BUILDING ENERGY MANAGEMENT AND REDESIGN RETROFIT (BEMARR)

BUILDING SURVEY GUIDELINES

CONTENTS PAGE

Figures

1. GENERAL

1.01 This section sets forth building survey guidelines for use by survey teams in conducting a building survey and retrofit program. The material used in this section has been extracted from the *Building Energy Management and Redesign Retrofit (BEMARR) Manual* issued with GL-76-10-77 (EL-4857), dated October 7, 1976.

1.02 Whenever this section is reissued, the reason(s) for reissue will be listed in this paragraph.

1.03 To accomplish a successful building survey and retrofit program, considerable effort is required in performing the following six steps. (Each step is discussed in further detail in the remainder of this section.)

(a) Establish a survey team of reliable people.

(b) Gather data for building to be surveyed.

(c) Conduct survey and identify potential energy projects.

(d) Conduct engineering studies and document findings.

(e) Take action to implement economically feasible items.

(f) Evaluate results and compare estimates.

1.04 Exhibits of survey forms are provided within this section for use by survey teams. These forms are extensive and can be modified to meet local conditions. The survey forms located at the end of this section are grouped into the following five parts:

(a) ***Part A—Energy Profile and Results Data:*** Provides a monthly review of energy consumption for the building before and after the retrofit. This part also serves as an executive summary of the program's results. (See Fig. 1.)

(b) ***Part B—Presurvey Data:*** Provides for information gathered and needed before conducting the survey. (See Fig. 2.)

(c) ***Part C—Load Analysis and U-Factor:*** Provides for collecting load information on telephone and building equipment; provides for documenting design and optimum U-factors. (See Fig. 3.)

(d) Part D—Field Survey and Tests (This part is extensive.): Provides Field Test and Diagnosis Procedures for heating, refrigeration, and air-handling equipment. This section should be split, with copies made of equipment test sheets as appropriate. (See Fig. 4.)

(e) ***Part E—Survey Results:*** Provides a format for recording study results for all projects, categorized by No/Low Cost, Medium Cost, or Engineering Study of Cost Items. (See Fig. 5 through 7.)

(f) Form BS-752 is an engineering checklist for Building Energy Management (BEM) that may be used during energy surveys. (See Fig. 8.)

2. ESTABLISHING THE SURVEY TEAM—STEP ONE

2.01 The first step is most important in conducting a building survey and retrofit program. The success of the program depends primarily on assignment of qualified people to the project and their resulting teamwork.

2.02 Ideally, the team should consist of Building Engineers and Building Operations Managers. Although this team will vary among local organizations and in the use of consultants, a model team consists of three or four members, including the following personnel:

1— Mechanical Engineer to analyze heating, ventilation, and air conditioning systems.

1— Electrical Engineer to analyze electrical consumption, electrical systems, and operation.

1— Field Operations Manager to analyze operating and maintenance procedures and to provide "hands-on" experience.

1— Staff Operations Manager to provide analytical, procedural, and operations expertise. Companies that do not have a staff organization may wish to include another field manager or engineer.

2.03 A representative from the Switching Systems staff should be appointed to advise and provide the coordination with the field switching personnel in modifications that will be made to building systems supporting telephone equipment.

2.04 The team should work under a District Building Engineer and a District Building Operations Supervisor. District Managers will be responsible for communicating with upper management, other departments, and the Energy Coordinator.

2.05 Team operating guidelines for varying sizes of buildings are as follows:

(a) ***Buildings 100,000 Square Feet and Larger:*** All four people function as a single team to survey and study the building. If a consultant is used, at least one engineer and one operations person should work with the consultant.

(b) ***Buildings Greater Than 25,000 Square Feet, But Less Than 100,000 Square Feet:*** A number of buildings should be studied simultaneously by all four team members working in two 2-member teams composed of an engineer and an operations person. Each team should study a building individually and rely on the expertise of the other team for assistance in those fields not represented. If a consultant is used, an engineer and an operations person should work with the consultant.

(c) ***Buildings Less Than 25,000 Square Feet:*** These buildings will probably be the last studied. At this time, a level of expertise should be developed by each team member so that each can perform a survey by himself. Other team members should provide assistance as needed. Another approach might be for the entire team to study these buildings as groups, such as No. 1 and No. 2 Electronic Switching Systems (ESS) buildings. If this is done, each building should also be looked at individually because of variations that may exist.

2.06 Once established, the survey team must become knowledgeable of the opportunities available for energy conservation. The team should also develop a library of reference sources which will be of value during the project.

2.07 During initial meetings, it is important that team members develop a clear understanding of their responsibilities. Too often, committees meet periodically with no follow-up work because members are unaware of their responsibilities. At each meeting, clarify generalities into specific tasks for each member. Documentation of assignments and progress will help maintain commitments to the program and enable supervisors to gauge each member's performance.

3. GATHERING DATA—STEP TWO

3.01 Considerable data is required before conducting the survey. Sufficient time must be spent in this phase, or time will be wasted during the survey and study phases searching for the information.

PART A—ENERGY PROFILE AND RESULTS DATA

Building Energy Conservation Survey Form

3.02 Refer to Fig. 1 of the survey form. The data on this form provides a monthly review of energy consumed by the building under study for a 5-year period. This data is required for analyzing consumption patterns, establishing a conservation goal, and evaluating results upon completion of the program. The form also serves as an executive summary of program results. The following comments clarify this form:

(a) ***Building Identification, Total Square Footage, and Survey Team:*** These items are self-explanatory.

(b) ***Survey Date:*** This is the date the survey is conducted. ***Retrofit start*** and ***complete dates*** indicate the period during which modifications are made; the data for this period will show the gradual effects of the program. The ***Engineering Audit Date*** is the date the form is completed.

(c) ***Electricity, Fuel Oil, Other:*** The next section tracks three different sources of energy. The three listed may be changed depending upon the major energy sources used in the building. Space for recording consumption for 5 years is provided. The third year, the ***base year,*** is the 12 months before the start of the retrofit program. The first and second years are required for analyzing usage patterns. The fourth and fifth years are used to track consumption changes during and after retrofit. The months are self-explanatory as is the total line. The order of months may change depending upon when the survey is conducted. The ***DECEMBER RATE*** line is used to track the year-end energy rates. Entries should be cents per kilowatt hour (kWh) for electricity, cents per gallon for fuel oil, and dollars per 100,000 BTUs (therm) for other energy sources. This will show cost increases and is used for calculating savings.

(d) ***Survey and Retrofit Results:*** This part of the form provides a savings/cost summary. Savings should be calculated by comparing the first 12-month period after retrofit is completed to the 12-month period before starting the program. The savings/cost ratio summarizes the effectiveness of the program. It may be necessary to calculate savings if significant modifications (such as adding telephone equipment) are made to the building after retrofit. In place of the savings/cost ratio, an operating company may use rate of return, payback period, etc, depending upon the method selected for economic analysis.

PART B—PRESURVEY DATA

A. Item I — Building Occupancy

3.03 Refer to Fig. 2 of the survey form. This part identifies minimum operating time for equipment; when and how often heating, ventilating, and air conditioning (HVAC) equipment and lights can be turned off; start and stop times for equipment, etc.

B. Item II — Lighting

3.04 Refer to Fig. 2 of the survey form. This portion identifies changes in the lighting system that can be made to conserve energy. In addition to lowering lighting levels, establishing optimum on-off schedules and changing switching arrangements can save considerable energy.

C. Item III — Heating, Ventilating, and Air Conditioning Data

3.05 Refer to Fig. 2 of the survey form. This part gives an overview of the equipment in the building, how it operates, and how much energy it consumes. The proper evaluation of this equipment is critical because it offers the greatest opportunity for conservation.

D. Item IV — Miscellaneous

3.06 This category identifies other energy users and problem areas.

E. Item V — Building Future

3.07 Refer to Fig. 2 of the survey form. Future planning must be accurate to ensure that modifications to building systems are in concert with planning projected over the next few years. Fans that are oversized today may be required in 2 or 3 years for additional equipment. Data should be collected from Equipment Engineers and office planners for the next 10 years.

