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VireCon, INC.

ENERGY CONSULTANTS
HVAC SPECIALISTS


FINAL REPORT
~~MARCH, 1991~~
February 28, 1992
VOLUME II

# ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)
# LAUNDRY PLANT STUDY
# FORT LEONARD WOOD, MISSOURI

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
KANSAS CITY DISTRICT
CONTRACT NO. DACA41-89-0-0007




MAIN STREET / KANSAS CITY, MISSOURI 64108 / (816) 842-9225

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

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Marie Wakefield,
Librarian Engineering

ViroCon, INC.

February 28, 1992

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700 Federal Building - Room 629
Kansas City, Missouri 64106-2896

Attn: CEMRK-ED-MF/Mr. Robert Miller

Re: Contract # DACA41-89-D-0007
EEAP Laundry Plant Final Submittal (March 1991)
Replacement Pages

Gentlemen:

The attached pages incorporate final review comments corrections. These individual pages should replace the like numbered pages in the Final Report dated March 1991.

We are transmitting with a copy of this letter a total of seven sets of pages IV-3, II-22, IV-4A, IV-4B, IV-7A, IV-55, IV-56, IV-61A, IV-61B, IV-67, IV-67A, IV-68, IV-73, IV-73A, IV-73B, and IV-74 in accordance with the following distribution schedule:

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Ft. Monroe, VA 23351

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Ft. Leonard Wood - Building #2205
Attn: ATZT-CS-EC/Deshurly
Ft. Leonard Wood, Missouri

Sincerely,

VIROCON, INC.

Paul P. Apprill

Paul P. Apprill, P.E.

PPA:sse

TABLE OF CONTENTS

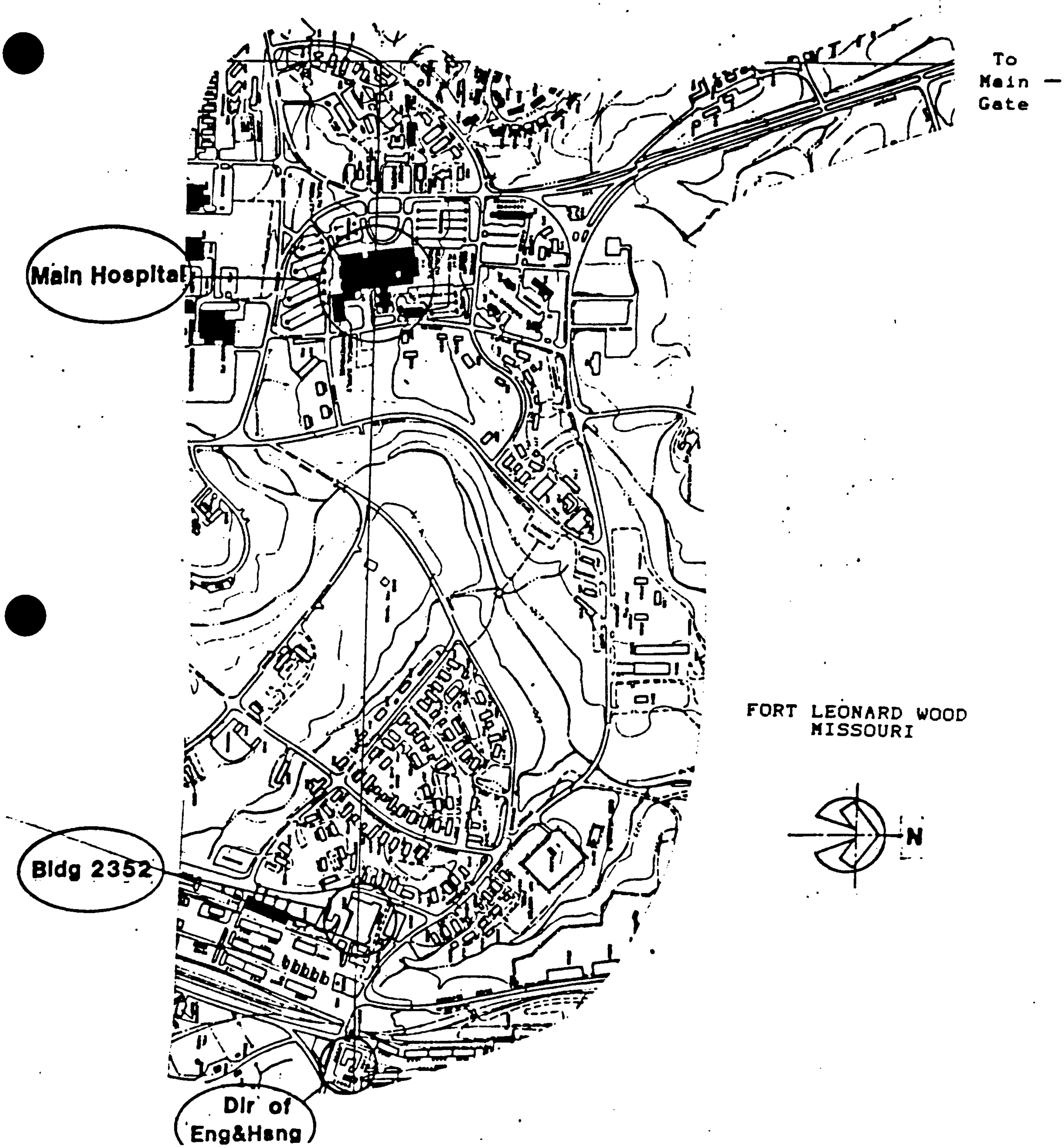
# I PROJECT OVERVIEW

## A FACILITY DESCRIPTION

The Fort Leonard Wood Laundry Plant is located in Building 2352 which is situated in the Northeast portion of Main Post. Building 2352 has approximately 48,000 square feet of floor space which contains various types of laundry and dry cleaning process equipment. The facility provides service to the Post Hospital and Army training units. The facility also provides service to individuals on a piece rate basis.

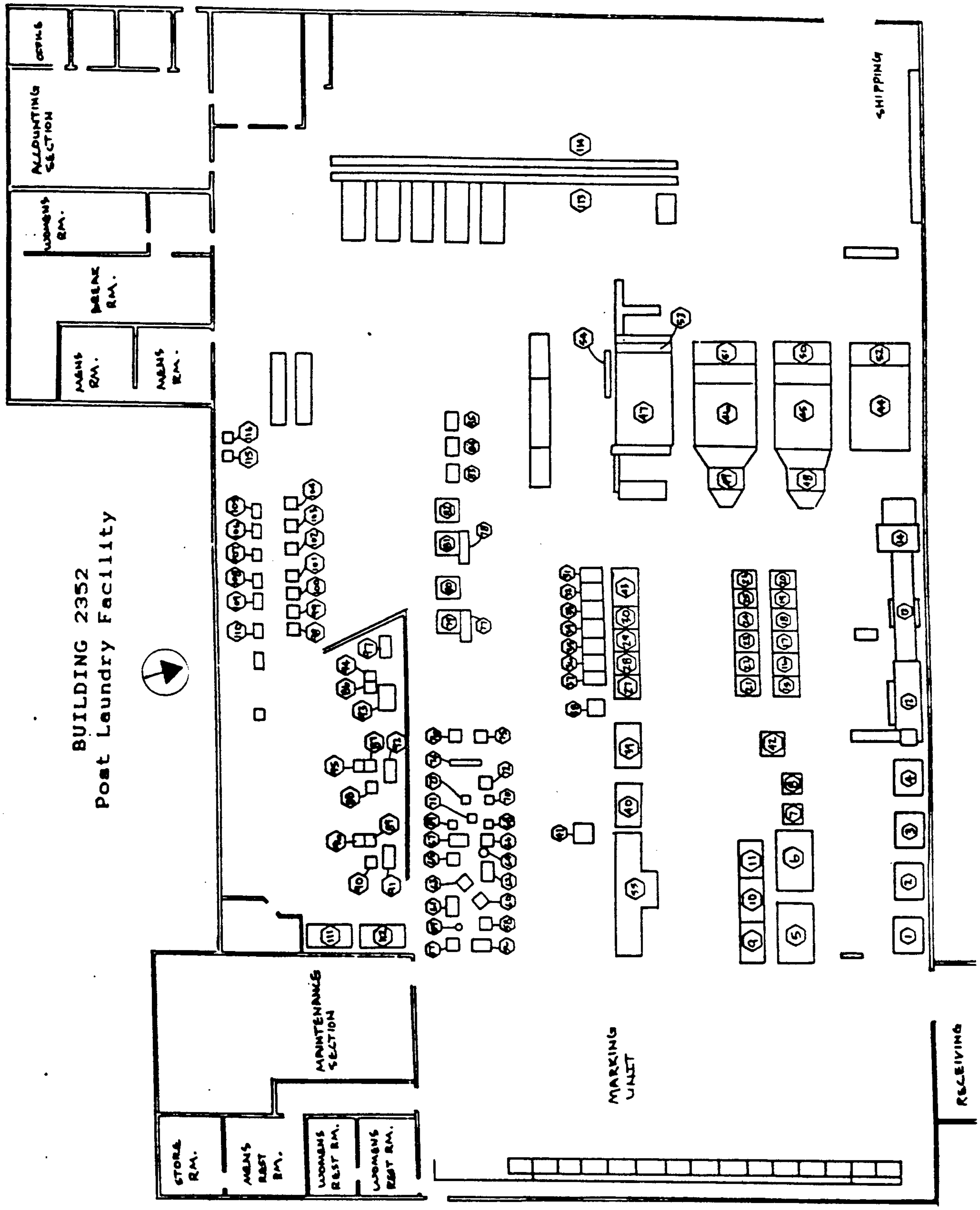
Building 2352 is heated with steam unit heaters. The building has no cooling except for window air conditioners serving the accounting area. The plant area has ventilation fans to provide air circulation during the cooling season.

The laundry plant receives steam and hot water from the Boiler Plant located Building 2351. The steam is used for building heating and for process requirements of the laundry equipment. The hot water is used by the laundry plant's washing machines. In addition to the steam and hot water supplied from the boiler plant, the laundry facility also has some gas-fired dryers which use LPG as a source of heating energy.



To
Main
Gate
Main Hospital
Bldg 2352
Dir of
Eng&Hsng
FORT LEONARD WOOD
MISSOURI
N

# BUILDING 2352
## Post Laundry Facility



## B PURPOSE OF THE STUDY

The purpose of this energy engineering analysis program (EEAP), Laundry Plant Study at Ft. Leonard Wood, Missouri is to develop energy saving type projects for funding through the energy conservation investment program (ECIP) or other applicable funding source.

## C SCOPE OF WORK

The following outlines the tasks performed in this study. The complete scope of work is included in Appendix G of this report.

1. Review of previously completed energy engineering analysis program (EEAP) studies applicable to the laundry facilities.

2. Perform a detailed survey of the laundry facility and associated energy using equipment.

3. Perform a complete energy audit and analysis of the laundry facilities.

4. Identify energy conservation opportunities including low cost/no cost items.

5. Provide complete programming and implementation documentation for all recommended ECO's.

6. Prepare a comprehensive report documenting the work accomplished and the results of the study.

## D. ENERGY CONSERVATION OPPORTUNITIES (ECO'S)

Contract Annex A, ENERGY CONSERVATION OPPORTUNITIES, provides a minimum list of ECO's to be evaluated under this contract. A copy of Annex A follows:

**ANNEX A**
**ENERGY CONSERVATION OPPORTUNITIES**
**LAUNDRY STUDY**
**FORT LEONARD WOOD, MISSOURI**

1. Insulation (wall, roof, pipe, duct, etc.)
2. Insulated glass or double glazed windows
3. Weather stripping & caulking
4. Solar films
5. Vestibules
6. Reduction of glass area
7. Shutdown energy to hot water heaters or modify controls
8. Energy conserving fluorescent lamps and ballasts
9. Reduce lighting levels
10. Replace incandescent lighting
11. Use more efficient lighting source
12. Infrared heaters
13. Heat reclaim from laundry equipment
14. Heat destratification
15. Heat recovery from laundry wash water
16. Booster heaters at major hot water users
17. Lower processing hot water temperature
18. Make HVAC operations more efficient
19. Steam traps (size, operation, type)
20. Optimize laundry facilities operation (space utilization, more efficient equipment-operational procedures)

21. Use air curtains/plastic strips at personnel entrances

22. Dryers equipped with temperature sensor located on discharge duct. Sensor to provide information to stop heating during drying cycle at the most energy efficient point.

23. Recycling of rinse water for a following wash cycle

24. Equipping dryer exhaust with heat exchanger for preheating incoming air to dryer

25. Verify that supply steam and condensate system is functioning in the most efficient manner

26. Utilization of high temperature, oil heated processes rather than steam

27. Use of cold water laundering

28. Waste heat recovery

29. Efficiency of compressed air system

30. Thermal storage

31. Shut off steam supply during non use hours

E. ENERGY CONSERVATION OPPORTUNITIES NOT ANALYZED

Of the 31 ECO's listed in Contract Annex A, 15 were eliminated from consideration prior to any calculation of potential energy saving.

* ECO #2 - identifies insulated glass or double glazed windows as an ECO. All windows have been replaced in a recent building renovation and are double glazed. Therefore this item was not evaluated.

* ECO #4 - identifies solar films as an ECO. The building is not air conditioned and therefore solar films were not evaluated.

* ECO #5 - identifies vestibules as an ECO. Vestibules are in place at existing primary entrances and therefore were not evaluated.

* ECO's #9, #10 & #11 - identify conservation opportunities as related to building lighting. The facility has only one incandescent fixture and the remaining lighting consists of standard suspended fluorescent fixtures. Therefore, all potential conservation measures related to building lighting are addressed in ECO #8 titled "Lighting Modifications".

* ECO #13 - identifies heat reclaim from laundry equipment. The laundry washers and dryers represent the process equipment most likely to benefit from heat reclaim. Heat reclaim for washers is addressed in ECO's 15 and 15A. Heat reclaim for dryers is addressed in ECO's 24 and 24A.

