DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
REGIONAL COUNSEL, WESTERN REGION (JACL)
630 Sansome Street - Room 1316
San Francisco, California 94111-2278

Reply to
Attn of: ROEN (Abalateo/556-0541) 7 February 1989

Subject: Engineering Technical Letter (ETL) 88-6: Heat Distribution Systems
Outside of Buildings

To: CESPD-ED-PM CENPD-EN-TE WESTNAVFACENGCOM(code 09A2C.54)

The attached letter provides criteria on underground heat distribution systems
and effective date for implementation.

A. R. MARTINS, Chief 1 Atch
Airlift, Logistics & Training Br AF/LEEE ETL-88-6
Engineering & Construction Division

CESPD-ED-PM 1st End

DA, So. Pac. Div. Corps of Engineers, 630 Sansome St.,
Room 1216, San Francisco, CA 94111 10 Feb 1989

TO: Commander, Sacramento District
ATTN: CESPK-ED-M

w/encl/nc W.C.D.

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
Washington, D.C. 20332-5000

Reply to
Attn of: LEEE 01 Aug 1988

Subject: Engineering Technical Letter (ETL) 88-6: Heat Distribution Systems
Outside of Buildings

TO: ALMAJCOM/DEE/DEM/DEP AFRCE-WR AFRCE-CR AFRCE-ER
AFRCE-BMS AFRCE-SAC AFIT/DET/DEM HQ AFCC/DEM
HQ AFRES/DE AAFES/ENC ANGSC/DEE HQ AFESC/DEM
NAVFAC Code 04/05 1100 ABG/DE CEEC-ES HQ USAFA/DEMA

1. Purpose.

* a. This letter provides the necessary criteria on underground heat distribution systems. This ETL is to be implemented in accordance with AFR 8-7, Air Force Engineering Technical Letters (ETL). Waivers will be processed in accordance with the procedures established by the Model Installation Program.

b. Requires the use of the appropriate guide specifications and updates the procedures for project and design managers in the selection and as the basis for the design of central heat distribution systems.

c. Requires a life cycle cost analysis (LCCA) be used to make the selection of aboveground, shallow concrete trench, and direct buried conduit distribution systems based on the optimum routing for each.

* d. Supersedes ETL 86-18, dated 18 December 1986 and identifies changes with an asterisk "*".

2. Effective Date. This publication is effective immediately for projects that have not reached 35 percent complete design state and all projects with design initiated after the date of issuance of this ETL. Any project beyond the 35 percent complete design state may be modified at the designer's option to use these criteria.

3. Referenced Publications.

a. Corps of Engineers Guide Specification (CEGS) 15711 - Aboveground Heat Distribution Systems.

* b. Naval Facilities Engineering Command Guide Specification (NFGS) 02695
- Exterior Steam Distribution.

c. CEGS 15709 - Concrete Shallow Trench Systems.

* d. NFGS 02693 - Heat Distribution Systems Outside of Buildings (Concrete
Shallow Trench Type).

e. CEGS 15704 - Underground (Chilled Water) (and) (Low Temperature Hot Water) (Dual Temperature) Distribution Systems.

f. NFGS 02698 - Exterior Buried Preinsulated Water Piping.

g. CEGS 15705 - Underground (Heat Distribution System) (and) (Condensate Return System) (Prefabricated or Pre-engineered Types).

* h. NFGS 02694 - Underground Heat Distribution Systems (Prefabricated or Pre-engineered Type).

4. Procedure.

a. Results of an auditable LCCA shall be used to determine system selection. All systems with site criteria compatible with project site characteristics shall be included in the LCCA.

b. System Selection. For each type system to be considered, select the system design parameters (e.g., temperature, above-ground or underground, etc.) that will provide the lowest life cycle cost and that will satisfy end use conditions. Comparative life cycle cost analysis for different systems shall be based on optimum user-acceptable routing for each type of system.

c. Route Selection. System configuration shall be coordinated with the facility master plan. The route selected has considerable impact on system selection. The type system will often be determined by the available route, i.e., aboveground systems are generally not acceptable if they will create obstructions along the system profile will greatly increase the cost of underground systems. However, previous studies indicate that for the smaller pipe sizes, the direct buried conduit system has a lower life cycle cost than shallow concrete trench systems. Attention should be give to any unusually severe or complex installation conditions which adversely impact the life cycle cost advantage of any system.

d. Site Surveys. For underground systems, a site survey and soil borings in accordance with the criteria contained in the specifications referenced in paragraph 3 above are required to determine, as appropriate, soil types, soil resistivity, ground water conditions, and type and location of obstructions along the proposed route of the new system. This information is required to

determine the applicability of shallow concrete trench and direct buried conduit type systems, to establish the site classification for medium and high temperature direct buried conduit systems, and to develop accurate plans and specifications. Class A site conditions shall not be assumed. The requirement for Class A systems in Class B, C, and D sites does not improve system performance but may increase initial construction cost unnecessarily. Extensive obstructions may require reevaluation of the selected route. Soil resistivity will determine the requirement for cathodic protection.

e. Design.