3.08 When systems have been designed for future telephone equipment growth, it may or may not be feasible to modify building equipment operation. Projected calling-volume growth and plans for additional equipment should be analyzed to determine the life of the modifications. Often, current loading of the telephone equipment may indicate it is feasible to reduce building equipment operation, but projected growth in usage may indicate that such modification is worthwhile for only 1 to 2 years. The expected annual savings should be compared to the cost of readjusting the systems and the time it is expected the cost will be incurred.

F. Item VI — Existing Energy Conservation Measures

3.09 Refer to Fig. 2 of the survey form. This action is required for two reasons. First, the energy team members are informed of changes made so that they are working with the latest information. Second, the information is used to evaluate the effectiveness of what has been accomplished for possible application in other buildings.

G. Item VII — Maintenance Check

3.10 Refer to Fig. 2 of the survey form. Before conducting the survey, inspect the entire HVAC system to assure that it is operating as designed. This inspection is imperative for fine-tuning the system to meet actual load conditions. For example, one company reported that only two-thirds of the refrigeration equipment was required after punching its condenser tubes and cleaning the water piping in the air conditioning system. A 100-ton unit was taken off-line.

3.11 The survey should be performed with the equipment in good operating condition. Proper functioning of controls, clean heat-transfer surfaces, clean filters, etc, should be verified before survey. However, it will not be necessary to perform large scale maintenance unless equipment has been neglected.

H. Review Drawings, Specifications, and Other Information

3.12 This information can be obtained from local operating personnel responsible for the building. After obtaining information, the survey team members should obtain a copy of the architectural, mechanical, and electrical as-built drawings and specifications to familiarize themselves with building configuration and design, electrical and mechanical systems layout, operation, and control. If such drawings are not available, it may be necessary to develop single-line diagrams of existing mechanical and electrical systems. The survey team reviews all written maintenance and operating procedures. Also, the team obtains utility rate schedules and local weather data to use during the engineering study.

4. CONDUCTING THE SURVEY—STEP THREE

4.01 After team members have familiarized themselves with building design, operation, control, occupancy, and energy usage, they are prepared to conduct the survey.

4.02 There is no step-by-step process in conducting a survey. Because the building is a system composed of a structure, internal systems, and occupancy, changes in one area will affect one or more other areas. The building must be examined as a single system recognizing many alternatives. A competent team, familiar with the building and its operation, is able to make the necessary judgments to determine which projects receive priority.

PART C—LOAD ANALYSIS AND U-FACTOR

Sequence for Conducting Survey

4.03 As a general guide, this sequence for examining a building is offered:

(a) To analyze an internal load, refer to Fig. 3 of the survey form. The intent of this phase of the building survey is to determine whether any modifications can be made to building equipment without affecting the telephone equipment environment. In telephone areas where building equipment has been overdesigned because equipment loads were overstated or future loads have not materialized, energy reductions can be accomplished by reducing fan speeds; cycling fans; shutting off excess refrigeration equipment; and, in some electromechanical areas, by shutting fans off during unoccupied hours. Similar tests should also be conducted for office areas. In central office equipment areas, the 24-hour ampere readings are available from Central Office Power Engineers to enable a determination of the internal heat load of the equipment. The utility company bills should also be reviewed to determine the total power requirements for the building.

(b) When conducting these tests, the rate of temperature rise should not exceed 5°F per hour and the maximum temperature should not exceed 85°F. The 5°F per hour has been determined by Bell Laboratories to be an acceptable rate of rise which would not confuse test results by causing telephone equipment troubles.

(c) When turning off equipment serving telephone areas, the rate of temperature change is monitored in the hottest spots identified by local switching people. In electromechanical offices, the measurements should be taken during the busy-hour period. In electronic offices, this can be done at any time as the equipment load is constant. Rates of temperature change should be closely watched, recognizing that temperatures will rise fast in the beginning and then level off or even recede as the building mass absorbs the space heat. During this time, Switching Systems personnel should look for marginal circuit packs in electronic offices and replace them.

(d) Air-handling systems can then be adjusted to obtain the desired temperature in the space.

(e) Meeting with Switching Systems people will be required in this phase of the survey. Discussions are first held with the Switching Systems staff group. The group then coordinates with its field managers. For each building, the survey team should hold a joint meeting with Switching and Building Managers before conducting the tests.

PART D—FIELD SURVEY AND TESTS

4.04 Refer to Items I and II, Fig. 4, of the survey form.

(a) ***Building Envelope:*** Obtain the actual U-factor for the building. The optimum U-factor is determined as explained in Section 760-310-120*, Building Envelope. By comparing the actual to the optimum, it can be determined whether any changes can or should be made in the building envelope.

Note: If feasible, modifications are made to the envelope first as these will affect the HVAC operation. At this time, air tightness and transmission characteristics should be checked and analyzed for improvement.

(b) ***Building Occupancy:*** Refer to Item II, Fig. 4, of the survey form. Changes in occupancy—either previously planned or initiated to save energy—can affect HVAC and lighting systems. Modify occupancy procedures for energy conservation where possible.

(c) ***Lighting Systems:*** Refer to Item II, Fig. 4, of the survey form. Changes in lighting level and control can result from occupancy changes and will affect HVAC operation. Examine all existing systems for changes to conserve energy.

4.05 Refer to Item III, Fig. 4, of the survey form—***Air-Handling Equipment — Field Test and Diagnosis.*** Because changes in fan operation can result in significant savings, each fan system should be carefully analyzed for reduction operation. Item III of the survey form provides a means for documenting fan system modifications. In many cases, changes in fan operation can be performed more easily on a trial and error basis rather than by detailed calculations. When performing such trials, it is necessary to use recording hygro-thermographs in the space affected. Temporary controls can be provided, and space changes can be monitored to determine the most efficient operation. After this determination is made, permanent control changes can then be made.

4.06 Refer to Item IV, Fig. 4, of the survey form—***Heating and Air Conditioning.*** Because changes in equipment operation can result in significant savings, each component of the heating and air conditioning equipment should be carefully analyzed for improvement in operational efficiency. Item IV of the survey form provides a means of documenting the equipment operating characteristics as well as proposed changes to heating and air conditioning systems. For example, key items to look for are:

(a) Eliminate simultaneous heating and cooling of a room or a zone.

*Check Divisional Index 760 for availability.

(b) Reduce heating and cooling capacities to the minimum required.

(c) Revise systems to operate at or near optimum efficiency (includes pumping systems, fan systems, etc).

(d) Convert to variable volume operation where possible.

(e) Cool with outside air where possible.

(f) Reduce fan operation (to meet minimum heating and cooling requirements) by slowing down fans, cycling fans, and/or shutting fans off when not required.

(g) Eliminate return fans, using only supply fans where possible.

(h) Cut back ventilation and exhaust systems to minimum operation.

Modifying and fine-tuning HVAC equipment can account for 50 percent of the potential energy savings in a building. The survey team must be competent in building design and operations to make these changes.

4.07 ***Control Systems:*** After analyzing the potential modifications to the HVAC systems, changes to the control system should then be considered. In some instances, temporary changes to controls can be made to verify that proposed changes will work. It is vitally important that all changes to control settings and system changes be documented.

4.08 ***Distribution Systems:*** Modifications to water, steam, and air conditioning systems can now be considered to meet the reduced HVAC requirements efficiently.

4.09 ***Electrical Systems:*** Preliminary study can begin at any time on the building power profile and electrical systems. Permanent changes should not be made until all other system modifications have been completed, as these can affect power factor, demand profiles, etc.

4.10 ***Heat Recovery:*** After existing systems have been modified, examine the new operation for heat recovery potential.

A. Equipment Required for the Survey

4.11 In conducting the survey, the team should have the following equipment to monitor conditions during system adjustments and modifications:

(a) Ammeters—recording and instantaneous

(b) Thermometers—recording and instantaneous

(c) Water flow meters

(d) Voltmeters—recording and instantaneous

(e) Humidity meters—recording and instantaneous

(f) Static pressure gauges

(g) Tachometer

(h) Watt meter

(i) Manometer, air meter, or hot wire anemometer.