* ECO #16 - identifies the use of booster heaters for major hot water users. Booster heaters are all ready in place at the laundry facility.

* ECO #18 - addresses improved efficiency for HVAC systems. The laundry facility generates a great deal of heat from process equipment and therefore the building heating system is relatively small and simplistic. The facility is not air conditioned. Due to the nature of the existing HVAC systems, there is little potential for conservation in this area.

* ECO #22 - addresses conservation of energy by using sensors in dryer discharges ducts to control drying cycles. This feature exists in those dryers used in ECO's 20A and 20B.

* ECO #25 (steam & condensate efficiency) - the existing steam and condensate system is functioning efficiently and this ECO was not evaluated.

* ECO #28 (waste heat recovery) - this ECO is evaluated as part of ECO's 15, 15A, 24 & 24A.

* ECO #29 (efficiency of the compressed air system) - a new air compressor was being installed during the energy audit site survey. It is not feasible to replace the new air compressor and the piping is in good condition with no apparent leaks, therefore no ECO's were evaluated for the compressed air system.

* ECO #30 (thermal storage) - thermal storage is a feature of the packaged equipment used in ECO's 15 and 15A. Further use of thermal storage was not considered.

## F. ENERGY CONSERVATION OPPORTUNITIES ANALYZED

Of the 31 ECO's listed in the Contract Annex, 16 were analyzed for potential energy savings. In some cases an ECO was considered with different options. In that case a letter suffix was attached to the ECO number to identify each option separately. The total number of ECO's analyzed including options is 21. Some ECO's have been re-titled to give a more accurate description of the type modification required to achieve energy savings. A list of all ECO's considered in this report follows:

| ECO # | ECO TITLE |
|---|---|
| 1 | Repair Pipe Insulation |
| 3 | Caulk & Seal Windows |
| 6 | Reduce Window Area |
| 7 | Install Gas Fired Hot Water Heater |
| 8 | Lighting Modifications |
| 12 | Install Radiant Heaters |
| 14 | Heat Destratification |
| 15 | Install Wash Water Heat Recovery Unit |
| 15A | Install Wash Water Heat Recovery Unit With New Heater |
| 17 | Lower Hot Water Supply Temperature |
| 19 | Replace Steam Traps |
| 20 | Install 1000 LB Continuous Batch Washer |
| 20A | Replace Steam Dryers |
| 20B | Replace 400 LB Gas Dryer |
| 21 | Install Air Curtain |
| 23 | Recycle Rinse Water |

| | |
|---|---|
| 24 | Install Exhaust Heat Recovery on 100 LB Dryers |
| 24A | Install Exhaust Heat Recovery on 400 LB Dryers |
| 26 | Install Thermal Fluid Presses |
| 27 | Cold Water Laundering |
| 31 | Turn Off Steam |

**SECTION III** of this report provides an economic summary and description of the ECO's analyzed.

Calculation procedures and documentation are included in **SECTION IV.**

**SECTION V** of this report contains a sample or programming documents for a project involving ECO's.

## II. ENERGY AUDIT

A comprehensive energy audit was accomplished at the Fort Leonard Wood landry facility. The purpose of the audit was to analyze existing energy consumption at the facility. The energy audit included the following activities:

1. Analysis of utility records for fiscal years 1985 through 1987.

2. Analysis of laundry production records for fiscal years 1987 and 1988.

3. A complete inventory of all energy consuming equipment located in the laundry building.

4. A computer simulation of energy consumption at the laundry facility for calendar year 1987.

Information obtained from the above activities was compiled and cross referenced to provide an estimate of energy use for different areas and functions within the laundry facility.

### A. UTILITY DATA ANALYSIS

Table II-1 displays information extracted from utility records for the laundry facility. Fuel consumption is based upon meter readings taken at the boiler plant located in Building 2351. Energy costs are based upon actual expenditures made to fuel suppliers. As shown, total fuel consumption was highest in FY 85 with total fuel use at 34,215 million btu. Total fuel use in FY 86 & FY 87 was approximately 14% lower with total fuel use at 29,356 and 29,522 million BTU respectively. Total electricity consumption is listed as 2337, 2472, and 2417 million BTU for FY 85, 86 & 87.

Table II-2 shows average monthly energy use over the three year period between FY 85 and FY 87. Annual electricity use averages to 705,723 KWH or 2408 million BTU. Propane consumption averages to 286,409 gallons per year which equates to an energy use of 27,352 million BTU. Average fuel oil consumption is shown as 26,539 gallons which equates to 3679 million BTU of energy. Total average fuel use equates to 31,031 million BTU.

Figures II-1,II-2 & II-3 graphically depict the information contained in Table II-2.

Fuel oil is used on a random and infrequent basis at the boiler plant in Building 2351. Over a three year period the consumption of fuel oil consists of less than 12% of total fuel use. Since fuel oil usage makes up such a small percentage of total use, calculations and life cycle cost analysis contained in Section IV consider LPG as the only fuel used at the Laundry Facility. Therefore, fuel saving resulting from ECO's are considered as savings in LPG.

Not reflected in utility data is water usage. Water is a valuable resource and considerable dollar savings are possible through a reduction in consumption of domestic water. However, water is not considered as an energy resource, and a detailed analysis of water consumption is outside the scope of work of this study. For example, the cost associated with supplying water to Fort Leonard Wood facilities is approximately 68 cents per 1000 gallons of water. ECO #20 saves approximately 1,735,500 gallons of water each year which amounts to a dollar savings of $1180.00.

TABLE II-1
BUILDING 2352 - FORT LEONARD WOOD, MO.
UTILITY DATA FY85 - FY87

| | YEAR | KWH | ELEC MBTU'S | ELEC $ | LPG GALS | LPG MBTU'S | LPG $ | #2 FUEL GALS | #2 FUEL MBTU'S | #2 FUEL $ | TOTAL $ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OCT | 84 | 55754 | 190 | 2648.00 | 28509 | 2723 | 15247.00 | 350 | 49 | 340.00 | 18235.00 |
| NOV | 84 | 52680 | 180 | 2502.00 | 34882 | 3331 | 18655.00 | 440 | 61 | 427.00 | 21584.00 |
| DEC | 84 | 38790 | 132 | 1843.00 | 27374 | 2614 | 14640.00 | 1236 | 171 | 1200.00 | 17683.00 |
| JAN | 85 | 43042 | 147 | 2045.00 | 44290 | 4230 | 23686.00 | 364 | 50 | 353.00 | 26084.00 |
| FEB | 85 | 86292 | 295 | 4099.00 | 33613 | 3210 | 17976.00 | 1343 | 186 | 1304.00 | 23379.00 |
| MAR | 85 | 47656 | 163 | 2264.00 | 23790 | 2272 | 12723.00 | 2640 | 366 | 2563.00 | 17550.00 |
| APR | 85 | 50700 | 173 | 2408.00 | 32329 | 3087 | 17290.00 | 1760 | 244 | 1790.00 | 21488.00 |
| MAY | 85 | 65818 | 225 | 3126.00 | 20468 | 1955 | 10946.00 | 1467 | 203 | 1424.00 | 15496.00 |
| JUN | 85 | 44496 | 152 | 2114.00 | 22833 | 2181 | 12211.00 | 1222 | 169 | 1187.00 | 15512.00 |
| JUL | 85 | 65278 | 223 | 3101.00 | 19215 | 1835 | 10276.00 | 1497 | 208 | 1454.00 | 14831.00 |
| AUG | 85 | 73040 | 249 | 3572.00 | 27735 | 2649 | 14833.00 | 2365 | 328 | 2296.00 | 20701.00 |
| SEP | 85 | 61042 | 208 | 2985.00 | 19308 | 1844 | 10326.00 | 1796 | 249 | 1744.00 | 15055.00 |
| TOTAL | | 684588 | 2337 | 32707.00 | 334346 | 31931 | 178809.00 | 16480 | 2284 | 16082.00 | 227598.00 |

| | YEAR | KWH | ELEC MBTU'S | ELEC $ | LPG GALS | LPG MBTU'S | LPG $ | #2 FUEL GALS | #2 FUEL MBTU'S | #2 FUEL $ | TOTAL $ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OCT | 85 | 59646 | 204 | 2917.00 | 40742 | 3891 | 21789.00 | 1145 | 159 | 973.00 | 25679.00 |
| NOV | 85 | 52150 | 178 | 2467.00 | 28587 | 2730 | 13307.00 | 1131 | 157 | 961.00 | 16735.00 |
| DEC | 85 | 76254 | 260 | 3607.00 | 32199 | 3075 | 14989.00 | 2677 | 371 | 2275.00 | 20871.00 |
| JAN | 86 | 74462 | 254 | 3522.00 | 21994 | 2100 | 10238.00 | 5238 | 726 | 4451.00 | 18211.00 |
| FEB | 86 | 37292 | 127 | 1764.00 | 16980 | 1622 | 7904.00 | 2262 | 314 | 1922.00 | 11590.00 |
| MAR | 86 | 75970 | 259 | 3593.00 | 22390 | 2138 | 10423.00 | 2335 | 324 | 1984.00 | 16000.00 |
| APR | 86 | 64484 | 220 | 3050.00 | 19619 | 1874 | 9133.00 | 1362 | 189 | 1157.00 | 13340.00 |
| MAY | 86 | 37400 | 128 | 1769.00 | 17208 | 1643 | 8010.00 | 1255 | 174 | 1066.00 | 10845.00 |
| JUN | 86 | 67704 | 231 | 3202.00 | 17594 | 1680 | 8190.00 | 1326 | 184 | 1127.00 | 12519.00 |
| JUL | 86 | 64850 | 221 | 3067.00 | 18738 | 1789 | 8723.00 | 1085 | 150 | 922.00 | 12712.00 |
| AUG | 86 | 48534 | 166 | 2233.00 | 12821 | 1224 | 5968.00 | 1788 | 247 | 1511.00 | 9712.00 |
| SEP | 86 | 65500 | 224 | 3013.00 | 10630 | 1015 | 4948.00 | 11392 | 1580 | 9681.00 | 17642.00 |
| | | 724246 | 2472 | 34204.00 | 259502 | 24781 | 123622.00 | 32996 | 4575 | 28030.00 | 185856.00 |

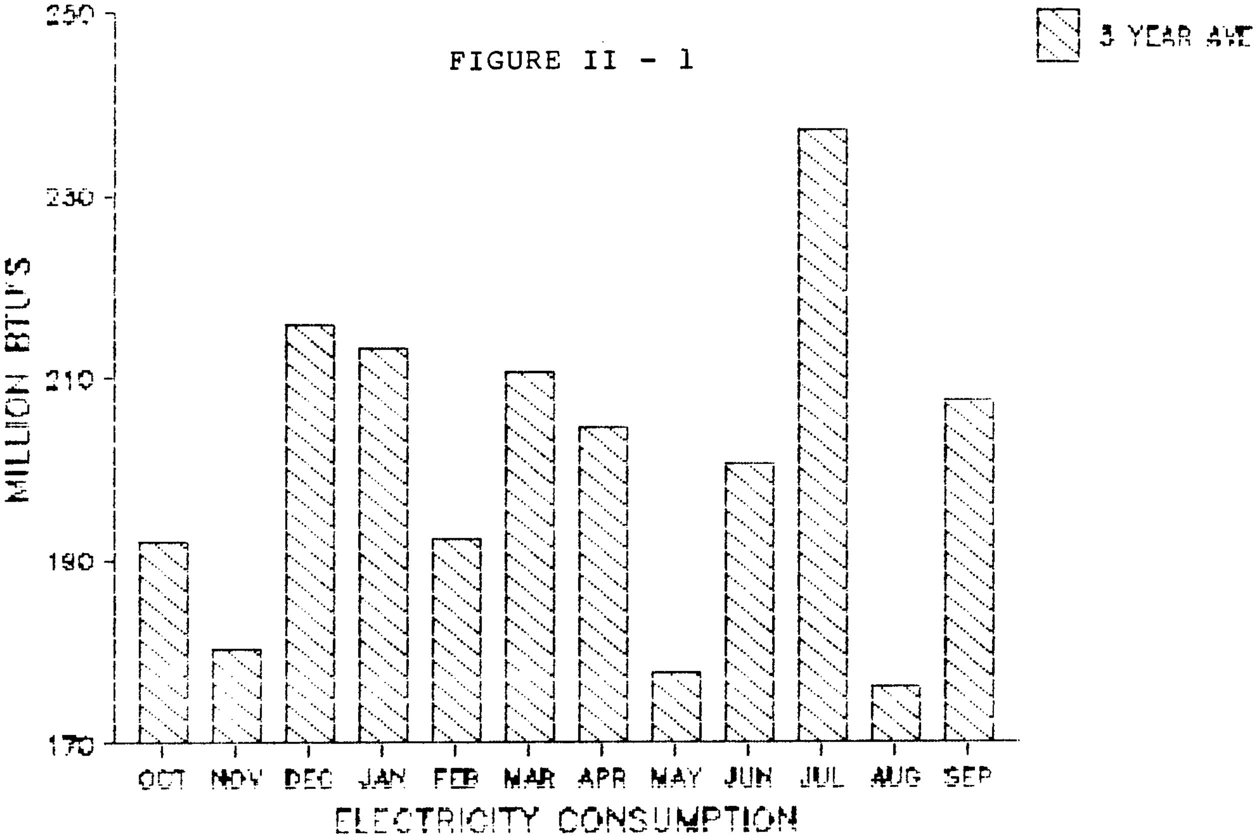
| | YEAR | KWH | ELEC MBTU'S | ELEC $ | LPG GALS | LPG MBTU'S | LPG $ | #2 FUEL GALS | #2 FUEL MBTU'S | #2 FUEL $ | TOTAL $ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OCT | 86 | 53466 | 182 | 2459.00 | 17041 | 1627 | 7933.00 | 6868 | 953 | 5424.00 | 15816.00 |
| NOV | 86 | 53712 | 183 | 2471.00 | 27674 | 2643 | 12882.00 | 1244 | 173 | 983.00 | 16336.00 |
| DEC | 86 | 75030 | 256 | 3451.00 | 28691 | 2740 | 12019.00 | 2825 | 392 | 2231.00 | 17701.00 |
| JAN | 87 | 69998 | 239 | 3220.00 | 30622 | 2924 | 12828.00 | 5186 | 719 | 4096.00 | 20144.00 |
| FEB | 87 | 45284 | 155 | 2160.00 | 27398 | 2617 | 11477.00 | 3277 | 454 | 2588.00 | 16225.00 |
| MAR | 87 | 61600 | 210 | 2944.00 | 23431 | 2238 | 9815.00 | 4380 | 607 | 3459.00 | 16218.00 |
| APR | 87 | 64780 | 221 | 3096.00 | 19976 | 1908 | 8368.00 | 2857 | 396 | 2256.00 | 13720.00 |
| MAY | 87 | 52750 | 180 | 2521.00 | 16988 | 1622 | 7116.00 | 1496 | 207 | 1182.00 | 10819.00 |
| JUN | 87 | 64016 | 218 | 3060.00 | 18036 | 1722 | 7555.00 | 412 | 57 | 325.00 | 10940.00 |
| JUL | 87 | 78666 | 268 | 3760.00 | 15230 | 1454 | 6380.00 | 448 | 62 | 354.00 | 10494.00 |
| AUG | 87 | 33276 | 114 | 1591.00 | 20178 | 1927 | 8453.00 | 404 | 56 | 319.00 | 10363.00 |
| SEP | 87 | 55758 | 190 | 2665.00 | 20113 | 1921 | 8425.00 | 744 | 103 | 588.00 | 11678.00 |
| | | 708336 | 2416 | 33398.00 | 265378 | 25343 | 113251.00 | 30141 | 4179 | 23805.00 | 170454.00 |

