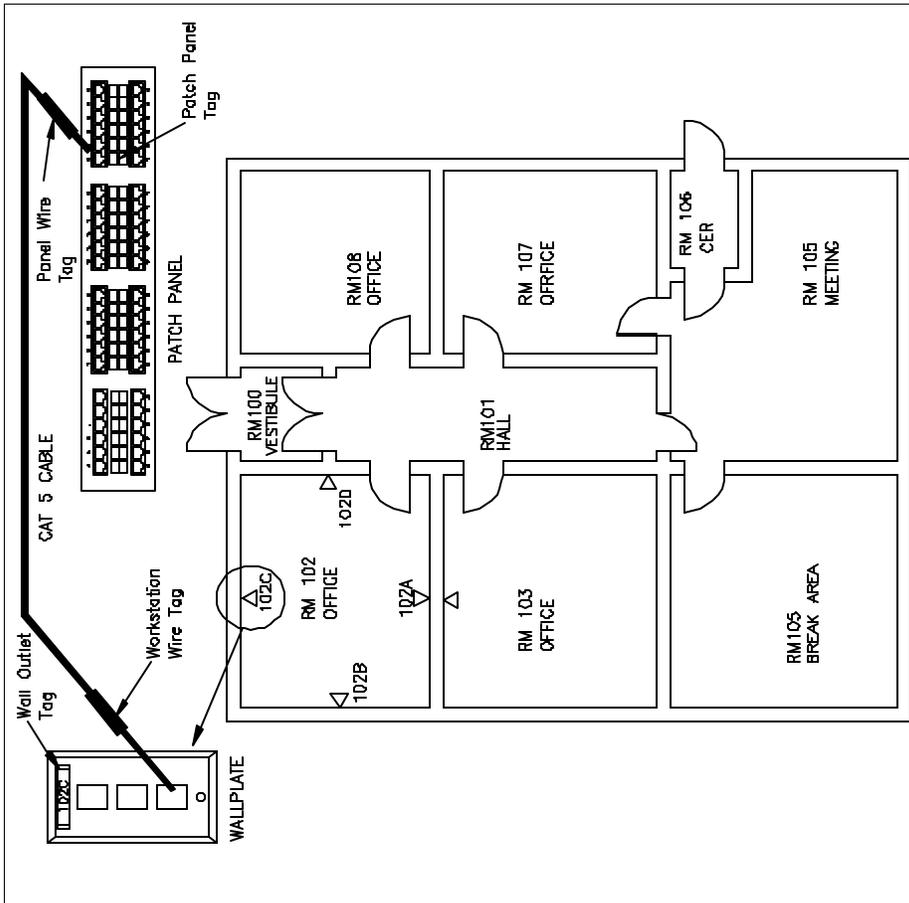
1. Provide a duplex service outlet on the unused wall
2. Provide fourplex outlets with isolated (Computer) ground on all walls adjacent to installed equipment
3. Room shall be provided with environmentally controlled temperatures and lighting as required for office space
4. Room access shall be lockable with access limited to the building custodian and comm personnel.
5. Wiring shall be installed to EIA 568B standards. All installations shall comply with EIA/TIA 568, 569, 570
6. Grounding and bonding shall comply with EIA B07/NFPA 70 tested to 10 Ohms
7. Documentation of installations shall comply with EIA 505
8. Provide 1EA-4'x8'x3/4" ACX Plywood sheeting, fire retardant treated, long dimension vertical, attached to the wall for each 100 connections

9. Provide one EIA/TIA standard 18" LAN/MAN Rack with 12/24 threaded fasteners set at 5/8, 5/8, 1/2 pitch, floor mounted directly adjacent to existing rack locations for each 75 nodes
10. Extend 2 Ea-5" Diameter PVC/NMT entrance conduits 8" above the finished floor in the corner adjacent to the plywood panels, and extend each conduit to the nearest communications manhole system. Install new manholes at 475' maximum spacing to connect to the existing communications systems.
11. Floor shall be hard surfaced and be moisture resistant
12. Brace all racks from the top to the nearest wall