Note: If the equipment is not readily available, purchase or rent as determined by costs and the required rental period.

B. Walk-Through Survey

4.12 As indicated, a good in-depth survey cannot be accomplished by simply walking through the building; more effort is required. However, a walk-through and careful observation can uncover much. Figure 8 provides a checklist of energy conservation items that can be considered during either an in-depth or walk-through survey.

4.13 This checklist is available as Form B-752 (Fig. 8), and is designed for use in the Building Energy Management program. The use of this form is described in RL 82-02-106.

4.14 While the list provides many items to review, it is not necessarily complete. The team should carefully check for other energy conservation opportunities during each building survey.

C. Documentation and Analysis

4.15 During the survey, documentation of items will vary. To assist in the engineering studies, observe the following items when taking notes:

(a) Description of the potential energy conservation project.

(b) How will it contribute to reducing energy consumption?

(c) How much labor is required for implementation (estimate in dollars)?

(d) What materials are required for implementation (estimate in dollars)?

(e) How much energy could be saved (eg, turn off 6-horsepower motor for 70 hours per week)?

(f) Will the expenditure be capital or expense money?

(g) Is a contractor required or can work be performed using telephone employees?

(h) What further investigation is required?

4.16 When developing estimates for costs and savings, it is often difficult to predict such figures accurately. In these cases, a "gut" figure is better than no estimate. Such "gut feelings" usually provide ball park estimates on whether the project should be pursued further.

4.17 The survey team may find that several visits are required to collect data. In any thorough investigation, sufficient time must be spent to gather complete and accurate information.

4.18 Conduct the survey using the principles of value engineering. Since information is already published on this subject, personnel unfamiliar with the subject are referred to the *Value Engineering Guide and Value Engineering Workbook* published by the AT&T Building, Planning, and Design Group. For copies, contact your BSP/documentation coordinator.

5. CONDUCTING ENGINEERING STUDY—STEP FOUR

5.01 The purpose of the engineering study is to evaluate the feasibility—both technical and economical—of the items uncovered and to develop a plan for implementation. The techniques for conducting economic studies should already be part of the job knowledge of operating company personnel. Team members should be trained or an in-house expert should be made available to conduct studies and/or assist in areas where the team does not have expertise.

Engineering Study Guidelines

5.02 The following comments will help in conducting the studies:

(a) A consistent economic technique should be used so that comparisons can easily be made between projects.

(b) Cash flow should be a prime consideration in the decision to implement a project. For example, one company found that blocking up windows with insulation panels yielded a rate of return slightly less than required. However, this company was paying a significant cost penalty by replacing contract guard service with plant crafts people who were reassigned because of reduced work loads. An economic study indicated that using craft employees to block up windows was very advantageous to cash flow. Energy projects performed by your own people, without additional cash flow for overtime or new employees, should be carefully examined because the projects will save energy dollars flowing from the company.

(c) A project that is economically justified in one building should not require a repeat study unless circumstances indicate savings might be considerably less than indicated in the previous study.

(d) Use ***caution*** in calculating savings. Assure that each study takes into account operational changes that may result from other projects. For example, installing time clocks to turn on air conditioning equipment only during occupied hours may yield a substantial savings in reduced running time. If a study is made for an economizer or enthalpy system, then savings must be calculated by using the reduced running time of the system. This shows the need for a coordinated approach in determining the best way to conserve energy. When two or more different projects interface, each should be studied alone. The results determine which project has the highest payoff. That project is then used to establish the new operating conditions for evaluating other projects.

(e) When a project involves capital money, a determination of the annual charges should be made using only factors that apply. For example, if we consider the project of blocking up windows, one factor that does not apply is administration. A flat application of the total annual charge rate may rule out projects which in reality are economical.

PART E—SURVEY RESULTS

Format of Study Results

5.03 To expedite the benefits of the survey, all feasible items should be placed in one of the following three categories. (Refer to Fig. 5, 6, and 7 of the survey form.)

(a) ***No/Low Cost Items (Fig. 5):*** No/low cost items do not require an economic or technical analysis. Their effectiveness is either obvious or it has been supported by previous studies. The cost for implementation is low. These items should be referred to either the appropriate field supervisor or an engineer for immediate implementation. Examples include lowering lighting levels, installing weather stripping, pipe insulation, etc.

(b) ***Medium Cost Items (Fig 6):*** Medium cost items do not require an economical or technical study since their effectiveness has been established. However, they require expenditures of up to $1,000. Proper budget authorization should be obtained and implementation scheduled as soon as possible. Example: install time clocks to control package units serving office areas.

(c) ***Engineering Study of Cost Items (Fig. 7):*** Cost items in this category require detailed technical and economical analysis and substantial expenditures. The items should be ranked according to savings/cost ratio, rate of return, etc, which will enable discrete implementation of priority items within budget and/or force limitations.

5.04 There may be a need for a fourth category identified as trial projects. When the engineering analysis is extensive and the result uncertain, a trial installation may be easier and less expensive. Vendors may agree to a money-back guarantee for such installations. In this case, time would be better spent in determining an acceptable contract and a sound measurement technique for comparing before and after results.

6. TAKING ACTION—STEP FIVE

6.01 The implementation of design changes should follow local procedures. However, circumstances may justify a different course of action. The following ideas, which may or may not be in accord with local procedures, are offered for consideration:

(a) Items listed under "No/Low Cost Items" and "Medium Cost Items" can be referred to the local operations manager when engineering design and/or involvement are not required. This will free the energy team to pursue more productive work. However, there should be a system for reporting costs and savings to the energy team.

(b) When the team is required for design and supervision of the work, judgment should be exercised in determining when and how much work will be done at a location. For example, in one building 50 percent of the work has a savings/cost ratio of 0.5 and higher, and 50 percent has a ratio between 0.15 and 0.5. If the higher payoff work has application elsewhere, the team may go to other buildings to complete the higher payoff items. While the team would have to return for the remaining items, this would ensure maximum payback at the beginning of the program.

Note: Because of geographical location and/or availability of resources, the team may elect to complete all work before moving to the next building. There are many alternatives, and some thought should be applied in determining the best course.

(c) Some companies have found it cheaper to hire contract help to perform modifications on a time and material basis. In place of preparing bid specifications and soliciting bids, the contractor works under the telephone company's or a consultant's supervision. Because of the savings, this procedure may be worthwhile. However, this procedure should be performed carefully with periodic bidding to ensure that it is more economical. Use only reputable contractors and obtain as-built drawings after completion of the work.

(d) When changes to building equipment operation may affect occupants, the team should first explain the changes to the occupants. It is far easier to gain acceptance and support before making the modifications.

(e) Budgets should be carefully prepared, and there should be sufficient monies for implementing economical projects.

7. EVALUATING RESULTS—STEP SIX

7.01 After the work is completed on a building, total costs are tabulated and energy usage is tracked for the next 12 months. A mechanized tracking system (ENERGY II) down to the building level is recommended. When telephone equipment additions or other changes affect energy consumption, estimates of savings should be developed. Energy usage is compared to the 12 months before start of the work. This is the bottom line and the only real measure of the program's success.

7.02 If results do not meet anticipated savings, the team should analyze each project to find the reason for the difference. This step is important because project analysis provides information on projects that are effective or ineffective and indicates the corrective action required. Analytical data will be a valuable tool for subsequent surveys.