TABLE II-2
BUILDING 2352 - FORT LEONARD WOOD, MO.
UTILITY DATA - 3 YEAR AVERAGE

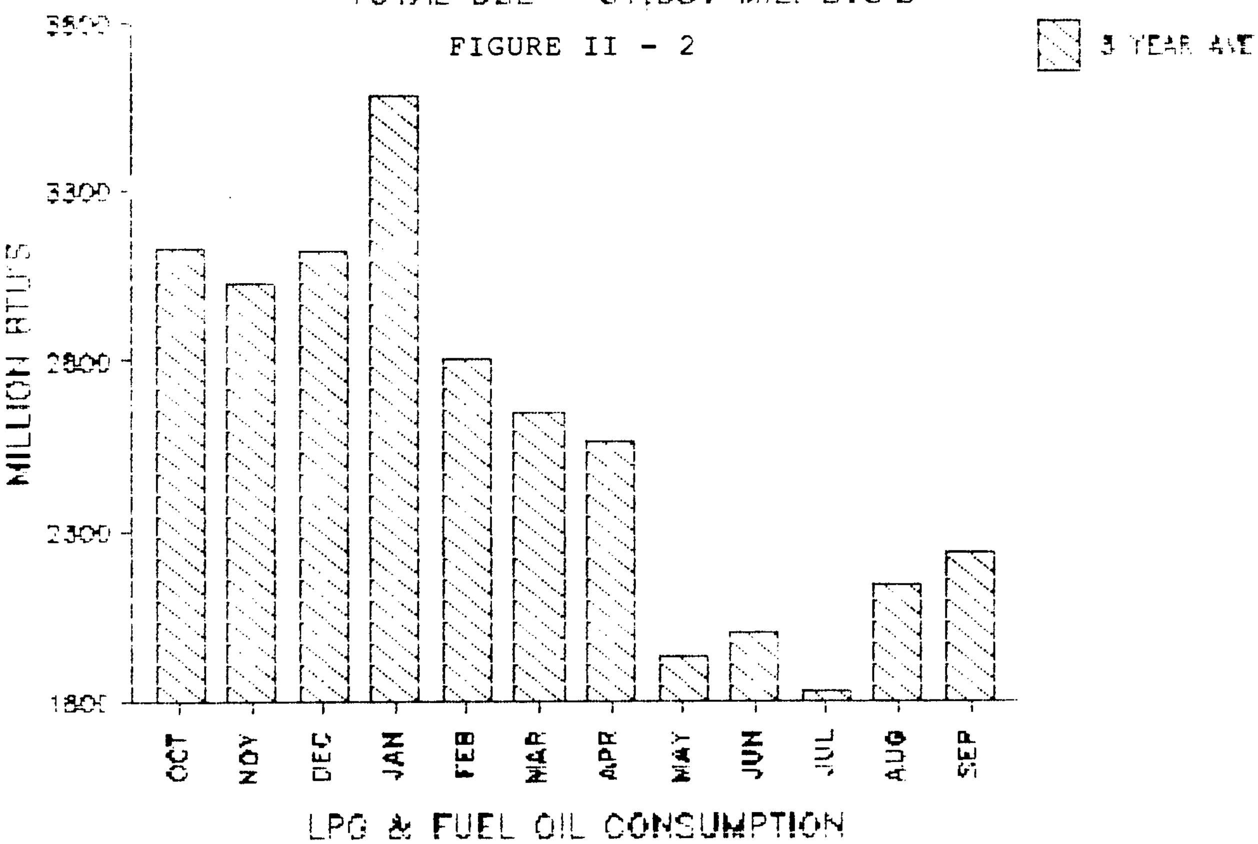
| | YEAR | KWH | ELEC MBTU'S | ELEC $ | LPG GALS | LPG MBTU'S | LPG $ | #2 FUEL GALS | #2 FUEL MBTU'S | #2 FUEL $ | TOTAL $ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OCT | AVE | 56289 | 192 | 2674.67 | 28764 | 2747 | 14989.67 | 2788 | 387 | 2245.67 | 19910.00 |
| NOV | AVE | 52847 | 180 | 2480.00 | 30381 | 2901 | 14948.00 | 938 | 130 | 790.33 | 18218.33 |
| DEC | AVE | 63358 | 216 | 2967.00 | 29421 | 2810 | 13882.67 | 2246 | 311 | 1902.00 | 18751.67 |
| JAN | AVE | 62501 | 213 | 2929.00 | 32302 | 3085 | 15584.00 | 3596 | 498 | 2966.67 | 21479.67 |
| FEB | AVE | 56289 | 192 | 2674.33 | 25997 | 2483 | 12452.33 | 2294 | 318 | 1938.00 | 17064.67 |
| MAR | AVE | 61742 | 211 | 2933.67 | 23204 | 2216 | 10987.00 | 3118 | 432 | 2668.67 | 16589.33 |
| APR | AVE | 59988 | 205 | 2851.33 | 23975 | 2290 | 11597.00 | 1993 | 276 | 1734.33 | 16182.67 |
| MAY | AVE | 51989 | 178 | 2472.00 | 18221 | 1740 | 8690.67 | 1406 | 195 | 1224.00 | 12386.67 |
| JUN | AVE | 58739 | 200 | 2792.00 | 19488 | 1861 | 9318.67 | 987 | 137 | 879.67 | 12990.33 |
| JUL | AVE | 69598 | 237 | 3309.33 | 17728 | 1693 | 8459.67 | 1010 | 140 | 910.00 | 12679.00 |
| AUG | AVE | 51617 | 176 | 2465.33 | 20245 | 1933 | 9751.33 | 1519 | 210 | 1375.33 | 13592.00 |
| SEP | AVE | 60767 | 207 | 2887.67 | 16684 | 1593 | 7899.67 | 4644 | 644 | 4004.33 | 14791.67 |
| | | ------- | ----- | ------- | ------- | ------- | ------- | -------- | -------- | -------- | -------- |
| TOTAL | | 705723 | 2408 | 33436.33 | 286409 | 27352 | 138560.67 | 26539 | 3679 | 22639.00 | 194636.00 |

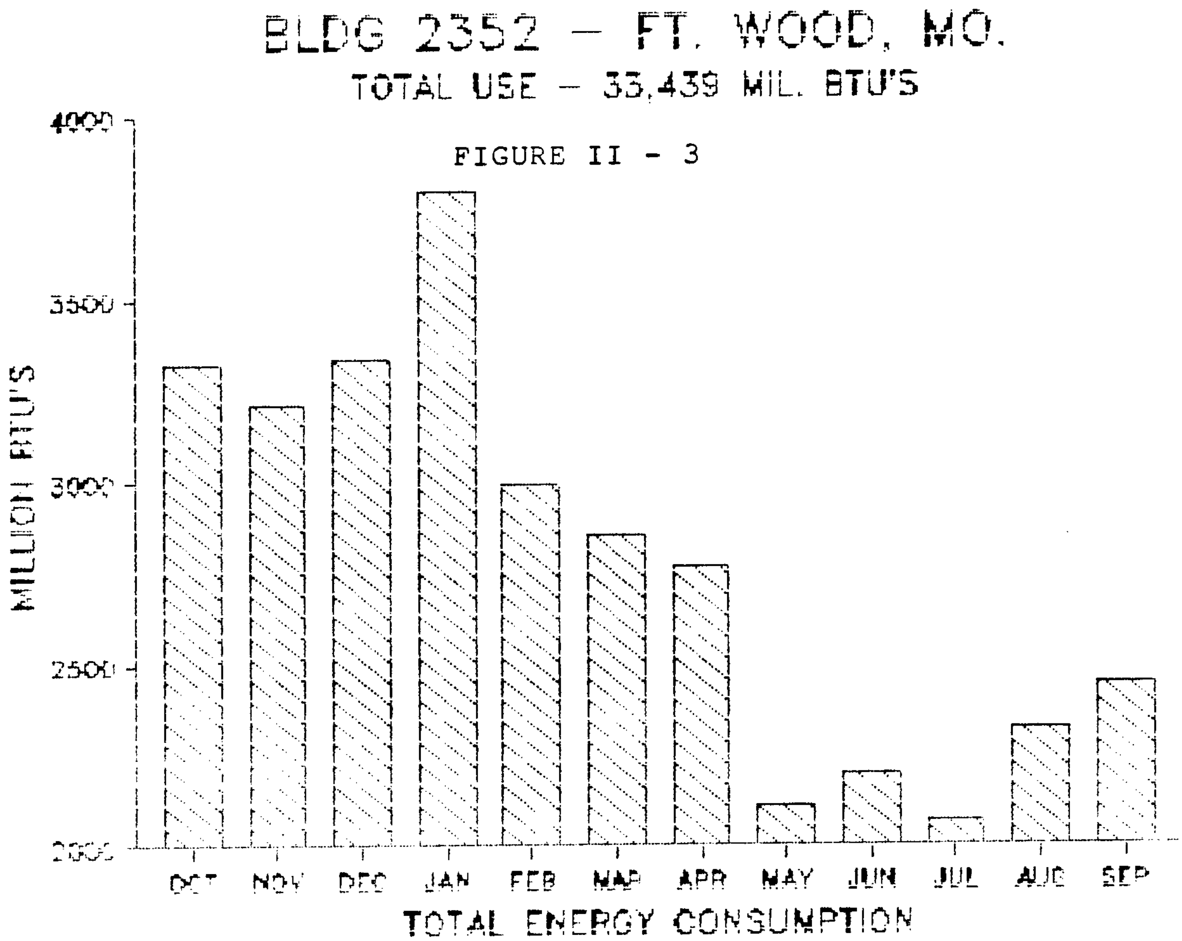
| | YEAR | $ PER KWH | $ PER MBTU'S | ELEC $ | $ PER GAL LPG | $ PER MBTU'S | LPG $ | $ PER GAL #2 | $ PER MBTU'S | #2 FUEL $ | TOTAL $ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OCT | AVE | .0475170 | 13.931 | 2674.67 | .52112594 | 5.456741 | 14989.67 | .8055722 | 5.802756 | 2245.67 | 19910.00 |
| NOV | AVE | .0469276 | 13.752 | 2480.00 | .49201804 | 5.152114 | 14948.00 | .8422735 | 6.063939 | 790.33 | 18218.33 |
| DEC | AVE | .0468291 | 13.736 | 2967.00 | .47185716 | 4.941037 | 13882.67 | .8468388 | 6.109208 | 1902.00 | 18751.67 |
| JAN | AVE | .0468635 | 13.730 | 2929.00 | .48244691 | 5.052086 | 15584.00 | .8249907 | 5.953177 | 2966.67 | 21479.67 |
| FEB | AVE | .0475105 | 13.905 | 2674.33 | .47899117 | 5.015036 | 12452.33 | .8448126 | 6.094340 | 1938.00 | 17064.67 |
| MAR | AVE | .0475149 | 13.926 | 2933.67 | .47350275 | 4.958032 | 10987.00 | .8557990 | 6.172706 | 2668.67 | 16589.33 |
| APR | AVE | .0475317 | 13.932 | 2851.33 | .48371893 | 5.064929 | 11597.00 | .8702124 | 6.276236 | 1734.33 | 16182.67 |
| MAY | AVE | .0475482 | 13.914 | 2472.00 | .47695010 | 4.994636 | 8690.67 | .8705548 | 6.287671 | 1224.00 | 12386.67 |
| JUN | AVE | .0475326 | 13.937 | 2792.00 | .47818278 | 5.007344 | 9318.67 | .8915541 | 6.436585 | 879.67 | 12990.33 |
| JUL | AVE | .0475493 | 13.944 | 3309.33 | .47720136 | 4.997834 | 8459.67 | .9009901 | 6.5 | 910.00 | 12679.00 |
| AUG | AVE | .0477624 | 13.981 | 2465.33 | .48167419 | 5.043793 | 9751.33 | .9054202 | 6.538827 | 1375.33 | 13592.00 |
| SEP | AVE | .0475206 | 13.928 | 2887.67 | .47349703 | 4.957950 | 7899.67 | .8622595 | 6.217909 | 4004.33 | 14791.67 |
| | | ------- | ----- | ------- | ------- | ------- | ------- | -------- | -------- | -------- | -------- |
| 12 MONTH AVE | | .0473839 | 13.884 | 2786.36 | .48259720 | 5.053461 | 11546.72 | .8601065 | 6.204446 | 1886.58 | 16219.67 |

# BLDG 2352 – FT. WOOD, MO.
## TOTAL USE – 2408 MIL. BTU'S




# BLDG 2352 – FT. WOOD, MO.
## TOTAL USE – 31,031 MIL. BTU'S




BLDG 2352 – FT. WOOD, MO.
TOTAL USE – 33,439 MIL. BTU'S
FIGURE II - 3
MILLION BTU'S
4000
3500
3000
2500
2000
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
TOTAL ENERGY CONSUMPTION

## B. LAUNDRY PRODUCTION ANALYSIS

Appendix "A" of this report contains laundry production records for fiscal years 1987 & 1988. These records show monthly and annual laundry production on an individual piece basis.