SAMPLE CER ROOM LAYOUT  
FIGURE 5

Not To Scale



SAMPLE FLOOR PLAN / LAW OFFICES

Starting from the Main Room entrance location, use room number followed by ascending Alpha Character for each telecommunications outlet, and move clockwise around the perimeter of the room. Mark each cable at each end and at each wall outlet on the face of the cover plate, and at the patch panel under the corresponding panel jack. Post the drawing with the identification of outlets and room numbers in the CER upon completion

SAMPLE CABLE NUMBERING PLAN  
 FIGURE 6

Not To Scale

**CATEGORY III**

Category III data cable with one or more conductor pairs complies with the requirements of EIA/TIA 568, Commercial Building Telecommunications Category Standard. These requirements apply to both shielded and unshielded cable constructions.

(CATEGORY III PERFORMANCE SPECIFICATIONS)

<b>SHIELDED OR UNSHIELDED</b>			
		<b>24 AWG</b>	<b>22 AWG</b>
<b>D-C Resistance</b> (ohms/100 meters at 20 C), max. for a single copper conductor regardless of whether it is solid or stranded and is or is not metal-coated. See UL 444 for multiplying factors for adjusting values of resistance read at temperatures other than 20 C.		9.38	5.91
<b>D-C Resistance Unbalance</b> (percent), max.		5	5
<b>Pair-to-Ground Capacitance Unbalance</b> (pF/100 meters), max.		330	330
<b>Impedance</b> (ohms) 772 kHz 1.0 - 16.0 MHz UL will apply the values in parentheses as the upper and lower limits.		102 + 15% (87-117) 100 + 15% (85-115)	
<b>Structural Return Loss</b> (dB) 1.0 - 10.0 Mhz 16.0 The Structural Return Loss is to be greater than or equal to the values listed in this table. The asterisked (*) value is for information only. Above 10 Mhz, the Structural Return Loss is to be determined using the formula $SRL_f > SRL_{10.0} - 10 \log_{10} (f/10.0)$		12 10*	
<b>Attenuation</b> (dB/100 meters at 20 C), max. 256 kHz 512 772 1.0 Mhz 4.0 8.0 10.0 16.0 The attenuation values for frequencies of 512 kHz and below are provided for information only. These values are intended for engineering purposes and not for conformance testing.		Solid Conductor <u>S</u> 1.3 1.8 2.2 2.6 5.6 8.5 9.8 13.1	Stranded Conductor <u>S</u> 1.6 2.2 2.6 3.1 6.7 10.2 11.8 15.7
<b>Worst-Pair</b> <b>Near-End</b> <b>Crosstalk</b> (dB), min. (a) 772 kHz 1.0 4.0 8.0 10.0 16.0		Solid Conductor <u>S</u> 1.3 1.8 2.2 2.6 5.6 8.5 9.8 13.1	
The asterisked (*) values are for information only. The minimum NEXT coupling loss for any pair combination at room temperature is to be greater than the value determined using formula $NEXT (fMHz) > NEXT (0.722) - 15 \log_{10} (fMHz/0.722)$ for all frequencies in the range of 0.772 MHz-16 MHz for a minimum length of 100 meters. For cable consisting of two or more jacketed members that are cabled together and then covered by an overall jacket, crosstalk between these members shall be $[6 + 10 \log_{10}(n)]$ dB better than the specified crosstalk of each member at all of the specified frequencies. In this instance, "n" refers to the number of members within the overall jacketed cable.			

(a) For cable employing 5 or more pairs, calculation is also to be made of the Power-Sum Near-End Crosstalk (P.S.NEXT) for uncorrelated disturbing pairs using the individual pair-to-pair crosstalk measurements at the stated discrete frequencies and limits, in accordance with ASTM D 4566-90.