PART A: ENERGY PROFILE AND RESULTS DATA

BUILDING ______________________ SURVEY TEAM: ____________ SURVEY DATE ________
TOTAL SQ FT ______ OFFICE ________ EQPT ________ ____________ RETROFIT START ________
BUILDING SERIAL # ______________ ____________ RETROFIT COMPLETE ________
____________ ENGRG AUDIT DATE ________

	ELECTRICTY (kWh) BASE AFTER RETROFIT					FUEL OIL (GALLONS) BASE AFTER RETROFIT					OTHER: NATURAL GAS, STEAM, CHILLED WATER (BTUs) BASE AFTER RETROFIT				
MONTH	19__	19__	19__	19__	19__	19__	19__	19__	19__	19__	19__	19__	19__	19__	19__
JANUARY															
FEBRUARY															
MARCH															
APRIL															
MAY															
JUNE															
JULY															
AUGUST															
SEPTEMBER															
OCTOBER															
NOVEMBER															
DECEMBER															
TOTAL															
DECEMBER RATE															

SURVEY AND RETROFIT RESULTS: ENERGY SAVINGS

SURVEY COSTS	$ ________	ELECTRICITY	________ kWh	____%	$______	$SAVINGS / $COST = ______
RETROFIT COSTS	$ ________	FUEL OIL	________ gal	____%	$______	
TOTAL COSTS	$ ________	OTHER	________ BTU	____%	$______	
		TOTAL	________ BOE	____%	$______	

Fig. 1—Survey Form—Energy Profile and Results Data

PART B: PRESURVEY DATA

BUILDING ______________ SURVEYED BY ______________ DATE ______________

I. BUILDING OCCUPANCY

FLOOR OR AREA	OCCUPANCY	WEEKDAY HOURS	WEEKEND/HOLIDAY HOURS

II. LIGHTING

A. Interior Lighting

FLOOR OR AREA	TYPE	FOOT-CANDLES	SWITCHING (BREAKER PANEL, WALL SW, CONTROL SW)

Fig. 2—Survey Data—Presurvey Data (Sheet 1 of 5)

II. LIGHTING (Contd)

B. Exterior Lighting

AREA	TYPE	SWITCHING (TIME CLOCK, PHOTOCELL, BREAKER PANEL, ETC)
____________	____________	______________________________
____________	____________	______________________________
____________	____________	______________________________

III. HEATING, VENTILATING, AND AIR CONDITIONING DATA

SYSTEM CAPACITY

Installed AC Tonnage____________________ CFM Total______________________________

No. of AC Compressors __________________ Total hp ______________________________

No. of Supply Fans______________________ Total hp ______________________________

No. of Return Fans______________________ Total hp ______________________________

No. of Chilled Water Pumps ______________ Total hp ______________________________

No. of Condenser Water Pumps____________ Total hp ______________________________

No. of Air-Cooled Condensers ____________ Total hp Fan Motors____________________

No. of Cooling Towers __________________ Total hp Fan Motors____________________

No. of Exhaust Fans_____________________ Total hp ______________________________

No. of Boilers _________________________ Total Capacity ____________________BTU/h

Steam or Hot Water?_____________________ Oil or Gas fired? ______________________

Electric Heat Capacity ________________kW

No. of Heating Hot Water Pumps __________ Total hp ______________________________

No. of Condensate Pumps ________________ Total hp ______________________________

Fig. 2—Survey Form—Presurvey Data (Sheet 2 of 5)

IV. MISCELLANEOUS: OTHER ENERGY USERS AND PROBLEM AREAS

AREA/EQUIPMENT	OPERATION/PROBLEM	SIZE, CAPACITY (BTU, kW HP)

V. BUILDING FUTURE (eg, Planned Additions, Central Office Equipment Changes and Additions, Changes in Occupancy)

AREA	CHANGE	ESTIMATED DATE

VI. EXISTING ENERGY CONVERSATION MEASURES

A. Building Structure (Insulation, Storm Windows, Glazing, etc)

Fig. 2—Survey Form—Presurvey Data (Sheet 3 of 5)

VI. EXISTING ENERGY CONSERVATION MEASURES (Contd)

B. Lighting (Lower Lighting Levels, Switching Changes, Fixture Changes, etc)

____

____

____

C. HVAC (Modifications, Changes, Operations, etc)

____

____

____

VII. MAINTENANCE CHECK

ITEM	MAINTENANCE ROUTINE	WHEN LAST MAINTAINED	PRESENT CONDITION
Filters			
Coils			
Spray Sections			
Fans			
Heat			
Exchangers			
Pumps			
Controls			

Fig. 2—Survey Form—Presurvey Data (Sheet 4 of 5)

VII: MAINTENANCE CHECK (Contd)

ITEM	MAINTENANCE ROUTINE	WHEN LAST MAINTAINED	PRESENT CONDITION
Heating	________	________	________
Plant	________	________	________
Air Conditioning	________	________	________
Plant	________	________	________
	________	________	________
Chemical	________	________	________
Treatment	________	________	________

Major Maintenance Items To Be Corrected ____

____

Fig. 2—Survey Form—Presurvey Data (Sheet 5 of 5)

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PART C: LOAD ANALYSIS AND U-FACTOR

BUILDING ______________ SURVEYED BY ______________ DATE ______________

I. TELEPHONE EQUIPMENT LOADS

FLOOR OR AREA	TYPE OF EQUIPMENT	VOLTAGE	CURRENT	WATTS/SQ FT PEAK	WATTS/SQ FT AVERAGE	DESIGN LOAD	FIELD TEST T°F START	FIELD TEST T°F FINISH	TIME

II. BUILDING EQUIPMENT LOADS

FLOOR OR AREA	TYPE OF EQUIPMENT	LOAD (kW)

Fig. 3—Survey Form—Load Analysis and U-Factor (Sheet 1 of 2)

III. U-FACTOR ANALYSIS

A. Design U-Factor

	U-FACTOR	AREA
Building	________	______
Walls	________	______
Roof	________	______
Total Structure	________	______

B. Optimum U-Factor

____

C. Remarks ____

____

____

____

Fig. 3—Survey Form—Load Analysis and U-Factor (Sheet 2 of 2)

PART D: FIELD SURVEY AND TESTS	
BUILDING________ SURVEYED BY________ DATE________	
I. BUILDING ENVELOPE	
ITEM	REMARKS
DOORS AND WINDOWS:	
Replace broken or cracked windows.	
Repair or add caulking or weatherstripping.	
Rehang misaligned doors and windows.	
Inspect and/or install automatic door closers.	
Inspect and/or add indoor and/or outdoor shading devices.	
Consider adding reflective and/or heat absorbing film.	
BUILDING STRUCTURE:	
Should anything be done to improve the U-Factor?	
Add/remove insulation.	
Block up windows.	
Caulk joints, cracks, and openings.	
Check wall and roof penetrations for air tightness.	
Check structure for damp roofing.	
OTHER:	
Use trees for shade and as a windbreaker.	
II. BUILDING OCCUPANCY AND LIGHTING SYSTEMS	
BUILDING OCCUPANCY:	
Change occupancy and/or schedules to conserve energy.	
Close off unused areas or rooms.	

Fig. 4—Survey Form—Field Survey and Tests (Sheet 1 of 19)

PART D: FIELD SURVEY AND TESTS (Contd)

BUILDING__________ SURVEYED BY__________ DATE__________

II. BUILDING OCCUPANCY AND LIGHTING SYSTEMS (Contd)

ITEM	REMARKS
Centralize after-hour working to reduce lighting and HVAC requirements.	
Place together people and/or equipment having similar lighting and/or HVAC requirements.	
LIGHTING SYSTEMS:	
Verify that lighting levels conform to reduced standards.	
Reduce lighting to a minimum in corridors and unoccupied areas.	
Provide switching for occasionally occupied areas and multipurpose areas.	
Check exterior lighting — levels and duration; use photocells or time clocks as appropriate.	
Check possibilities for changing to higher efficiency lighting — lamps and fixtures.	
Establish program to turn lights on only when and where they are needed.	
Disconnect unused ballasts.	
Replace continuous lighting in office areas with task-level lighting.	
Convert to lower wattage lamps where lighting levels are not critical.	
Use photocell switching when natural light is available.	

Fig. 4—Survey Form—Field Survey and Tests (Sheet 2 of 19)

PART D: FIELD SURVEY AND TESTS (Contd)

BUILDING________________ SURVEYED BY________________ DATE________________

II. BUILDING OCCUPANCY AND LIGHTING SYSTEMS (Contd)

ITEM	REMARKS
HOUSE SERVICE:	
Reduce lighting levels for after-hour cleaning; provide switching as required.	
Change cleaning personnel routines and/or schedules where possible.	
Convert to group relamping maintenance where feasible; delamp if possible.	