Appendix "B" contains a spread sheet analysis of the information contained in Appendix "A". The purpose of this spread sheet is to convert piece rate production to total pounds laundered. The spread sheet also separates dry cleaning production from total laundry production. Appendix "B" shows that approximately 208,586 lbs of dry cleaning and 4,155,644 lbs of laundered items were processed at the facility in FY 87. Total production equates to 4,364,230 lbs for FY 87. Total production for FY 88 was approximately 3,470,015 lbs. Of that amount, 3,294,263 lbs was laundered items and 175,751 lbs was dry cleaning items. The two year average production was 3,917,123 lbs of total production. The average dry cleaning production was 192,169 lbs. The average production of laundered items was 3,724,954 lbs.

Appendix "C" compares laundry production with water consumption over a three month period. The study period was limited to three months due to the availability of water consumption records. The purpose of the spread sheet in Appendix "C" is to obtain an accurate estimate of water consumed per pound of laundry. Once water consumption is determined on a unit basis, total annual water use can be estimated using laundry production data. As shown in Appendix "C", water consumption equates to approximately 2.6 gallons of water per pound of laundry processed. Using the average production rate of 3,724,954 lbs per year, the total annual process water use calculates to be 9,684,880 gallons.

## C. EQUIPMENT INVENTORY

Part of the energy audit for the laundry facility included a complete inventory of all energy consuming equipment. During the inventory, equipment operators were interviewed to determine approximate hours of equipment use. Hot water and dryer exhaust temperatures were measured and recorded. Motor amperage readings were taken on items of equipment that were in operation during the inventory. Maintenance files were checked for any available product literature on existing process equipment.

Appendix "D" contains a floor plan of the laundry indicating the location of process equipment. This appendix also contains equipment data forms which show information collected during the inventory.

Table II-4 is used to estimate energy consumption based on information collected during the equipment inventory. A description of information contained in the table follows:

Column

-A- Amount of steam input to process equipment in LBS/HR. The amount indicated was determined from product literature, data plate information or estimated from the size of steam supply lines.

-B- Amount of steam input to process equipment in thousands of BTU per hour. The amount indicated was calculated using the LBS/HR amount multiplied by a BTU content of 1080 BTU per pound of steam.

-C- Gallons of hot water used per equipment cycle. Product literature shows that hot water amounts to approximately 68% of total water consumption. The amount indicated was calculated by multiplying quantities in Column -D- by 0.68.

-D- Total water used per cycle. Amount shown was taken from product literature or was estimated by cross referencing production data, equipment capacity and hours of use.

-E- Amount of propane input to process equipment. The amount indicated was taken from equipment data plates.

-F- Total number of equipment cycles per year. The amount indicated was estimated through interviews with equipment operators and by cross referencing production data with equipment capacities.

-G- Total number of hours each year that fuel is input to the process equipment. The amount shown was estimated by cross referencing equipment efficiencies taken from product literature with production data and equipment capacities.

-H- Total annual steam use in millions of BTU's. The amount shown was obtained by multiplying quantities in Column -B- by those in Column -G-.

-I- Total annual hot water use in thousands of gallons. The amount shown is obtained by multiplying quantities in Column -C- by those in Column -F-.

-J- Total annual water consumption in thousands of gallons. The amount shown is obtained by multiplying quantities in Column -D- by those in Column -F-.

-K- Total propane consumption by process equipment. The amounts shown do not include the propane consumed by plant boilers to produce steam. Consumption is calculated by multiplying quantities in Column -E- by those in Column -G-.

Table II-4 shows a total steam consumption of 13,636.4 million BTU's per year and a propane consumption of 5910 million BTU's each year. The hot water energy consumption of 5519 million BTU's per year was calculated using the total hot water energy consumption in gallons and assuming a temperature rise of 100 degrees fahrenheit (BTU = Gallons hot water x 8.33x100).

TABLE 11-4
BUILDING 2352 - FORT LEONARD WOOD, MO
PROCESS FUEL & WATER CONSUMPTION

| EQUIPMENT | ID # | STEAM (LBS/HR) -A- | STEAM (MBH) -B- | HOT WATER (GPC) -C- | TOTAL WATER (GPC) -D- | PROPANE (MBH) -E- | CYCLES PER YEAR -F- | FUEL INPUT HOURS /YEAR -G- | TOTAL STEAM MMBTU -H- | TOTAL HW (GALS X 1000) -I- | TOTAL WATER (GALS X 1000) -J- | TOTAL PROPANE MMBTU -K- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WASHER-EXTRACTOR - A | 1 | 750 | 810.00 | 1061 | 1560 | | 610 | 280 | 225.75 | 647.09 | 951.6 | |
| WASHER-EXTRACTOR - A | 2 | 750 | 810.00 | 1061 | 1560 | | 610 | 280 | 225.75 | 647.09 | 951.6 | |
| WASHER-EXTRACTOR - A | 3 | 750 | 810.00 | 1061 | 1560 | | 610 | 280 | 225.75 | 647.09 | 951.6 | |
| WASHER-EXTRACTOR - A | 4 | 750 | 810.00 | 1061 | 1560 | | 610 | 280 | 225.75 | 647.09 | 951.6 | |
| WASHER-EXTRACTOR - B | 5 | 900 | 972.00 | 1414 | 2080 | | 610 | 280 | 270.9 | 862.78 | 1268.8 | |
| WASHER-EXTRACTOR - B | 6 | 900 | 972.00 | 1414 | 2080 | | 610 | 280 | 270.9 | 862.78 | 1268.8 | |
| WASHER-EXTRACTOR - C | 7 | 200 | 216.00 | 354 | 520 | | 732 | 280 | 60.2 | 258.84 | 380.64 | |
| WASHER-EXTRACTOR - C | 8 | 200 | 216.00 | 354 | 520 | | 732 | 280 | 60.2 | 258.84 | 380.64 | |
| WASHER-D | 9 | 150 | 162.00 | 177 | 260 | | 732 | 280 | 45.15 | 129.42 | 190.32 | |
| WASHER-D | 10 | 150 | 162.00 | 177 | 260 | | 732 | 280 | 45.15 | 129.42 | 190.32 | |
| WASHER-D | 11 | 150 | 162.00 | 177 | 260 | | 732 | 280 | 45.15 | 129.42 | 190.32 | |
| SHEET WASH | 12 | 200 | 216.00 | 707 | 1040 | | 1988 | 690 | 148.35 | 1405.9 | 2067.5 | |
| SHAPER, PRESS & CONV | 13 | | .00 | | | | 1988 | 1988 | 0 | | | |
| DRYER-TUMBLER | 14 | | .00 | | | 3000 | 1370 | 320 | 0 | | | 960 |
| DRYER-A | 15 | 350 | 378.00 | | | | 1000 | 700 | 263.38 | | | |
| DRYER-B | 16 | 350 | 378.00 | | | | 1000 | 700 | 263.38 | | | |
| DRYER-C | 17 | 350 | 378.00 | | | | 1000 | 700 | 263.38 | | | |
| DRYER-E | 18 | 350 | 378.00 | | | | 1000 | 700 | 263.38 | | | |
| DRYER-C | 19 | 350 | 378.00 | | | | 1000 | 700 | 263.38 | | | |
| DRYER-A | 20 | 350 | 378.00 | | | | 1000 | 700 | 263.38 | | | |
| DRYER-E | 21 | 350 | 378.00 | | | | 1000 | 700 | 263.38 | | | |
| DRYER-E | 22 | 350 | 378.00 | | | | 1000 | 700 | 263.38 | | | |
| DRYER-E | 23 | 350 | 378.00 | | | | 1000 | 700 | 263.38 | | | |
| DRYER-E | 24 | 350 | 378.00 | | | | 1000 | 700 | 263.38 | | | |
| DRYER-E | 25 | 350 | 378.00 | | | | 1000 | 700 | 263.38 | | | |
| DRYER-E | 26 | 350 | 378.00 | | | | 1000 | 700 | 263.38 | | | |
| DRYER-G | 27 | | .00 | | | 250 | 1000 | 750 | 0 | | | 187.5 |
| DRYER-G | 28 | | .00 | | | 250 | 1000 | 750 | 0 | | | 187.5 |
| DRYER-G | 29 | | .00 | | | 250 | 1000 | 750 | 0 | | | 187.5 |
| DRYER-G | 30 | | .00 | | | 250 | 1000 | 750 | 0 | | | 187.5 |
| DRYER-E | 31 | 350 | 378.00 | | | | 1000 | 700 | 263.38 | | | |
| DRYER-E | 32 | 350 | 378.00 | | | | 1000 | 700 | 263.38 | | | |
| DRYER-B | 33 | 350 | 378.00 | | | | 1000 | 700 | 263.38 | | | |
| DRYER-B | 34 | 350 | 378.00 | | | | 1000 | 700 | 263.38 | | | |
| DRYER-B | 35 | 350 | 378.00 | | | | 1000 | 700 | 263.38 | | | |
| DRYER-D | 36 | 350 | 378.00 | | | | 1000 | 700 | 263.38 | | | |
| DRYER-D | 37 | 350 | 378.00 | | | | 1000 | 700 | 263.38 | | | |
| DRYER-H | 38 | 350 | 378.00 | | | | 1000 | 700 | 263.38 | | | |
| DRYER-F | 39 | | .00 | | | 3000 | 1000 | 700 | 0 | | | 2100 |
| DRYER-F | 40 | | .00 | | | 3000 | 1000 | 700 | 0 | | | 2100 |
| DRYER-I | 41 | | .00 | | | 2000 | 0 | 0 | 0 | | | 0 |

TABLE 11-4
BUILDING 2352 - FORT LEONARD WOOD, MO
PROCESS FUEL & WATER CONSUMPTION

| EQUIPMENT | ID # | STEAM (LBS/HR) -A- | STEAM (MBH) -B- | HOT WATER (GPC) -C- | TOTAL WATER (GPC) -D- | PROPANE (MBH) -E- | CYCLES PER YEAR -F- | FUEL INPUT HOURS /YEAR -G- | TOTAL STEAM MMBTU -H- | TOTAL HW (GALS X 1000) -I- | TOTAL WATER (GALS X 1000) -J- | TOTAL PROPANE MMBTU -K- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LINT TRAP | 42 | | .00 | | | | | | 0 | | | |
| LINT TRAP | 43 | | .00 | | | | | | 0 | | | |
| SHEET PRESS | 44 | 1500 | 1620.00 | | | | | 400 | 645 | | | |
| SHEET PRESS | 45 | 1500 | 1620.00 | | | | | 400 | 645 | | | |
| SHEET PRESS | 46 | 1500 | 1620.00 | | | | | 400 | 645 | | | |
| SHEET PRESS | 47 | 1500 | 1620.00 | | | | | 400 | 645 | | | |
| SHEET SPREADER-FEEDER | 48 | | .00 | | | | | | 0 | | | |
| SHEET SPREADER-FEEDER | 49 | | .00 | | | | | | 0 | | | |
| SHEET-FOLDER | 50 | | .00 | | | | | | 0 | | | |
| SHEET-FOLDER | 51 | | .00 | | | | | | 0 | | | |
| SHEET-FOLDER | 52 | | .00 | | | | | | 0 | | | |
| SHEET-FOLDER | 53 | | .00 | | | | | | 0 | | | |
| TOWEL FOLDER | 54 | | .00 | | | | | | 0 | | | |
| STEAM SUPPLY/DIST | 55 | | .00 | | | | | | 0 | | | |
| SLEEVE PRESS | 56 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| FOLDING MACHINE | 57 | | .00 | | | | | 500 | 0 | | | |
| YOKE PRESS | 58 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| COLLAR FORMER | 59 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| 18" PRESS | 60 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| BODY PRESS | 61 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| BODY PRESS | 62 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| 18" PRESS | 63 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| COLLAR FORMER | 64 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| YOKE PRESS | 65 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| FOLDING MACHINE | 66 | | .00 | | | | | 500 | 0 | | | |
| SLEEVE PRESS | 67 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| PRESS | 68 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| PRESS | 69 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| MUSHROOM PRESS | 70 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| GARMENT PRESS | 71 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| MUSHROOM PRESS | 72 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| GARMENT PRESS | 73 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| GARMENT PRESS | 74 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| TROUSER PRESS | 75 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| TROUSER PRESS | 76 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| PANTS DRYER CABINET | 77 | | .00 | | | | | 500 | 0 | | | |
| PANTS DRYER CABINET | 78 | | .00 | | | | | 500 | 0 | | | |
| TROUSER PRESS | 79 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| TROUSER PRESS | 80 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| TROUSER PRESS | 81 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| TROUSER PRESS | 82 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| COAT PRESS | 83 | 450 | 486.00 | | | | | 500 | 241.88 | | | |
| COAT COLLAR PRESS | 84 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| COAT SLEEVE PRESS | 85 | 100 | 108.00 | | | | | 500 | 53.75 | | | |