TABLE 16740-A

**CATEGORY IV**

Category IV cable with one or more conductor pairs complies with the requirements of EIA/TIA 568-a Standards Proposal No.2840, Proposed Revisions of EIA/TIA 568, Commercial Building Telecommunications Category Standard. These requirements apply to both shielded and unshielded cable constructions.

(CATEGORY IV PERFORMANCE SPECIFICATIONS)

<b>SHIELDED OR UNSHIELDED</b>			
		<b>24 AWG</b>	<b>22 AWG</b>
<b>D-C Resistance</b> (ohms/100 meters at 20 C), max. for a single copper conductor regardless of whether it is solid or stranded and is or is not metal-coated. See UL 444 for multiplying factors for adjusting values of resistance read at temperatures other than 20 C.		9.38	5.91
<b>D-C Resistance Unbalance</b> (percent), max.		5	5
<b>Pair-to-Ground Capacitance Unbalance</b> (pF/100 meters), max.		330	330
<b>Impedance</b> (ohms) 772 kHz 1.0 - 20.0 MHz UL will apply the values in parentheses as the upper and lower limits.		102 + 15% (87-117) 100 + 15% (85-115)	
<b>Structural Return Loss (dB)</b> MHz 1.0 - 10.0 16.0 20.0 The Structural Return Loss is to be greater than or equal to the values listed in this table. The asterisked (*) value is for information only. Above 10 Mhz, the Structural Return Loss is to be determined using the formula $SRL_f > SRL_{10.0} - 10 \log_{10} (F/10.0)$		21 19* 18*	
<b>Attenuation</b> (dB/100 meters at 20 C), max. 256 kHz 512 772 1.0 Mhz 4.0 8.0 10.0 16.0 20.0 The attenuation values for frequencies of 512 kHz and below are provided for information only. These values are intended for engineering purposes and not for conformance testing.		<u>Solid Conductor</u> <u>s</u> 1.1 1.5 1.9 2.1 4.3 6.2 7.2 8.9 10.2	<u>Stranded Conductor</u> <u>s</u> 1.3 1.8 2.3 2.5 5.2 7.4 8.6 10.7 12.2
<b>Worst-Pair Near-End Crosstalk</b> (dB), min. (a) 772 kHz 1.0 MHz 4.0 8.0 10.0 16.0 20.0		<u>Solid Conductor</u> <u>s</u> 58* 56* 47* 42* 41* 38* 36*	

The asterisk (\*) values are for information only. The minimum NEXT coupling loss for any pair combination at room temperature is to be greater than the value determined using formula

$$\text{NEXT (fMHz)} > \text{NEXT (0.722)} - 15 \log_{10} (\text{fMHz}/0.772)$$

for all frequencies in the range of 0.772 MHz-16 MHz for a minimum length of 100 meters.

For cable consisting of two or more jacketed members that are cabled together and then covered by an overall jacket, crosstalk between these members shall be  $[6+10\log_{10}(n)]$ dB better than the specified crosstalk of each member at all of the specified frequencies. In this instance, "n" refers to the number of members within the overall jacketed cable.

(a) For cable employing 5 or more pairs, calculation is also to be made of the Power-Sum Near-End Crosstalk (P.S.NEXT) for uncorrelated disturbing pairs using the individual pair-to-pair crosstalk measurements at the stated discrete frequencies and limits, in accordance with ASTM D 4566-90.