III. AIR-HANDLING EQUIPMENT — FIELD TEST AND DIAGNOSIS

SYSTEM LOCATION ________________

SERVES ________________

FAN NUMBER
OR IDENTIFICATION ________________

A. Visual Inspection

1. Outside air screen and louver condition: Clear _______ Clogged _______.
2. Apparatus casing or plenum condition: Heavy air leaks _______
   Medium _______ None _______.
3. Filters: Dirty _______ Clean _______.
4. Cooling coil: Dirty _______ Clean _______.
5. Heating coil: Dirty _______ Clean _______.
6. Canvas connection: Good _______ Bad _______ Leaking _______ Tight _______.
7. Fan vortex damper position________________.
8. Belts: Tight _______ Loose _______ Worn _______ Good _______.
   Position in drive: High _______ Center _______ Low _______.
9. Position of outside air damper at minimum: ________________.

Fig. 4—Survey Form—Field Survey and Tests (Sheet 3 of 19)

PART D: FIELD SURVEY AND TESTS (Contd)

BUILDING________________ SURVEYED BY________________ DATE________________

III. AIR-HANDLING EQUIPMENT FIELD — TEST AND DIAGNOSIS (Contd)

10. Designate: DX cooling coil _______ Chilled water cooling coil _______.

11. Designate: Steam heating coil _______ Duct furnace _______ Hot water coil _______.

12. Designate system: Variable air volume _______ Single zone _______

    Double duct _______ Multizone _______ Reheat _______

    Other_______.

13. Does the system have static-pressure dampers? Yes _______ No _______

14. Designate operating condition of the following dampers when system is on full cooling or economy cycle:

    (a) Static-pressure damper: Full cooling _______ Type control _______.

    (b) Return air damper: Full cooling _______ Economy cycle _______

    Type control _______.

    (c) Outside air damper: Full cooling _______ Economy cycle _______

    Type control _______.

    (d) Relief or exhaust air damper: Full cooling _______ Economy cycle _______

    Type control _______.

15. Does system have return air fan? Yes _______ No _______

16. Visually examine duct work and report the following:

    (a) Is duct work insulated? Yes _______ No _______ Interior _______

    Exterior _______

    (b) Are duct work seams taped? Yes _______ No _______

    (c) Is duct work leaking air? Yes _______ No _______ Heavy _______

    Medium _______ Light _______.

Fig. 4— Survey Form—Field Survey and Tests (Sheet 4 of 19)

PART D: FIELD SURVEY AND TESTS (Contd)

BUILDING________________ SURVEYED BY____________ DATE__________

III. AIR-HANDLING EQUIPMENT — FIELD AND DIAGNOSIS (Contd)

(d) Are duct connections to outlets tight? Yes _______ No _______

(e) Is duct work accessible to repair leaks? Yes _______ No _______

(f) Does system have manual balancing dampers at zones?

Yes _______ No _______

If not, how many would be required for balancing? _______

(g) Do supply outlets have dampers? Yes _______ No _______

(h) Do return outlets have dampers? Yes _______ No _______

(i) If not, how many required? Supply _______ Return _______

17. Energy Conservation Recommendations:

ITEM	REMARKS
Reduce outdoor air to the minimum required.	
Inspect all outside air dampers to ensure that they are as airtight as possible when closed; check position indicators for accuracy; repair as needed.	
Check filters and replacement schedules; change filter efficiency and replacement schedules as needed.	
Reduce exhaust air as practical.	
Consider shutdown of ventilation when the building is closed during evenings and weekends.	
Consider closing outdoor air dampers during first and last hour of occupancy when the air must be heated or cooled.	
Reduce toilet exhaust air volume to a minimum.	
Consider installing economizer/enthalpy controls to use outside air for cooling as much as possible.	

Fig. 4—Survey Form—Field Survey and Tests (Sheet 5 of 19)

PART D: FIELD SURVEY AND TESTS (Contd)

BUILDING________________ SURVEYED BY________________ DATE________________

III. AIR-HANDLING EQUIPMENT — FIELD TEST AND DIAGNOSIS (Contd)

ITEM	ORIGINAL DESIGN	FIELD DATA	PROPOSED DESIGN	FINAL OPERATING DATA
B. Field Measurements				
Outside Air Intake Louver:				
(a) Total Cubic Feet Per Minute				
(b) Pressure Drop Across				
(c) Size				
(d) Free Area				
Exhaust or Relief Air Louver:				
(a) Total Cubic Feet Per Minute				
(b) Pressure Drop				
(c) Size				
(d) Free Area				
Return Air Into Unit:				
(a) Total Cubic Feet Per Minute				
(b) Size				
Fan Static Pressure Readings:				
(a) Discharge SP				
(b) Suction SP				
(c) Total SP				
SP Drop Across Filters:				
(a) Inlet Side				
(b) Outlet Side				

Fig. 4—Survey Form—Field Survey and Tests (Sheet 6 of 19)

PART D: FIELD SURVEY AND TESTS (Contd)

BUILDING________________ SURVEYED BY________________ DATE________________

III. AIR-HANDLING EQUIPMENT — FIELD TEST AND DIAGNOSIS (Contd)

ITEM	ORIGINAL DESIGN	FIELD DATA	PROPOSED DESIGN	FINAL OPERATING DATA
SP Across Cooling Coil:				
(a) Inlet Side				
(b) Outlet Side				
SP Across Heating Coil:				
(a) Inlet Side				
(b) Outlet Side				
Temperature Readings at Full Cooling:				
(a) Outside Air Entering System °FDB/°FWB				
(b) Return Air Entering System °FDB/°FWB				
(c) Supply Air Discharge °FDB/°FWB				
Temperature Readings at Full Heating:				
(a) Outside Air Entering System °FDB/°FWB				
(b) Return Air Entering System °FDB/°FWB				
(c) Supply Air Discharge °FDB/°FWB				
Motor Drive Information:				
(a) Motor Horsepower (b) Rated Amperage (c) Running Amperage (d) Rated Voltage (e) Running Voltage (f) Rated RPM (g) Running RPM (h) Sheave Size (i) Shaft Size				

Fig. 4—Survey Form—Field Survey and Tests (Sheet 7 of 19)

PART D: FIELD SURVEY AND TESTS (Contd)

BUILDING______________________ SURVEYED BY______________ DATE______________

III. AIR-HANDLING EQUIPMENT — FIELD TEST AND DIAGNOSIS (Contd)

ITEM	ORIGINAL DESIGN	FIELD DATA	PROPOSED DESIGN	FINAL OPERATING DATA
Fan Drive Information:				
(a) Sheave Size				
(b) Running RPM				
(c) Shaft Size				
(d) Belt Size and Quantity				
Fan Information:				
(a) Manufacturer				
(b) Model No.				
(c) Serial No.				
(d) Blade Type				
Face Size:				
(a) Cooling Coil				
(b) Heating Coil				
Face Velocity:				
(a) Cooling Coil				
(b) Heating Coil				
List each outlet and test for velocity and cubic feet per minute; place system on full call for cooling; test outlets as is.				
Transverse each zone and list results; place system on full call for cooling.				

Fig. 4—Survey Form—Field Survey and Tests (Sheet 8 of 19)

PART D: FIELD SURVEY AND TESTS (Contd)

BUILDING______________________ SURVEYED BY______________ DATE______________

III. AIR-HANDLING EQUIPMENT — FIELD TESTS AND DIAGNOSIS (Contd)

Control System Check

1. Check each thermostat for calibration of all zones.
2. Check operation of damper motors or terminal device connected to thermostat.
3. Check settings of the following and compare to actual readings:
   (a) Hot plenum set at _______; readout______________
   (b) Cold plenum set at _______; readout______________
   (c) Mixed air plenum set at _______; readout______________
   (d) Outside reset set at _______; readout______________.
4. Read each zone area temperature as compared to thermostat setting.