TABLE 11-4
BUILDING 2352 - FORT LEONARD WOOD, MO
PROCESS FUEL & WATER CONSUMPTION

| EQUIPMENT | ID # | STEAM (LBS/HR) -A- | STEAM (MBH) -B- | HOT WATER (GPC) -C- | TOTAL WATER (GPC) -D- | PROPANE (MBH) -E- | CYCLES PER YEAR -F- | FUEL INPUT HOURS /YEAR -G- | TOTAL STEAM MMBTU -H- | TOTAL HW (GALS X 1000) -I- | TOTAL WATER (GALS X 1000) -J- | TOTAL PROPANE MMBTU -K- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRYER - 70 LB | 86 | 250 | 270.00 | | | | 750 | 550 | 147.81 | | | |
| DRYER - 110 LB | 87 | 300 | 324.00 | | | | 750 | 550 | 177.38 | | | |
| DRYER - 110 LB | 88 | 300 | 324.00 | | | | 750 | 550 | 177.38 | | | |
| DRYER - 110 LB | 89 | 300 | 324.00 | | | | 750 | 550 | 177.38 | | | |
| DRYER - 110 LB | 90 | 300 | 324.00 | | | | 750 | 550 | 177.38 | | | |
| WASHER - 110 LB | 91 | 450 | 486.00 | | | | 750 | 550 | 266.06 | | | |
| WASHER - 110 LB | 92 | 450 | 486.00 | | | | 750 | 550 | 266.06 | | | |
| WASHER - 110 LB | 93 | 450 | 486.00 | | | | 750 | 550 | 266.06 | | | |
| COMPRESSER 70# | 94 | | .00 | | | | | | 0 | | | |
| COMPRESSER 110# | 95 | | .00 | | | | | | 0 | | | |
| COMPRESSER 110# | 96 | | .00 | | | | | | 0 | | | |
| VAPOR ABSORBER | 97 | 100 | 108.00 | | | | | | 0 | | | |
| 38" PRESS | 98 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| 18" PRESS | 99 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| 38" PRESS | 100 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| 18" PRESS | 101 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| 38" PRESS | 102 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| 18" PRESS | 103 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| 38" PRESS | 104 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| JACKET FORMER | 105 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| JACKET FORMER | 106 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| 52" PRESS | 107 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| PANT STEAMER | 108 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| PANT STEAMER | 109 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| 52" PRESS | 110 | 100 | 108.00 | | | | | 500 | 53.75 | | | |
| COMPRESSER | 111 | | .00 | | | | | | 0 | | | |
| COMPRESSER | 112 | | .00 | | | | | | 0 | | | |
| | | 26000 | 28080.00 | | | | | | 13636. | 6625.8 | 9743.8 | 5910 |

STEAM USE (MMBTUs) ---- 13636.4

PROPANE USE (MMBTUs) ---- 5910

HOT WATER (MMBTUs) ---- 5519.26

Table II-5 uses equipment inventory information to estimate total annual electricity consumption for process equipment. The motor horsepower indicated was taken from equipment data plates. Motor kilowatts were calculated using .746 KW per HP. Cycles per year and hours per year were estimated as in Table II-4. Total kilowatt hours were calculated by multiplying equipment KW by hours of use. Table II-5 shows electricity consumption for process equipment as 325,967 kilowatt hours.

Table II-6 is used to cross reference washer capacities with production data to estimate total number of cycles required and total hours of equipment operation.

Table II-7 is used to cross reference dryer capacities with production data to estimate total number of cycles required and total hours of equipment operation.

TABLE II-5
BUILDING 2352 - FORT LEONARD WOOD, MO
PROCESS ELECTRICITY CONSUMPTION

| EQUIPMENT | ID # | HP MTR 1 -A- | HP MTR 2 -B- | HP MTR 3 -C- | KW MTR 1 -D- | KW MTR 2 -E- | KW MTR 3 -F- | CYCLES PER YEAR -G- | HOURS /YEAR MTR 1 -H- | HOURS /YEAR MTR 2 -I- | HOURS /YEAR MTR 3 -J- | KWH MTR 1 -K- | KWH MTR 2 -L- | KWH MTR 3 M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WASHER-EXTRACTOR - A | 1 | 7.5 | 12.5 | 25 | 5.60 | 9.33 | 18.7 | 610 | 460 | 125 | 125 | 2573.7 | 1165.625 | 2331. |
| WASHER-EXTRACTOR - A | 2 | 7.5 | 12.5 | 25 | 5.60 | 9.33 | 18.7 | 610 | 460 | 125 | 125 | 2573.7 | 1165.625 | 2331. |
| WASHER-EXTRACTOR - A | 3 | 7.5 | 12.5 | 25 | 5.60 | 9.33 | 18.7 | 610 | 460 | 125 | 125 | 2573.7 | 1165.625 | 2331. |
| WASHER-EXTRACTOR - A | 4 | 7.5 | 12.5 | 25 | 5.60 | 9.33 | 18.7 | 610 | 460 | 125 | 125 | 2573.7 | 1165.625 | 2331. |
| WASHER-EXTRACTOR - B | 5 | 10 | 15 | 30 | 7.46 | 11.2 | 22.4 | 610 | 460 | 125 | 125 | 3431.6 | 1398.75 | 2798. |
| WASHER-EXTRACTOR - B | 6 | 10 | 15 | 30 | 7.46 | 11.2 | 22.4 | 610 | 460 | 125 | 125 | 3431.6 | 1398.75 | 2798. |
| WASHER-EXTRACTOR - C | 7 | 3 | 10 | 3 | 2.24 | 7.46 | 2.24 | 732 | 550 | 145 | 145 | 1230.9 | 1081.7 | 324.5 |
| WASHER-EXTRACTOR - C | 8 | 3 | 10 | 3 | 2.24 | 7.46 | 2.24 | 732 | 550 | 145 | 145 | 1230.9 | 1081.7 | 324.5 |
| WASHER-D | 9 | 2 | 2.5 | 5 | 1.49 | 1.87 | 3.73 | 732 | 550 | 145 | 145 | 820.6 | 270.425 | 540.9 |
| WASHER-D | 10 | 2 | 2.5 | 5 | 1.49 | 1.87 | 3.73 | 732 | 550 | 145 | 145 | 820.6 | 270.425 | 540.9 |
| WASHER-D | 11 | 2 | 2.5 | 5 | 1.49 | 1.87 | 3.73 | 732 | 550 | 145 | 145 | 820.6 | 270.425 | 540.9 |
| SHEET WASH | 12 | 15 | .75 | .75 | 11.2 | .560 | .560 | 1988 | 1988 | 400 | 400 | 22246. | 223.8 | 223.8 |
| SHAPER, PRESS & CONV | 13 | 15 | 15 | 2 | 11.2 | 11.2 | 1.49 | 1988 | 1100 | 925 | 1590 | 12309 | 10350.75 | 2372. |
| DRYER-TUMBLER | 14 | 20 | 5 | 2 | 14.9 | 3.73 | 1.49 | 1370 | 805 | 410 | 805 | 12011. | 1529.3 | 1201. |
| | | 1 | 2 | | .746 | 1.49 | 0 | 1000 | 800 | 800 | | 596.8 | 1193.6 | 0 |
| DRYER-A | 15 | 1.5 | | | 1.12 | 0 | 0 | 1000 | 800 | | | 895.2 | 0 | 0 |
| DRYER-B | 16 | .5 | 1 | | .373 | .746 | 0 | 1000 | 800 | 800 | | 298.4 | 596.8 | 0 |
| DRYER-C | 17 | .75 | 3 | | .560 | 2.24 | 0 | 1000 | 800 | 800 | | 447.6 | 1790.4 | 0 |
| DRYER-B | 18 | .5 | 1 | | .373 | .746 | 0 | 1000 | 800 | 800 | | 298.4 | 596.8 | 0 |
| DRYER-C | 19 | .75 | 3 | | .560 | 2.24 | 0 | 1000 | 800 | 800 | | 447.6 | 1790.4 | 0 |
| DRYER-A | 20 | 1.5 | | | 1.12 | 0 | 0 | 1000 | 800 | | | 895.2 | 0 | 0 |
| DRYER-E | 21 | .75 | 1.5 | | .560 | 1.12 | 0 | 1000 | 800 | 800 | | 447.6 | 895.2 | 0 |
| DRYER-E | 22 | .75 | 1.5 | | .560 | 1.12 | 0 | 1000 | 800 | 800 | | 447.6 | 895.2 | 0 |
| DRYER-E | 23 | .75 | 1.5 | | .560 | 1.12 | 0 | 1000 | 800 | 800 | | 447.6 | 895.2 | 0 |
| DRYER-E | 24 | .75 | 1.5 | | .560 | 1.12 | 0 | 1000 | 800 | 800 | | 447.6 | 895.2 | 0 |
| DRYER-E | 25 | .75 | 1.5 | | .560 | 1.12 | 0 | 1000 | 800 | 800 | | 447.6 | 895.2 | 0 |
| DRYER-E | 26 | .75 | 1.5 | | .560 | 1.12 | 0 | 1000 | 800 | 800 | | 447.6 | 895.2 | 0 |
| DRYER-G | 27 | 1 | 1.5 | | .746 | 1.12 | 0 | 1000 | 800 | 800 | | 596.8 | 895.2 | 0 |
| DRYER-G | 28 | 1 | 1.5 | | .746 | 1.12 | 0 | 1000 | 800 | 800 | | 596.8 | 895.2 | 0 |
| DRYER-G | 29 | 1 | 1.5 | | .746 | 1.12 | 0 | 1000 | 800 | 800 | | 596.8 | 895.2 | 0 |
| DRYER-G | 30 | 1 | 1.5 | | .746 | 1.12 | 0 | 1000 | 800 | 800 | | 596.8 | 895.2 | 0 |
| DRYER-B | 31 | .5 | 1 | | .373 | .746 | 0 | 1000 | 800 | 800 | | 298.4 | 596.8 | 0 |
| DRYER-B | 32 | .5 | 1 | | .373 | .746 | 0 | 1000 | 800 | 800 | | 298.4 | 596.8 | 0 |
| DRYER-B | 33 | .5 | 1 | | .373 | .746 | 0 | 1000 | 800 | 800 | | 298.4 | 596.8 | 0 |
| DRYER-B | 34 | .5 | 1 | | .373 | .746 | 0 | 1000 | 800 | 800 | | 298.4 | 596.8 | 0 |
| DRYER-B | 35 | .5 | 1 | | .373 | .746 | 0 | 1000 | 800 | 800 | | 298.4 | 596.8 | 0 |
| DRYER-D | 36 | .75 | 1.5 | | .560 | 1.12 | 0 | 1000 | 800 | 800 | | 447.6 | 895.2 | 0 |
| DRYER-D | 37 | .75 | 1.5 | | .560 | 1.12 | 0 | 1000 | 800 | 800 | | 447.6 | 895.2 | 0 |
| DRYER-H | 38 | .25 | 1.5 | | .187 | 1.12 | 0 | 1000 | 800 | 800 | | 149.2 | 895.2 | 0 |
| DRYER-F | 39 | 5 | 25 | 2 | 3.73 | 18.7 | 1.49 | 1000 | 800 | 800 | | 2984 | 14920 | 0 |
| DRYER-F | 40 | 5 | 25 | 2 | 3.73 | 18.7 | 1.49 | 1000 | 800 | 800 | | 2984 | 14920 | 0 |
| DRYER-I | 41 | 7.5 | 10 | .5 | 5.60 | 7.46 | .373 | 0 | 0 | | | 0 | 0 | 0 |