(1) When aboveground, shallow concrete trench, or chilled water/low temperature/dual temperature systems are selected, the design agent will provide complete plans and specifications.

* (a) Aboveground High or Low Profile Systems. Base the design on the materials and system requirements include in guide specifications CEGS 15704 or NFGS 02698.

* (2) When underground medium and high temperature direct buried, prefabricated conduit systems (including condensate returns) are selected, the design agent will provide general routing, pipe size, profiles, maximum allowable heat loss, locations and design of manholes, known underground obstructions, and easements for a distance of 25 feet on each side of the proposed system centerline as required in guide specification CEGS 15705 or NFGS 02694. The system supplier will provide the design details of the conduit system between manholes, and between manholes and building walls, including system wall penetrations, and expansion compensation as described in his approved product brochure.

* (a) Fiberglass Reinforced Plastic (FRP) Condensate Systems. Prefabricated insulated FRP condensate return systems are included in approved manufacturers brochures. This product may be specified as the users option in Class A sites as defined in guide specification CEGS 15705 or NFGS 02694. The system shall be a contractor's option in sites identified as Class B, C, or D.

* (b) When design allows FRP condensate return systems, special care must be taken in the design of steam drip connections to protect FRP piping from line steam due to failed traps. Therefore, connections to FRP condensate lines shall be through either vented receivers or a condensate cooling device located in the manhole to limit the temperature of the condensate entering the line to less than 250 degrees Fahrenheit. The condensate cooling device consists of a cooling tank with thermal diffuser and temperature relief valve. Design details of recommended type of condensate cooling device are available from the Army and Navy design agents.

(c) Because experience indicates that steam condensate lines fail at a greater rate than do the steam lines, condensate lines shall not be installed within the same conduit as the steam line.

(3) Modifications to guide specifications shall only be made when technically required. Modifications shall be those which meet the technical requirement at the lowest life cycle cost.

5. Life Cycle Cost Analysis.

* a. Preparation of the contracting documents will be accomplished using the "Invitation for Bid" format with fixed price and work scope. The project designer/manager will make the determination on the type distribution system to be used in accordance with the criteria stated in paragraph 4 above, and the results of an auditable life cycle cost analysis (LCAA). The LCAA shall be conducted in strict compliance with the economic studies criteria and standards established by the appropriate military service, i.e., Air Force Regulation (AFR) 88-15, Criteria and Standards for Air Force Construction, for Air Force projects; TM 5-802-1, Economic Studies for Military Construction Design-Applications, for Army projects; and Naval Facilities Engineering Command Publication NAVFAC P-442, Economic Analysis Handbook, for Navy projects.

b. The designer shall perform a comprehensive engineering analysis to determine the functional life and maintenance requirements of the systems under consideration. This analysis shall be a part of the LCCA and all data including historical references, engineering calculations, etc., shall be clearly and completely documented. The analysis shall be made a part of the design documentation and included in the project file. This file is subject to public review at bid opening.

c. All system types should have a minimum life of 25 years when properly installed and maintained; therefore, the end point of the analysis period shall be 25 years after the projected beneficial occupancy date (BOD) for the project. A 25 year life expectancy for direct buried conduit systems is based on tests required for system approval. Documentation shall be included in the design analysis to justify a system life other than 25 years.

d. When comparing systems, the designer shall use the same total heat loss for each system. Insulation thickness for each system shall be selected to achieve the required heat loss. These thicknesses shall be used in the operating and capital cost components of the LCCA.

e. If using a computer-aided LCCA, only those computer programs certified by the Headquarters of the appropriate military service as being in strict compliance with the economic studies criteria and standards stated above shall be used in the LCCA. The Life-Cycle-Cost-In-Design (LCCID) program developed by the US Army Construction Engineering Laboratory (CERL) is acceptable to all services. This is available through CERL's agent, the BLAST Support Office, University of Illinois, Champaign, Illinois, telephone (217) 333-3977.

FOR THE CHIEF OF STAFF

CHARLES A. SIPPIAL, COL, USAF
Chief, Engineering Division
Directorate of Engineering & Services