IV. HEATING AND AIR CONDITIONING

HEATING SYSTEMS — FIELD TEST & DIAGNOSIS PROCEDURE

SYSTEM LOCATION ________________

SERVES ________________

A. Visual Inspection

1. Nomenclature of boiler:

Boiler identification________________________________

Manufacturer________________________________

Type: Steam_______ Hot Water_______

Fuel: Gas_______ Oil_______ Elec_______ Coal_______

Model No. ________________________________

Burner type: Power_______ Atmospheric_______

Burner manufacturer________________________________

Year boiler installed________________________________.

Fig. 4—Survey Form—Field Survey and Tests (Sheet 9 of 19)

PART D: FIELD SURVEY AND TESTS (Contd)

BUILDING________________ SURVEYED BY________________ DATE________________

IV. HEATING AND AIR CONDITIONING (Contd)

2. Check operation of operating controller, modulating controller, low-water cutoffs, water feeder, and zone control valves.

3. Is boiler shell leaking? Yes _______ No _______

4. Color of flame: Yellow _______ Blue _______.

5. General appearance of boiler: Good _______ Bad _______.

6. Nomenclature of hot water pump:

   Manufacturer ________________________________

   Type________________________________

   Model No.________________________________

   Impeller Size ________________________________.

7. Is the hot water pump:

   Leaking: Yes _______ No _______

   Vibrating: Yes _______ No _______

   Motor: Cool _______ Warm _______ Hot _______

   General Appearance: Good _______ Bad _______.

8. Insulation:

   Condition: Good _______ Bad _______

   Water Leaks: Yes _______ No _______

   Color Coded: Yes _______ No _______

   Flow Direction Indicated: Yes _______ No _______.

Fig. 4—Survey Form—Field Survey and Tests (Sheet 10 of 19)

PART D: FIELD SURVEY AND TESTS (Contd)

BUILDING______________ SURVEYED BY______________ DATE______________

IV. HEATING AND AIR CONDITIONING (Contd)

9. Radiators, convectors, etc:

   Condition: Good _______ Bad _______

   Water Leaks: Yes _______ No _______

   Control Valve: Manual _______ Auto _______ None _______

   Strainer: Clean _______ Dirty _______

   Steam Trap: Good _______ Bad _______

   Housing Damper: Yes _______ No _______.

10. Zone balancing valves:

    Position _______.

11. Condenser water feeder:

    Condition: Good _______ Bad _______

    Water Leaks: Yes _______ No _______.

12. Make layout of boiler system and code properly, or obtain set of plans if available. Mark location of boiler, pump, radiator, zone valves, thermostats, thermometers, outside sensors, etc.

B. Field Measurements

ITEM	ORIGINAL DESIGN	FIELD DATA	PROPOSED DESIGN	FINAL OPERATING DATA
Steam Boiler:				
(a) Rated Input				
(b) Rated Firing Rate				
(c) Measured Input				
(d) Combustion Efficiency				
(e) Condensate Return Temperature				
(f) Operating Pressure				

Fig. 4—Survey Form—Field Survey and Tests (Sheet 11 of 19)

PART D: FIELD SURVEY AND TESTS (Contd)

BUILDING__________ SURVEYED BY__________ DATE__________

IV. HEATING AND AIR CONDITIONING (Contd)

ITEM	ORIGINAL DESIGN	FIELD DATA	PROPOSED DESIGN	FINAL OPERATING DATA
Hot Water Boiler:				
(a) Rated Input				
(b) Rated Firing Rate				
(c) Measured Input				
(d) Combustion Efficiency				
(e) Inlet Temperature				
(f) Outlet Temperature				
(g) Operating Pressure				
Hot Water System:				
(a) Number of Zones				
(b) Temperature Into Each Zone				
(c) Return Temperature of Each Zone				
(d) GPM of Each Zone				
(e) Pressure Reading Into Each Zone				
(f) Pressure Reading From Each Zone				
(g) Number and EDR Rating of Each Radiator				
(h) Pipe Insulation Thickness				

Note: All zones must be calling for heating.

Fig. 4—Survey Form—Field Survey and Tests (Sheet 12 of 19)

PART D: FIELD SURVEY AND TESTS (Contd)

BUILDING_______________ SURVEYED BY_______________ DATE_______________

IV. HEATING AND AIR CONDITIONING (Contd)

ITEM	ORIGINAL DESIGN	FIELD DATA	PROPOSED DESIGN	FINAL OPERATING DATA
Heating Hot Water Pump:				
(a) Motor Horsepower				
(b) Rated Amperes				
(c) Running Amperes				
(d) Rated Voltage				
(e) Running Voltage				
(f) Phase				
(g) Suction Pressure				
(h) Discharge Pressure				
(i) Revolutions Per Minute				
(j) Impeller Size				
Steam System:				
(a) Number and EDR Rating of Each Radiator per Zone				
(b) Number of Zones				

Fig. 4—Survey Form—Field Survey and Tests (Sheet 13 of 19)

PART D: FIELD SURVEY AND TESTS (Contd)

BUILDING________________________ SURVEYED BY______________ DATE______________

IV. HEATING AND AIR CONDITIONING (Contd)

REFRIGERATION SYSTEM — FIELD TEST & DIAGNOSIS PROCEDURE

SYSTEM LOCATION ________________

SERVES ________________

A. Visual Inspection

1. Refrigeration identification________________________________.

   Nomenclature of chiller unit or compressor:

   Manufacturer _______

   Type _______

   Model No. _______

   Nominal Tons _______.

2. Chiller:

   Water Leaks: Yes _______ No _______

   Refrigerant Leaks: Yes _______ No _______

   View sight glass in refrigerant line (if installed): Yes _______ No _______

   Vibration: Yes _______ No _______

   General Appearance: Good _______ Bad _______

   Basic Strainer: Clean _______ Dirty _______.

3. Cooling tower identification ________________________________.

   Nomenclature of cooling tower:

   Manufacturer _______

   Type _______

   Model No. _______

   Nominal Tons _______.

Fig. 4—Survey Form—Field Survey and Tests (Sheet 14 of 19)

PART D: FIELD SURVEY AND TESTS (Contd)

BUILDING________________ SURVEYED BY________________ DATE________________

IV. HEATING AND AIR CONDITIONING (Contd)

4. Cooling Tower:

   Water Leaks: Yes _______ No _______

   Fill Condition: Good _______ Bad _______

   Water make up float operation: Yes _______ No _______

   Water Treatment: Yes _______ No _______.

5. Chilled water pump identification ____________________.

   Nomenclature of chilled water pump:

   Manufacturer _______

   Type _______

   Model No. _______

   Impeller Size _______.

6. Condenser water pump identification ____________________.

   Nomenclature of condenser water pump:

   Manufacturer _______

   Type _______

   Model No. _______

   Impeller Size _______.

7. Condenser and chilled water pumps:

   Leaking: Yes _______ No _______

   Vibrating: Yes _______ No _______

   Motor: Cool _______ Warm _______ Hot _______

   General Appearance: Good _______ Bad _______.

Fig. 4—Survey Form—Field Survey and Tests (Sheet 15 of 19)

PART D: FIELD SURVEY AND TESTS (Contd)

BUILDING____________________ SURVEYED BY____________ DATE__________

IV. HEATING AND AIR CONDITIONING (Contd)

8. Insulation:

   Condition: Good _______ Bad _______

   Water Leaks: Yes _______ No _______

   Color Coded: Yes _______ No _______

   Flow Direction Indicated: Yes _______ No _______.

9. Check operation of 2- or 3-way valves at coils, chillers, etc.

10. Inspect strainers: Clean _______ Dirty _______.

11. Examine all mechanical linkages to valves, etc, and report condition of same.

12. List all apparent malfunctions or conditions which would contribute to the malfunction of the present system; also list complaints.

13. Make layout of chilled and condenser water systems and code properly or obtain set of plans if available. Mark locations of chiller, pumps, cooling tower, balancing valves, thermostats, modulating valves, etc.

B. Field Measurements

ITEM	ORIGINAL DESIGN	FIELD DATA	PROPOSED DESIGN	FINAL OPERATING DATA
Chiller Unit:				
(a) Head Pressure				
(b) Suction Pressure				
(c) Suction Temperature				
(d) Type of Refrigerant				
(e) Oil Pressure				
(f) Motor Horsepower				

Note: All zones must be calling for full cooling.