TABLE II-5
BUILDING 2352 - FORT LEONARD WOOD, MO
PROCESS ELECTRICITY CONSUMPTION

| EQUIPMENT | ID # | HP MTR 1 -A- | HP MTR 2 -B- | HP MTR 3 -C- | KW MTR 1 -D- | KW MTR 2 -E- | KW MTR 3 -F- | CYCLES PER YEAR -G- | HOURS /YEAR MTR 1 -H- | HOURS /YEAR MTR 2 -I- | HOURS /YEAR MTR 3 -J- | KWH MTR 1 -K- | KWH MTR 2 -L- | KWH MTR 3 M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LINT TRAP | 42 | 15 | 1 | | 11.2 | .746 | 0 | | 2000 | | | 22380 | 0 | 0 |
| LINT TRAP | 43 | 15 | 1 | | 11.2 | .746 | 0 | | 2000 | | | 22380 | 0 | 0 |
| SHEET PRESS | 44 | 7.5 | | | 5.60 | 0 | 0 | | 700 | | | 3916.5 | 0 | 0 |
| SHEET PRESS | 45 | 7.5 | | | 5.60 | 0 | 0 | | 700 | | | 3916.5 | 0 | 0 |
| SHEET PRESS | 46 | 7.5 | | | 5.60 | 0 | 0 | | 700 | | | 3916.5 | 0 | 0 |
| SHEET PRESS | 47 | 7.5 | | | 5.60 | 0 | 0 | | 700 | | | 3916.5 | 0 | 0 |
| SHEET SPREADER-FEEDER | 48 | 1.5 | .25 | .25 | 1.12 | .187 | .187 | | 700 | 700 | 700 | 783.3 | 130.55 | 130.6 |
| SHEET SPREADER-FEEDER | 49 | 1.5 | .25 | .25 | 1.12 | .187 | .187 | | 700 | 700 | 700 | 783.3 | 130.55 | 130.6 |
| SHEET-FOLDER | 50 | 1 | .33 | .33 | .746 | .246 | .246 | | 700 | 700 | 700 | 522.2 | 172.326 | 172.3 |
| SHEET-FOLDER | 51 | 1 | .33 | .33 | .746 | .246 | .246 | | 700 | 700 | 700 | 522.2 | 172.326 | 172.3 |
| SHEET-FOLDER | 52 | .25 | | | .187 | 0 | 0 | | 700 | | | 130.55 | 0 | 0 |
| SSHEET-FOLDER | 53 | .5 | | | .373 | 0 | 0 | | 700 | | | 261.1 | 0 | 0 |
| TOWEL FOLDER | 54 | 1 | | | .746 | 0 | 0 | | 700 | | | 522.2 | 0 | 0 |
| STEAM SUPPLY/DIST | 55 | .33 | .25 | | .246 | .187 | 0 | | 2000 | 2000 | 2000 | 492.36 | 373 | 0 |
| SLEEVE PRESS | 56 | | | | 0 | 0 | 0 | | 300 | | | 0 | 0 | 0 |
| FOLDING MACHINE | 57 | .33 | | | .246 | 0 | 0 | | 300 | | | 73.854 | 0 | 0 |
| YOKE PRESS | 58 | | | | 0 | 0 | 0 | | 300 | | | 0 | 0 | 0 |
| COLLAR FORMER | 59 | | | | 0 | 0 | 0 | | 300 | | | 0 | 0 | 0 |
| 18" PRESS | 60 | | | | 0 | 0 | 0 | | 300 | | | 0 | 0 | 0 |
| BODY PRESS | 61 | 5 | | | 3.73 | 0 | 0 | | 300 | | | 1119 | 0 | 0 |
| BODY PRESS | 62 | 5 | | | 3.73 | 0 | 0 | | 300 | | | 1119 | 0 | 0 |
| 18" PRESS | 63 | | | | 0 | 0 | 0 | | 300 | | | 0 | 0 | 0 |
| COLLAR FORMER | 64 | | | | 0 | 0 | 0 | | 300 | | | 0 | 0 | 0 |
| YOKE PRESS | 65 | | | | 0 | 0 | 0 | | 300 | | | 0 | 0 | 0 |
| FOLDING MACHINE | 66 | .33 | | | .246 | 0 | 0 | | 300 | | | 73.854 | 0 | 0 |
| SLEEVE PRESS | 67 | | | | 0 | 0 | 0 | | 300 | | | 0 | 0 | 0 |
| PRESS | 68 | | | | 0 | 0 | 0 | | 300 | | | 0 | 0 | 0 |
| PRESS | 69 | | | | 0 | 0 | 0 | | 300 | | | 0 | 0 | 0 |
| MUSHROOM PRESS | 70 | | | | 0 | 0 | 0 | | 300 | | | 0 | 0 | 0 |
| GARMENT PRESS | 71 | | | | 0 | 0 | 0 | | 300 | | | 0 | 0 | 0 |
| MUSHROOM PRESS | 72 | | | | 0 | 0 | 0 | | 300 | | | 0 | 0 | 0 |
| GARMENT PRESS | 73 | | | | 0 | 0 | 0 | | 300 | | | 0 | 0 | 0 |
| GARMENT PRESS | 74 | | | | 0 | 0 | 0 | | 300 | | | 0 | 0 | 0 |
| TROUSER PRESS | 75 | 1 | 1.5 | | .746 | 1.12 | 0 | | 300 | 300 | | 223.8 | 335.7 | 0 |
| TROUSER PRESS | 76 | 1 | 1.5 | | .746 | 1.12 | 0 | | 300 | 300 | | 223.8 | 335.7 | 0 |
| PANTS DRYER CABINET | 77 | .5 | .5 | .063 | .373 | .373 | .047 | | 300 | 300 | 300 | 111.9 | 111.9 | 14.10 |
| PANTS DRYER CABINET | 78 | .5 | .5 | .063 | .373 | .373 | .047 | | 300 | 300 | 300 | 111.9 | 111.9 | 14.10 |
| TROUSER PRESS | 79 | 1 | 1.5 | | .746 | 1.12 | 0 | | 300 | 300 | | 223.8 | 335.7 | 0 |
| TROUSER PRESS | 80 | 1 | 1.5 | | .746 | 1.12 | 0 | | 300 | 300 | | 223.8 | 335.7 | 0 |
| TROUSER PRESS | 81 | 1 | 1.5 | | .746 | 1.12 | 0 | | 300 | 300 | | 223.8 | 335.7 | 0 |
| TROUSER PRESS | 82 | 1 | 1.5 | | .746 | 1.12 | 0 | | 300 | 300 | | 223.8 | 335.7 | 0 |
| COAT PRESS | 83 | 2 | | | 1.49 | 0 | 0 | | 300 | | | 447.6 | 0 | 0 |
| COAT COLLAR PRESS | 84 | | | | 0 | 0 | 0 | | 300 | | | 0 | 0 | 0 |
| COAT SLEEVE PRESS | 85 | 1 | | | .746 | 0 | 0 | | 300 | | | 223.8 | 0 | 0 |

TABLE II-5
BUILDING 2352 - FORT LEONARD WOOD, MO
PROCESS ELECTRICITY CONSUMPTION

| EQUIPMENT | ID # | HP MTR 1 -A- | HP MTR 2 -B- | HP MTR 3 -C- | KW MTR 1 -D- | KW MTR 2 -E- | KW MTR 3 -F- | CYCLES PER YEAR -G- | HOURS /YEAR MTR 1 -H- | HOURS /YEAR MTR 2 -I- | HOURS /YEAR MTR 3 -J- | KWH MTR 1 -K- | KWH MTR 2 -L- | KWH MTR 3 M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRYER - 70 LB | 86 | .5 | .75 | | .373 | .560 | 0 | 750 | 550 | 550 | | 205.15 | 307.725 | 0 |
| DRYER - 110 LB | 87 | .33 | .33 | | .246 | .246 | 0 | 750 | 550 | 550 | | 135.40 | 135.399 | 0 |
| DRYER - 110 LB | 88 | .33 | .33 | | .246 | .246 | 0 | 750 | 550 | 550 | | 135.40 | 135.399 | 0 |
| DRYER - 110 LB | 89 | .33 | .33 | | .246 | .246 | 0 | 750 | 550 | 550 | | 135.40 | 135.399 | 0 |
| DRYER - 110 LB | 90 | .33 | .33 | | .246 | .246 | 0 | 750 | 550 | 550 | | 135.40 | 135.399 | 0 |
| WASHER - 110 LB | 91 | 7.5 | 3 | 2 | 5.60 | 2.24 | 1.49 | 750 | 550 | 60 | 550 | 3077.3 | 134.28 | 820.6 |
| WASHER - 110 LB | 92 | 7.5 | 3 | 2 | 5.60 | 2.24 | 1.49 | 750 | 550 | 60 | 550 | 3077.3 | 134.28 | 820.6 |
| WASHER - 110 LB | 93 | 5 | .5 | 2 | 3.73 | .373 | 1.49 | 750 | 550 | 60 | 550 | 2051.5 | 22.38 | 820.6 |
| COMPRESSER 70# | 94 | 15 | .5 | .33 | 11.2 | .373 | .246 | | 300 | 60 | 550 | 3357 | 22.38 | 135.4 |
| COMPRESSER 110# | 95 | 15 | .5 | .33 | 11.2 | .373 | .246 | | 360 | | | 4028.4 | 0 | 0 |
| COMPRESSER 110# | 96 | 15 | .5 | .33 | 11.2 | .373 | .246 | | 360 | | | 4028.4 | 0 | 0 |
| VAPOR ABSORBER | 97 | | | | 0 | 0 | 0 | | 500 | | | 0 | 0 | 0 |
| 38" PRESS | 98 | | | | 0 | 0 | 0 | | | | | 0 | 0 | 0 |
| 18" PRESS | 99 | | | | 0 | 0 | 0 | | | | | 0 | 0 | 0 |
| 38" PRESS | 100 | | | | 0 | 0 | 0 | | | | | 0 | 0 | 0 |
| 18" PRESS | 101 | | | | 0 | 0 | 0 | | | | | 0 | 0 | 0 |
| 38" PRESS | 102 | | | | 0 | 0 | 0 | | | | | 0 | 0 | 0 |
| 18" PRESS | 103 | | | | 0 | 0 | 0 | | | | | 0 | 0 | 0 |
| 38" PRESS | 104 | | | | 0 | 0 | 0 | | | | | 0 | 0 | 0 |
| JACKET FORMER | 105 | | | | 0 | 0 | 0 | | | | | 0 | 0 | 0 |
| JACKET FORMER | 106 | | | | 0 | 0 | 0 | | | | | 0 | 0 | 0 |
| 52" PRESS | 107 | | | | 0 | 0 | 0 | | | | | 0 | 0 | 0 |
| PANT STEAMER | 108 | | | | 0 | 0 | 0 | | | | | 0 | 0 | 0 |
| PANT STEAMER | 109 | | | | 0 | 0 | 0 | | | | | 0 | 0 | 0 |
| 52" PRESS | 110 | | | | 0 | 0 | 0 | | | | | 0 | 0 | 0 |
| COMPRESSER | 111 | 60 | | | 44.8 | 0 | 0 | | 500 | | | 22380 | 0 | 0 |
| COMPRESSER | 112 | 60 | | | 44.8 | 0 | 0 | | 500 | | | 22380 | 0 | 0 |
| CONVEYOR | 113 | .5 | | | .373 | 0 | 0 | | 500 | | | 186.5 | 0 | 0 |
| CONVEYOR | 114 | .5 | | | .373 | 0 | 0 | | 500 | | | 186.5 | 0 | 0 |
| VACUUM UNIT | 115 | 5 | | | 3.73 | 0 | 0 | | 500 | | | 1865 | 0 | 0 |
| VACUUM UNIT | 116 | 5 | | | 3.73 | 0 | 0 | | 500 | | | 1865 | 0 | 0 |
| | | | | | ----- | ----- | ----- | | | | | ------ | ------ | ------ |
| | | | | | 324 | 184 | 148 | | | | | 224400 | 77348 | 2422[illegible] |

TOTAL KWH --- 325967.2

TABLE II-
WASHER CAPACITIES, PRODUCTION & HOURS OF OPERATION

| EQUIPMENT | ID # | STEAM (LBS/HR) -A- | STEAM (MBH) -B- | HOT WATER (GPC) -C- | TOTAL WATER (GPC) -D- | PROPANE (MBH) -E- | CYCLES PER YEAR -F- | LBS LAUND PER CYCLE -G- | LBS LAUND PER HOUR -H- | LBS LAUND PER YEAR -I- | LBS STEAM/ LBS LAUND -J- | GAL WATER /LBS LAUND -K- | EQUIP OPER HOURS /YEAR -L- | FUEL INPUT HOURS /YEAR -M- | TOTAL STEAM MMBTU -N- | TOTAL HW (GALS X 1000) -O- | TOTAL WATER (GALS X 1000) -P- | TOTAL PROPANE MMBTU -Q- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WASHER-EXTRACTOR - A | 1 | 750 | 810.00 | 1061 | 1560 | | 610 | 600 | 600 | 366000 | .5737705 | 2.6 | 610 | 280 | 225.75 | 647.09 | 951.6 | |
| WASHER-EXTRACTOR - A | 2 | 750 | 810.00 | 1061 | 1560 | | 610 | 600 | 600 | 366000 | .5737705 | 2.6 | 610 | 280 | 225.75 | 647.09 | 951.6 | |
| WASHER-EXTRACTOR - A | 3 | 750 | 810.00 | 1061 | 1560 | | 610 | 600 | 600 | 366000 | .5737705 | 2.6 | 610 | 280 | 225.75 | 647.09 | 951.6 | |
| WASHER-EXTRACTOR - A | 4 | 750 | 810.00 | 1061 | 1560 | | 610 | 600 | 600 | 366000 | .5737705 | 2.6 | 610 | 280 | 225.75 | 647.09 | 951.6 | |
| WASHER-EXTRACTOR - B | 5 | 900 | 972.00 | 1414 | 2080 | | 610 | 800 | 800 | 488000 | .5163934 | 2.6 | 610 | 280 | 270.9 | 862.78 | 1268.8 | |
| WASHER-EXTRACTOR - B | 6 | 900 | 972.00 | 1414 | 2080 | | 610 | 800 | 800 | 488000 | .5163934 | 2.6 | 610 | 280 | 270.9 | 862.78 | 1268.8 | |
| WASHER-EXTRACTOR - C | 7 | 200 | 216.00 | 354 | 520 | | 732 | 200 | 240 | 146400 | .3825137 | 2.6 | 610 | 280 | 60.2 | 258.84 | 380.64 | |
| WASHER-EXTRACTOR - C | 8 | 200 | 216.00 | 354 | 520 | | 732 | 200 | 240 | 146400 | .3825137 | 2.6 | 610 | 280 | 60.2 | 258.84 | 380.64 | |
| WASHER-D | 9 | 150 | 162.00 | 177 | 260 | | 732 | 100 | 120 | 73200 | .5737705 | 2.6 | 610 | 280 | 45.15 | 129.42 | 190.32 | |
| WASHER-D | 10 | 150 | 162.00 | 177 | 260 | | 732 | 100 | 120 | 73200 | .5737705 | 2.6 | 610 | 280 | 45.15 | 129.42 | 190.32 | |
| WASHER-D | 11 | 150 | 162.00 | 177 | 260 | | 732 | 100 | 120 | 73200 | .5737705 | 2.6 | 610 | 280 | 45.15 | 129.42 | 190.32 | |
| SHEET WASH | 12 | 200 | 216.00 | 707 | 1040 | | 1988 | 400 | 530 | 795000 | .1735849 | 2.6 | 1500 | 690 | 148.35 | 1405.6 | 2067 | |
| | | 5850 | 6318.00 | | | | | | | 3747400 | | | | | 1849 | 6625.4 | 9743.2 | |