TABLE 16740-B

**CATEGORY V**

Category V cable with one or more conductor pairs complies with the requirements of EIA/TIA 568, Commercial Building Telecommunications Category Standard. These requirements apply to both shielded and unshielded cable constructions

(CATEGORY V PERFORMANCE SPECIFICATIONS)

<b>SHIELDED OR UNSHIELDED</b>																																													
		<b>24 AWG</b>	<b>22 AWG</b>																																										
<b>D-C Resistance</b> (ohms/100 meters at 20 C), max. for a single copper conductor regardless of whether it is solid or stranded and is or is not metal-coated. See UL 444 for multiplying factors for adjusting values of resistance read at temperatures other than 20 C.		9.38	5.91																																										
<b>D-C Resistance Unbalance</b> (percent), max.		5	5																																										
<b>Pair-to-Ground Capacitance Unbalance</b> (pF/100 meters), max.		330	330																																										
<b>Impedance</b> (ohms) 772 kHz 1.0 - 100.0 MHz UL will apply the values in parentheses as the upper and lower limits.		102 + 15% (87-117) 100 + 15% (85-115)																																											
<b>Structural Return Loss (dB)</b> 1.0 - 20.0 Mhz 25.0 31.25 62.5 100.0 The Structural Return Loss is to be greater than or equal to the values listed in this table. The asterisked (*) value is for information only. Above 10 Mhz, the Structural Return Loss is to be determined using the formula $SRLf > SRL10.0 - 101 \log_{10}(F/10.0)$		23 22* 21* 18* 16*																																											
<b>Attenuation</b> (dB/100 meters at 20 C), max. The attenuation values for frequencies of 512 kHz and below are provided for information only. These values are intended for engineering purposes and not for conformance testing.		<table border="1"> <thead> <tr> <th style="text-align: center;">Solid Conductors</th> <th style="text-align: center;">Stranded Conductors</th> <th style="text-align: center;">Solid Conductors</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">1.1</td><td style="text-align: center;">1.3</td><td style="text-align: center;">1.1</td></tr> <tr><td style="text-align: center;">1.5</td><td style="text-align: center;">1.8</td><td style="text-align: center;">1.5</td></tr> <tr><td style="text-align: center;">1.8</td><td style="text-align: center;">2.2</td><td style="text-align: center;">1.8</td></tr> <tr><td style="text-align: center;">2.1</td><td style="text-align: center;">2.5</td><td style="text-align: center;">2.1</td></tr> <tr><td style="text-align: center;">4.3</td><td style="text-align: center;">5.2</td><td style="text-align: center;">4.3</td></tr> <tr><td style="text-align: center;">5.9</td><td style="text-align: center;">7.1</td><td style="text-align: center;">5.9</td></tr> <tr><td style="text-align: center;">6.6</td><td style="text-align: center;">7.9</td><td style="text-align: center;">6.6</td></tr> <tr><td style="text-align: center;">8.2</td><td style="text-align: center;">9.8</td><td style="text-align: center;">8.2</td></tr> <tr><td style="text-align: center;">9.2</td><td style="text-align: center;">11.0</td><td style="text-align: center;">9.2</td></tr> <tr><td style="text-align: center;">10.5</td><td style="text-align: center;">12.6</td><td style="text-align: center;">10.5</td></tr> <tr><td style="text-align: center;">11.8</td><td style="text-align: center;">14.2</td><td style="text-align: center;">11.8</td></tr> <tr><td style="text-align: center;">17.1</td><td style="text-align: center;">20.5</td><td style="text-align: center;">17.1</td></tr> <tr><td style="text-align: center;">22.0</td><td style="text-align: center;">26.4</td><td style="text-align: center;">22.0</td></tr> </tbody> </table>	Solid Conductors	Stranded Conductors	Solid Conductors	1.1	1.3	1.1	1.5	1.8	1.5	1.8	2.2	1.8	2.1	2.5	2.1	4.3	5.2	4.3	5.9	7.1	5.9	6.6	7.9	6.6	8.2	9.8	8.2	9.2	11.0	9.2	10.5	12.6	10.5	11.8	14.2	11.8	17.1	20.5	17.1	22.0	26.4	22.0	
Solid Conductors	Stranded Conductors	Solid Conductors																																											
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TABLE 16740-C