Fig. 4—Survey Form—Field Survey and Tests (Sheet 16 of 19)

PART D: FIELD SURVEY AND TESTS (Contd)

BUILDING________________ SURVEYED BY________________ DATE________________

IV. HEATING AND AIR CONDITIONING (Contd)

ITEM	ORIGINAL DESIGN	FIELD DATA	PROPOSED DESIGN	FINAL OPERATING DATA
(g) Rated Amperes				
(h) Running Amperes				
(i) Rated Voltage				
(j) Running Voltage				
(k) Phase				
(l) Leaving Chilled Water Temperature				
(m) Entering Chilled Water Temperature				
(n) Inlet Condenser Water Temperature				
(o) Outlet Condenser Water Temperature				
(p) Chilled Water Gallons Per Minute				
(q) Condenser Water Gallons Per Minute				
(r) Pressure Reading at Inlet to Chiller				
(s) Pressure Reading at Outlet to Chiller				
(t) Pressure Reading at Inlet to Condenser				
(u) Pressure Reading at Outlet to Condenser				

Note: All zones must be calling for full cooling.

Fig. 4—Survey Form—Field Survey and Tests (Sheet 17 of 19)

PART D: FIELD SURVEY AND TESTS (Contd)

BUILDING__________ SURVEYED BY__________ DATE__________

IV. HEATING AND AIR CONDITIONING (Contd)

ITEM	ORIGINAL DESIGN	FIELD DATA	PROPOSED DESIGN	FINAL OPERATING DATA
Chilled Water Pump:				
(a) Motor Horsepower				
(b) Rated Amperes				
(c) Running Amperes				
(d) Rated Voltage and Phase				
(e) Running Voltage				
(f) Revolutions Per Minute				
(g) Suction Pressure				
(h) Discharge Pressure				
(i) Impeller Size				
Condenser Water Pump:				
(a) Motor Horsepower				
(b) Rated Amperes				
(c) Running Amperes				
(d) Rated Voltage and Phase				
(e) Running Voltage				
(f) Revolutions Per Minute				
(g) Suction Pressure				
(h) Discharge Pressure				
(i) Impeller Size				

Note: All zones must be calling for full cooling.

Fig. 4—Survey Form—Field Survey and Tests (Sheet 18 of 19)

PART D: FIELD SURVEY AND TESTS (Contd)

BUILDING__________ SURVEYED BY__________ DATE__________

IV. HEATING AND AIR CONDITIONING (Contd)

ITEM	ORIGINAL DESIGN	FIELD DATA	PROPOSED DESIGN	FINAL OPERATING DATA
Cooling Tower:				
(a) Outside °FDB				
(b) Outside °FWB				
(c) Tower Discharge °FDB				
(d) Tower Discharge °FWB				
(e) Entering Water Temperature				
(f) Inlet Pressure				
(g) Leaving Water Temperature				
(h) Fan Motor Horsepower				
(i) Number of Fans				
Piping Insulation Thickness For Chilled Water System				

Note: All zones must be calling for full cooling.

Fig. 4—Survey Form—Field Survey and Tests (Sheet 19 of 19)

PART E: SURVEY RESULTS

NO/LOW COST ITEMS

BUILDING ______________ REPORT BY ______________ DATE ______________

ITEM	PROJECT COSTS			SAVINGS DISCUSSED OR QUANTIFIED	SAVINGS ($) / COSTS ($)	REFERRED TO FOR COMPLETION	DATE COMPLETED	ACTUAL COST
	LABOR	MATERIALS	TOTAL					

Fig. 5—Survey Form—Survey Results—No/Low Cost Items

PART E: SURVEY RESULTS

MEDIUM COST ITEMS

BUILDING ______________________ REPORT BY ______________________ DATE ______________________

ITEM	PROJECT COSTS			SAVINGS DISCUSSED OR QUANTIFIED	SAVINGS ($) / COSTS ($)	REFERRED TO FOR COMPLETION	DATE COMPLETED	ACTUAL COST
	LABOR	MATERIALS	TOTAL					

Fig. 6—Survey Form—Survey Results—Medium Cost Items

PART E: SURVEY RESULTS

ENGINEERING STUDY OF COST ITEMS

BUILDING ______________ REPORT BY ______________ DATE ______________

ITEM	PROJECT COSTS			SAVINGS	ESTIMATED SAVINGS	SAVINGS ($) / COSTS ($)	DATE COMPLETED	ACTUAL	SAVINGS($) / COST($)
	LABOR	MATERIALS	TOTAL	DISCUSSION OF SAVINGS					

Fig. 7—Survey Form—Survey Results—Engineering Study of Cost Items

Bell System

Engineering — Building Energy Management Review

BS-752 (3-82)

Page 1 Of 9

Building	Floor

Check Items As Indicated, Status (Att., OK, N/A)

Item	Status	Location, Notes, Etc.
Heating And Cooling — General		
Simultaneous Heating And Cooling Eliminated?		
Heating And Cooling Reduced In Spaces Used Infrequently?		
Heating Reduced To 55°F In Office/Equipment Space During Unoccupied Hours? Heating To 65°F When Occupied?		
Mechanical Cooling Off During Cooling Season When Office Space Unoccupied? Use Mechanical Cooling Above 78°F When Occupied?		
Mechanical Cooling Used In Equipment Space To Maintain 80°F As Recommended In RL 80-10-230?		
Heating And Cooling In Office Space And Optimum Start Controls?		
Humidity Controls Disconnected Where Possible?		
Heating And Cooling Vents Closed Where Possible Such As In Lobbies, Corridors And Vestibules?		
Direct Ducting Of Outside Air For Combustion Air For Heating Plants?		
Boilers Shut Down In Central Office Equipment Space?		
Small Domestic Hot Water Heater Installed In Buildings Where Boiler Operated In Summer For Domestic Hot Water?		
Heating In Office Buildings Turned Off During The Last Hour Of Occupancy		
All Reheats Disconnected Where Possible?		
System Balanced To Minimize Overcooling Or Overheating?		
Supplementary Cooling Or Heating Added Where Needeo		
Centrifugal Chillers Optimized?		

FCC Item No. 85

Fig. 8—Form BS-752—Engineering—Building Energy Management Review (Sheet 1 of 9)

Item	Status	Location, Notes, Etc.
Condenser And Chilled Water Balanced To Load?		
Multi-Chiller Installations Sequenced To Operate First Chiller At Maximum Capacity?		
Reduce Use Of Heat Reclaim Chillers For Cooling Only?		
Heat Reclaim Chillers Replaced With Standard Centrifugals In Building With Little Internal Heat Load?		
Ammeters Installed On Centrifugal Chillers?		
Chiller Plant Shut Down Where Possible When Outdoor Air Can Provide Cooling?		
Condenser Water Economizer Installed (Strainer Cycle)?		
Air Handling Equipment		
Fan Speeds Reduced To Match Load?		
Return Fans Removed Or Operated On Opening Of Outside Air Damper?		
Bypass Ducts And Dampers Installed Where Return Fans Are Shut Down?		
Fans Under Wide Band Temperature Operation?		
Outside Air Quantities Reduced To Minimum Required: $\% \text{ O.A.} = \frac{{}^{\circ}\text{F RA} - {}^{\circ}\text{F MA}}{{}^{\circ}\text{F RA} - {}^{\circ}\text{F OA}}$		
Air Economizer Cycles Installed?		
Parallel Blade Dampers Replaced With Opposed Blade Dampers?		
Fans Shut Down During Unoccupied Periods?		
Toilet Ventilation Fans Exhausting Excessive Amounts Of Air?		
Single Zone Systems		
Supply Air Temperatures Raised During The Cooling Season And Lowered During The Heating Season?		
Cooling Coil Being Used For Both Heating And Cooling Where Hot Water Is Used?		