STEAM USE (MMBTUs) ---- 1849

PROPANE USE (MMBTUs) ---- 0

HOT WATER (MMBTUs) ---- 5518.96

TABLE II-7

DRYER CAPACITIES, PRODUCTION & HOURS OF OPERATION

| EQUIPMENT | ID # | STEAM (LBS/HR) -A- | STEAM (MBH) -B- | WATER RET (#PC) -C- | TOTAL WATER RET # -D- | PROPANE (MBH) -E- | CYCLES PER YEAR -F- | LBS LAUND PER CYCLE -G- | LBS LAUND PER HOUR -H- | LBS LAUND PER YEAR -I- | BTU/ LBS LAUND -J- | BTU/ LBS LAUND -J- | EQUIP OPER HOURS /YEAR -L- | FUEL INPUT HOURS /YEAR -M- | TOTAL STEAM MMBTU -N- | TOTAL PROPANE MMBTU -O- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRYER-TUMBLER | 14 | | .00 | 260 | 356200 | 3000 | 1370 | 400 | 680 | 548000 | 1751.825 | 547400 | 805 | 320 | 0 | 960 |
| DRYER-A | 15 | 350 | 378.00 | 65 | 65000 | | 1000 | 100 | 125 | 100000 | 2646 | 100000 | 800 | 700 | 263.38 | |
| DRYER-B | 16 | 350 | 378.00 | 65 | 65000 | | 1000 | 100 | 125 | 100000 | 2646 | 100000 | 800 | 700 | 263.38 | |
| DRYER-C | 17 | 350 | 378.00 | 65 | 65000 | | 1000 | 100 | 125 | 100000 | 2646 | 100000 | 800 | 700 | 263.38 | |
| DRYER-B | 18 | 350 | 378.00 | 65 | 65000 | | 1000 | 100 | 125 | 100000 | 2646 | 100000 | 800 | 700 | 263.38 | |
| DRYER-C | 19 | 350 | 378.00 | 65 | 65000 | | 1000 | 100 | 125 | 100000 | 2646 | 100000 | 800 | 700 | 263.38 | |
| DRYER-A | 20 | 350 | 378.00 | 65 | 65000 | | 1000 | 100 | 125 | 100000 | 2646 | 100000 | 800 | 700 | 263.38 | |
| DRYER-E | 21 | 350 | 378.00 | 65 | 65000 | | 1000 | 100 | 125 | 100000 | 2646 | 100000 | 800 | 700 | 263.38 | |
| DRYER-E | 22 | 350 | 378.00 | 65 | 65000 | | 1000 | 100 | 125 | 100000 | 2646 | 100000 | 800 | 700 | 263.38 | |
| DRYER-E | 23 | 350 | 378.00 | 65 | 65000 | | 1000 | 100 | 125 | 100000 | 2646 | 100000 | 800 | 700 | 263.38 | |
| DRYER-E | 24 | 350 | 378.00 | 65 | 65000 | | 1000 | 100 | 125 | 100000 | 2646 | 100000 | 800 | 700 | 263.38 | |
| DRYER-E | 25 | 350 | 378.00 | 65 | 65000 | | 1000 | 100 | 125 | 100000 | 2646 | 100000 | 800 | 700 | 263.38 | |
| DRYER-E | 26 | 350 | 378.00 | 65 | 65000 | | 1000 | 100 | 125 | 100000 | 2646 | 100000 | 800 | 700 | 263.38 | |
| DRYER-G | 27 | | .00 | 65 | 65000 | 250 | 1000 | 100 | 100 | 100000 | 1875 | 100000 | 1000 | 750 | 0 | 187.5 |
| DRYER-G | 28 | | .00 | 65 | 65000 | 250 | 1000 | 100 | 100 | 100000 | 1875 | 100000 | 1000 | 750 | 0 | 187.5 |
| DRYER-G | 29 | | .00 | 65 | 65000 | 250 | 1000 | 100 | 100 | 100000 | 1875 | 100000 | 1000 | 750 | 0 | 187.5 |
| DRYER-G | 30 | | .00 | 65 | 65000 | 250 | 1000 | 100 | 100 | 100000 | 1875 | 100000 | 1000 | 750 | 0 | 187.5 |
| DRYER-B | 31 | 350 | 378.00 | 65 | 65000 | | 1000 | 100 | 125 | 100000 | 2646 | 100000 | 800 | 700 | 263.38 | |
| DRYER-B | 32 | 350 | 378.00 | 65 | 65000 | | 1000 | 100 | 125 | 100000 | 2646 | 100000 | 800 | 700 | 263.38 | |
| DRYER-B | 33 | 350 | 378.00 | 65 | 65000 | | 1000 | 100 | 125 | 100000 | 2646 | 100000 | 800 | 700 | 263.38 | |
| DRYER-B | 34 | 350 | 378.00 | 65 | 65000 | | 1000 | 100 | 125 | 100000 | 2646 | 100000 | 800 | 700 | 263.38 | |
| DRYER-B | 35 | 350 | 378.00 | 65 | 65000 | | 1000 | 100 | 125 | 100000 | 2646 | 100000 | 800 | 700 | 263.38 | |
| DRYER-D | 36 | 350 | 378.00 | 65 | 65000 | | 1000 | 100 | 125 | 100000 | 2646 | 100000 | 800 | 700 | 263.38 | |
| DRYER-D | 37 | 350 | 378.00 | 65 | 65000 | | 1000 | 100 | 125 | 100000 | 2646 | 100000 | 800 | 700 | 263.38 | |
| DRYER-H | 38 | 350 | 378.00 | 65 | 65000 | | 1000 | 100 | 125 | 100000 | 2646 | 100000 | 800 | 700 | 263.38 | |
| DRYER-F | 39 | | .00 | 260 | 260000 | 3000 | 1000 | 400 | 680 | 400000 | 5250 | 401200 | 590 | 700 | 0 | 2100 |
| DRYER-F | 40 | | .00 | 260 | 260000 | 3000 | 1000 | 400 | 680 | 400000 | 5250 | 401200 | 590 | 700 | 0 | 2100 |
| DRYER-I | 41 | | .00 | | 0 | 2000 | 0 | 400 | 0 | 0 | | | | 0 | 0 | 0 |
| | | 7000 | 7560.00 | | | | | | | 3748000 | | 3749800 | | | 5267.5 | 5910 |

STEAM USE (MMBTUs)---- 5267.5

PROPANE USE (MMBTU---- 5910

## D. COMPUTER ANALYSIS

A computer program was used to simulate energy consumption at the laundry facility for calendar year 1987. The software selected for computer simulation was PC-DOE, Version 2.1 B. PC-DOE is a microcomputer version of the DOE-2.1B computer program. All instruction and reference manuals which apply to DOE-2.1 also apply to PC-DOE.

The computer simulation was used primarily to estimate energy consumption for plant and space heating equipment. The program does not account for steam operated process equipment. To obtain an accurate simulation of total consumption, process steam was included in domestic hot water use in the computer simulation. Electrical loads for process equipment are shown in the computer simulation as miscellaneous equipment.

Input files for the computer simulation are contained in Appendix "E" of this report. Output files from the computer program are listed in Appendix "F".

Table II-8 compares energy consumption as estimated by the computer simulation with energy consumption taken from utility records. Figures II-4 & II-5 graphically depict information contained in Table II-8.

The computer model estimates a total annual electricity consumption of 2143.4 million BTU's. Utility records show an actual use of 2384 million BTU's in 1987. Therefore, the computer provides an estimate that is approximately 10% lower than actual usage. When comparing total annual electricity consumption for 1987.

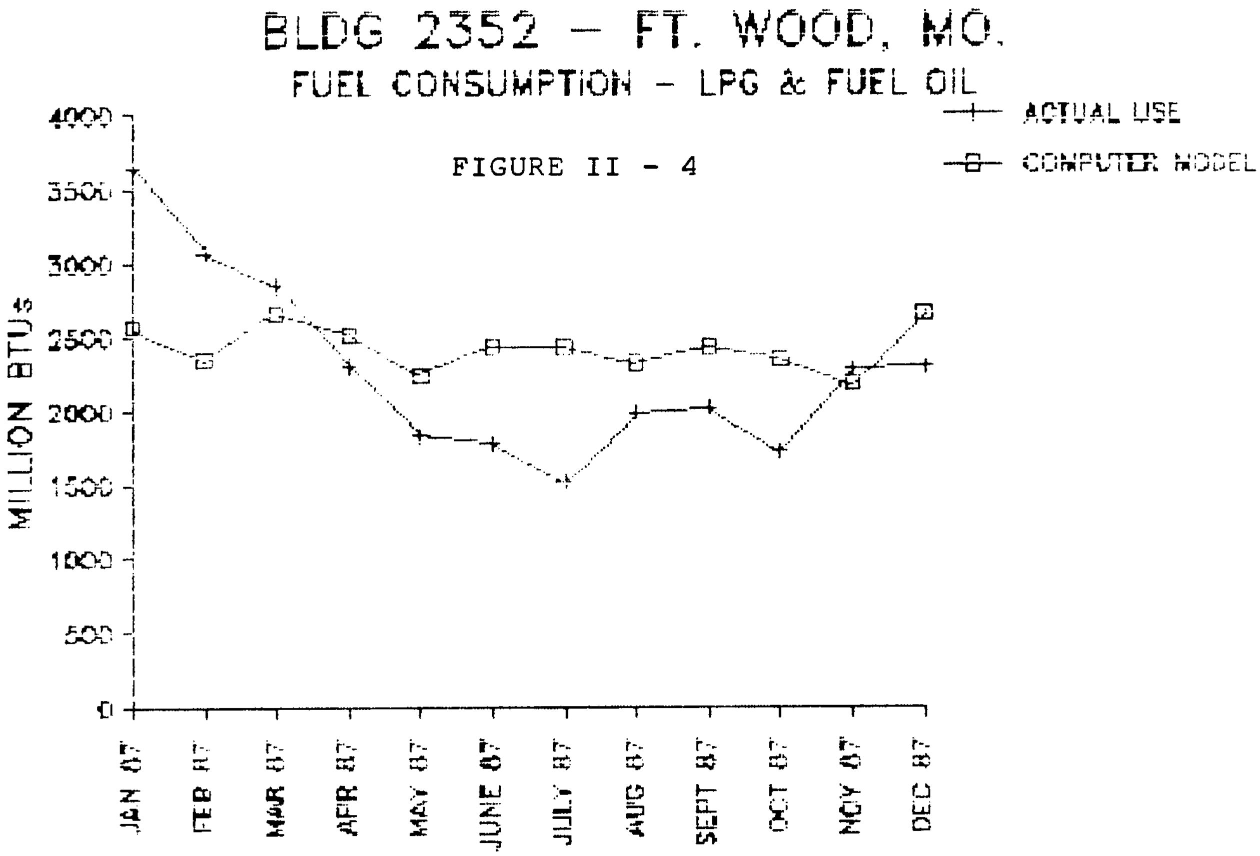
Figure II-5 shows a fairly accurate simulation on monthly consumption trends for electricity. This graph shows a substantial drop in actual electricity use between July and August. This dramatic change i consumption can probably be attributed to the period between meter readings during the summer months of 1987.

The computer model shows an annual fuel use of 29,147.1 million BTU's. The total actual fuel use of LPG & Fuel Oil combined was 27,302 million BTU's in 1987. Therefore, the computer provides a model that predicates within 7% total annual fuel usage.

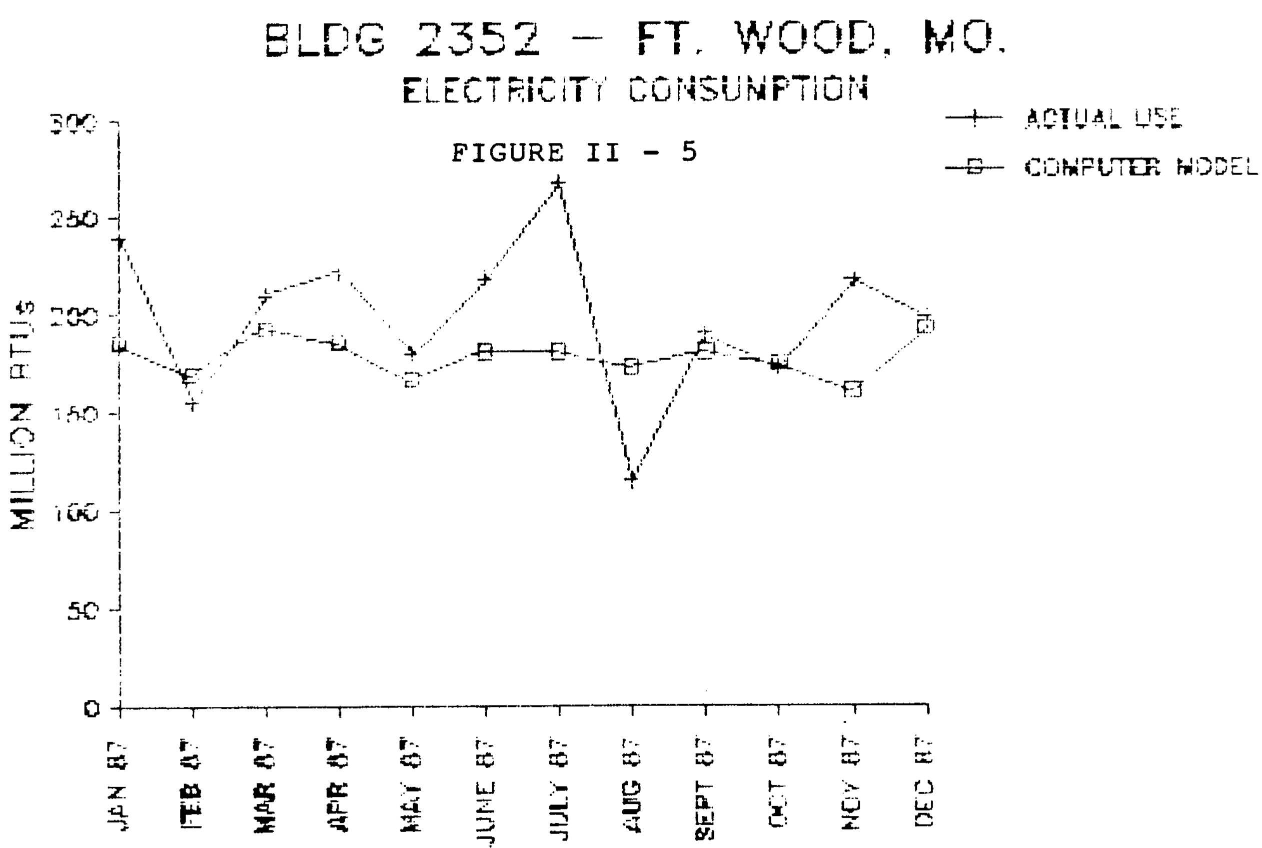
Figure II-A shows that monthly fuel consumption trends are not accurately predicted by the computer model when compared with utility records. The computer shows a fairly consistent fuel usage from month to month. Utility records show a wide fluctuation. The difference between the computer simulation and monthly utility records may be attributed to varying production rates at the Laundry Facility from month to month. Some differences could also be attributed to the actual time elapsed between meter readings.