Fig. 8—Form BS-752—Engineering—Building Energy Management Review (Sheet 2 of 9)

Item	Status	Location, Notes, Etc.
System Converted To Variable Volume?		
Constant Volume Systems		
Airflow Reduced To Satisfactory Minimum Amount?		
System Converted To Variable (Step Controlled) Volume?		
Fan Coil Systems		
Air Flow Reduced To Minimally Satisfactory Levels?		
Chilled And Hot Water Flows Balanced To Minimally Satisfactory Levels?		
Fans Shut Down When Heating And Cooling Loads Are Minimal, Enabling Coil To Act As A Connector?.		
Interlocks Installed To Prevent Simultaneous Heating And Cooling?		
Self Contained Systems		
Centralized Automatic Shutoff And Manual Override Controls Installed?		
Units Replaced With Air-To-Air Heat Pumps Or Similar Units Having A Higher Equivalent Efficiency Rating?		
Induction Systems		
Primary Air Volume Set to Minimum Required?		
Nozzles Inspected To Determine If Orifices Have Become Enlarged?		
Induction Heating And Cooling Set To Minimum Acceptable Levels?		
Temperature Of Heating And Cooling Water Rescheduled According To Load?		
Simultaneous Heating And Cooling In Any Zone Avoided?		
Secondary Water Flow During Minimum Heating And Cooling Periods Reduced By Pump Throttling Or By Operating One Pump?		
Variable Air Volume Systems		

Fig. 8—Form BS-752—Engineering—Building Energy Management Review (Sheet 3 of 9)

Item	Status	Location, Notes, Etc.
Volume Of Air Handled Reduced To Minimally Satisfactory Level?		
Hot Water Temperature Lowered And Chilled Water Temperature Raised To Meet Space Requirements?		
Air Supply Temperature Raised To Allow VAV Box Serving The Space With Most Extreme Load To Open Fully?		
Static Pressure Controls Considered For More Effective Regulation Of Pressure Bypass Dampers?		
Fan Inlet Damper Control Systems Installed?		
Dual-Duct Systems		
Hot Deck Temperature Lowered And Cold Deck Raised?		
Airflow To All Boxes Reduced To Minimally Acceptable Levels?		
Cold Ducts Closed Off And Cooling System Shut Down When No Cooling Loads Are Present?		
Hot Deck Reset To Heating Loads And Operated As A Single-Duct System?		
System Converted To Variable Volume?		
Multizone Systems		
Hot Deck Temperatures Reduced And Cold Deck Temperatures Increased?		
Demand Reset Controls To Regulated Hot And Cold Deck Temperatures Installed?		
Systems Serving Interior Zones Converted To Variable Volume?		
Terminal Reheat System		
Air Volume Reduced To Minimally Satisfactory Levels?		
Reheat Coils De-Energized Or Shut Off And Chilled Water Temperature Raised In Summer Months.		
Water Temperature And Flow Lowered To Reheat Coils?		
Systems Converted To Variable Volume?		

Fig. 8—Form BS-752—Engineering—Building Energy Management Review (Sheet 4 of 9)

Page 5 Of 9

Item	Status	Location, Notes, Etc.
Control Systems		
Controls Adjusted To Prevent Simultaneous Heating And Cooling?		
Controls Added To Enable Complete Shut Down Of Air And Water To Unoccupied Space?		
Thermostats Relocated From Near Or On Outside Walls, Areas Seldom Used, Or Areas Subject To Outside Drafts?		
Thermostats Protected By Tamper-Proof Guards.		
Reheats Disconnected Where Possible?		
Humidity Controls Eliminated Where Possible?		
Thermostats Installed To Control Heating Equipment Where None Exist?		
Staged Controls On Electric Heating Coils?		
HVAC Systems Under Wide Band Temperature Operation? (SR 80-09-019)		
Night Set-Back Controls Installed.		
Time Clocks Installed To Turn Off Heating And Cooling Systems During Unoccupied Periods?		
Computerized Or Microprocessor Energy Management Controls Installed?		
Distribution Systems And Pumping Water Systems		
Insulation Added Or Installed On All Heating And Chilled Water Piping?		
Fine Mesh Strainer Baskets Replaced With Those With Largest Practical Openings?		
Impellers Trimmed To Actual Size Required On Pump Curve?		
Flow Measurement Instrumentation Installed Where None Existed For Better Control?		
Undersized Valves, Filters And Pipe Sections Replaced?		
System Balanced For Minimum Temperature And Water Flow?		

Fig. 8—Form BS-752—Engineering—Building Energy Management Review (Sheet 5 of 9)

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Item	Status	Location, Notes, Etc.
Variable Speed Drive Pumps Considered?		
Steam Systems		
Insulation Added Or Installed On All Mains, Risers, Branches Economizers, Water Heaters, And Condensate Receiver Tanks?		
Additional Shut-Off Valves Installed For Better Zone Control?		
Instrumentation Added For Better Control?		
Air Systems		
Insulation Added Or Installed On All Duct Work In Non-Conditioned Spaces?		
Duct Fittings And Sections Imposing Resistance Replaced?		
High Resistance Inlets And Outlets Replaced?		
Air Volume Reduced To Minimum Acceptable Levels By Reduction Of Fan Speed?		
Fan Motors Replaced With Smaller, High Efficiency Types?		
Heat Wheels, Pipe Systems, Evaporative Coolers, Rotary Coolers Installed?		
Electrical		
Voltage Checked For Low And High Conditions And Corrected?		
Building Being Billed On Correct Rate Schedule?		
Building Power Factor Checked And Corrected If Economical?		
Motors Checked For Proper Size?		
Building Demand Checked And An Automated Load Shed Program Installed?		
Distribution Analyzed For Unbalanced Loads?		
Exterior Transformer Banks Shaded Where Possible?		

Fig. 8—Form BS-752—Engineering—Building Energy Management Review (Sheet 6 of 9)

Item	Status	Location, Notes, Etc.
Transformer Banks Ventilated To Keep Them Cool?		
Unloaded Transformers De-Energized?		
Outside And Parking Lot Lighting Replaced With Hi-Pressure Sodium? Timers And/Or Photo Cell Control?		
Incandescent Bulbs Replaced With Fluorescent Fixtures?		
Data Speed 40 And Office Equipment Shut Down After Hours?		
Individual Fans, Heaters, etc., Not Allowed?		
Soldering Irons Turned Off During Non-Use Periods?		
Building Delamping Completed? Additional Opportunities?		
Light Switching Flexibility To Use Daylighting?		
Infiltration — Transmission		
Windows, Doors, Etc., Weather-Stripped?		
Window Film Or Screens Installed On Windows?		
Garage And Work Center Doors Gasketed And On Automatic Eye Control?		
Broken And Cracked Windows Repaired?		
Caulking Around Windows And Doors Done?		
Indoor Shading Installed And Used?		
Computer Rooms		
All Infiltration-Transmission Eliminated?		
Temperature Controls Set As Recommended By Manufacturers As Outlined In RL 80-03-360 And BSP 760-250-150?		
Humidity Limits Set At Manufacturers Recommended Maximum And Minimum Set Points (BSP 760-250-150)?		

Fig. 8—Form BS-752—Engineering—Building Energy Management Review (Sheet 7 of 9)

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Item	Status	Location, Notes, Etc.
UP Systems Temperature Controls Set As Recommended By SL 80-09-019?		
HVAC Systems Designed With Future In Mind But Installed To Handle Present Load?		
Food Service Facilities		
Cooking Equipment Preheated Just Before Use?		
Equipment Turned Off During Slack Periods?		
Full Production Capacity Used?		
Correct Selection Of Proper Equipment For Cooking Job?		
Equipment Utilized And Maintained As Recommended By Manufacturer?		
Equipment Kept Clean?		
Refrigeration Equipment, Cabinets And Cases Properly Closed?		
Kitchen Ventilation Systems Properly Sized According To Type Of Food As Recommended By Law?		
Ventilation Fans On Time Clocks?		
Booster Water Heater Installed?		
Separate Hot Water Heater Installed? Time Clock Control?		
Other Considerations		

Fig. 8—Form BS-752—Engineering—Building Energy Management Review (Sheet 8 of 9)

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Item	Status	Location, Notes, Etc.

Fig. 8—Form BS-752—Engineering—Building Energy Management Review (Sheet 9 of 9)