TABLE II-8
BUILDING 2352 - FORT LEONARD WOOD, MO
COMPUTER SIMULATION vs UTILITY RECORD DATA

| | UTILITY RECORDS | | | | | COMPUTER MODEL | |
|---|---|---|---|---|---|---|---|
| | ELECTRICAL USE MBTUS | STEAM PRODUCTION 1000 LB | FUEL (OIL) MBTUS | FUEL (GAS) MBTUS | TOTAL FUEL USE MBTUS | TOTAL FUEL INPUT | TOTAL ELECTRICAL USE |
| JAN 87 | 239 | 2614 | 719 | 2924 | 3643 | 2564 | 185.5 |
| FEB 87 | 155 | 1977 | 454 | 2617 | 3071 | 2344.6 | 169.2 |
| MAR 87 | 210 | 1998 | 607 | 2238 | 2845 | 2658.2 | 192.9 |
| APR 87 | 221 | 1608 | 396 | 1908 | 2304 | 2517.4 | 185.5 |
| MAY 87 | 180 | 1088 | 207 | 1622 | 1829 | 2248.6 | 166.5 |
| JUNE 87 | 218 | 1105 | 57 | 1722 | 1779 | 2433 | 181 |
| JULY 87 | 268 | 1137 | 62 | 1454 | 1516 | 2432.8 | 181 |
| AUG 87 | 114 | 1092 | 56 | 1927 | 1983 | 2322.2 | 172.8 |
| SEPT 87 | 190 | 1226 | 103 | 1921 | 2024 | 2432.8 | 181 |
| OCT 87 | 173 | 1266 | 697 | 1025 | 1722 | 2352.8 | 174.4 |
| NOV 87 | 217 | 1411 | 569 | 1716 | 2285 | 2181.4 | 160.6 |
| DEC 87 | 199 | 1627 | 970 | 1331 | 2301 | 2659.3 | 193 |
| TOTAL | 2384 | 18149 | 4897 | 22405 | 27302 | 29147.1 | 2143.4 |




COMPUTER SIMULATION vs UTILITY RECORD DATA




COMPUTER SIMULATION vs UTILITY RECORD DATA

## E. SUMMARY

The information obtained from utility records, production records, the equipment inventory, and computer simulation was compiled and cross referenced to obtain a reasonable estimate of energy consumption for particular areas within the laundry facility.

Table II-9 provides a summary of information resulting from the energy audit. A plant efficiency of 75% was used in converting steam consumption to total fuel consumption. The plant reward efficiency was taken from a boiler and chiller plants energy engineering analysis program report dated April, 1988 prepared by Lutz, Daily and Brain. Existing energy consumption used in this study for the various categories is shown under the heading SPREAD SHEETS.

Figure II-6 provides a graphical representation of electricity use for various purposes at the laundry. Figure II-7 provides a representation of total fuel use in different areas.

Table II-10 provides a summary of energy use for different processes at the facility. Figures II-8 & II-9 graphically depict the information in Table II-10.

The information collected and analyzed during the energy audit is used to make reasonable estimates concerning existing fuel usage. When ECO's are analyzed for economic feasibility in Section IV, ECIP guidance cost factors were used for fuel costs. Current ECIP guidance is used for determining discount factors in the life cycle cost analysis.

Energy costs were taken from current ECIP guidance because these values were approved for use in a previous study for facilities at Ft. Leonard Wood.

TABLE II-9

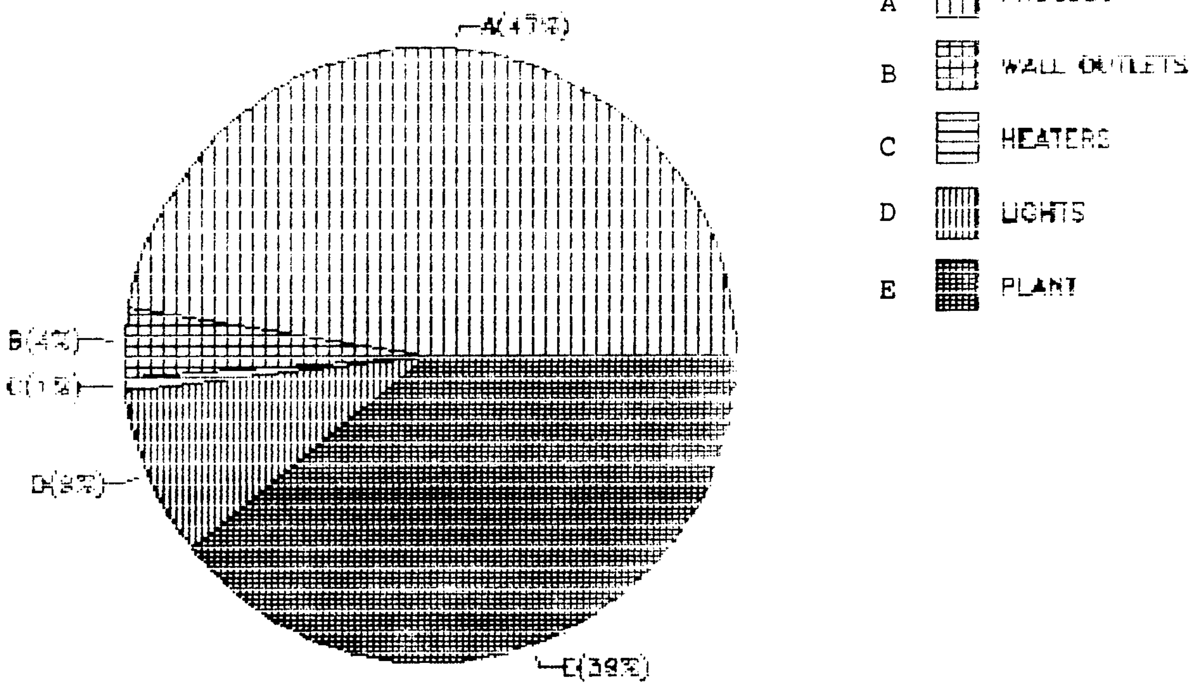
FORT LEONARD WOOD
BUILDING 2352
AUDIT SUMMARY

| | | PROPANE MBTU | #2 FUEL MBTU | TOTAL FUEL MBTU | STEAM MBTU | ELECTRIC KWH X 1000 | ELECTRIC MBTU |
|---|---|---|---|---|---|---|---|
| UTILITY RECORDS | | 27352 | 3679 | 31031 | | 705.7 | 2408 |
| COMPUTER PROGRAM | | | | 29147 | | 628 | 2143 |
| SPREAD SHEETS | | | | | | | |
| A | PROCESS ELEC | | | | | 326 | 1112.64 |
| B | CONV. OUTLETS | | | | | 26 | 88.74 |
| C | UNIT HEATERS | | | | | 5.47 | 18.67 |
| D | LIGHTS | | | | | 61.7 | 210.58 |
| E | PLANT ELEC (FROM COMP. OUTPUT) | | | | | 270.2 | 922.19 |
| | SUB TOTAL | | | | | 689.37 | 2352.82 |
| A | PROCESS STEAM | | | 18181 | 13636 | | |
| B | PROCESS PROPANE | | | 5910 | 5910 | | |
| C | PROCESS HOT WATER | | | 7359 | 5519 | | |
| D | DOMESTIC HOT WAT | | | 16 | 12 | | |
| E | SPACE HEAT (FROM COMP. OUTPUT) | | | 1170 | | | |
| | | | | 32636 | 25077 | | |

BLDG 2352 - FT WOOD, MO.

ELECTRICITY USE - 689,000 KWH

FIGURE II - 6

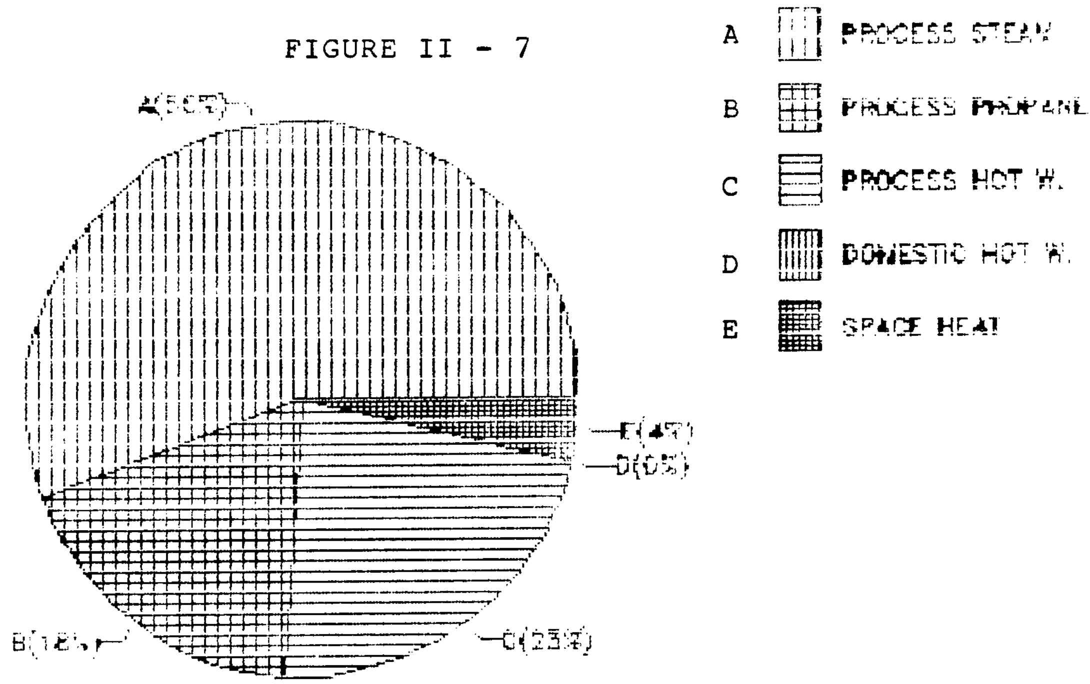



PERCENTAGE OF ANNUAL CONSUMPTION

BLDG 2352 – FT WOOD, MO.

TOTAL FUEL USE – 32,636 MILLION BTU

FIGURE II - 7




PERCENTAGE OF ANNUAL CONSUMPTION

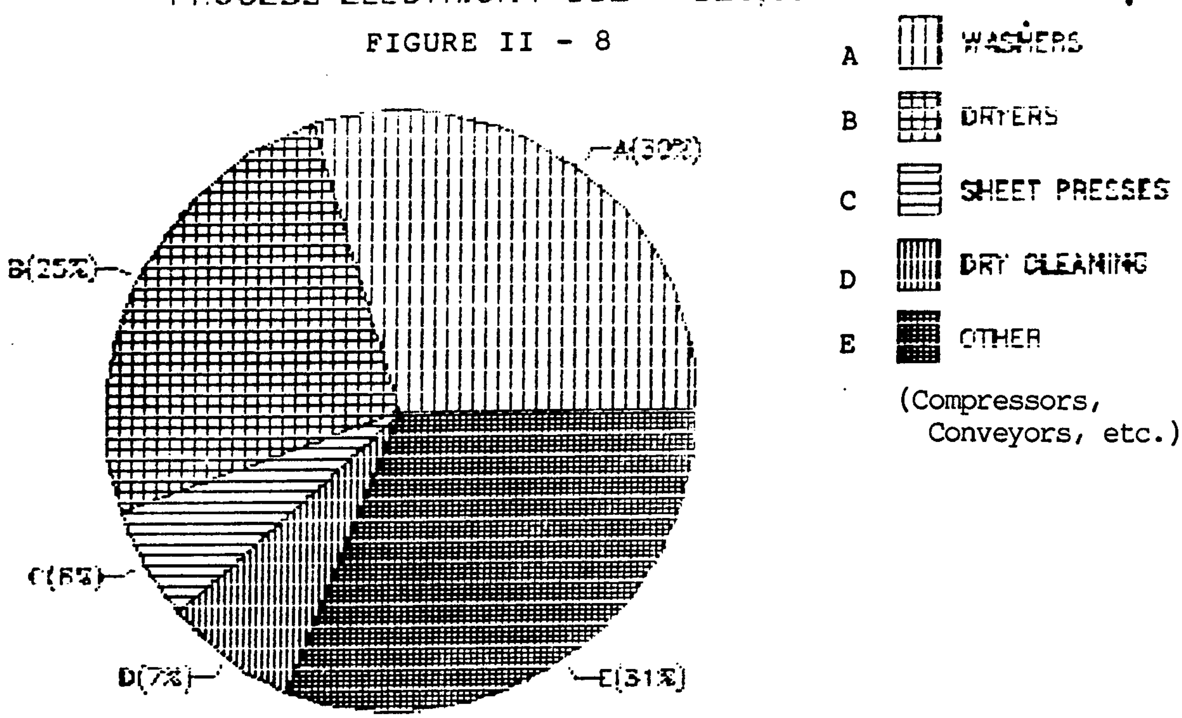
TABLE II-10
BUILDING 2352 - FORT LEONARD WOOD, MO

PROCESS ENERGY DISTRIBUTION

| | | STEAM MBTU | HOT WATER MBTU | PROPANE MBTU | TOTAL FUEL MBTU | ELECTRICITY KWH X 1000 | ELECTRICITY MBTU | TOTAL MBTU |
|---|---|---|---|---|---|---|---|---|
| WASHERS | A | 1849 | 5519 | 0 | 7368 | 97.4 | 332.43 | 7700.426 |
| DRYERS | B | 5267.5 | | 5910 | 11177.5 | 82.6 | 281.91 | 11459.41 |
| SHEET PRESSES | C | 2580 | | | 2580 | 20.4 | 69.63 | 2649.625 |
| DRY CLEANING | D | 1655.5 | | | 1655.5 | 24.1 | 82.25 | 1737.753 |
| OTHER | E | 2284 | | | 2284 | 101.5 | 346.42 | 2630.420 |
| | | 13636 | 5519 | 5910 | 25065 | 326 | 1112.64 | 26177.64 |

BLDG 2352 - FT WOOD, MO
PROCESS ELECTRICITY USE - 326,000 KWH

FIGURE II - 8

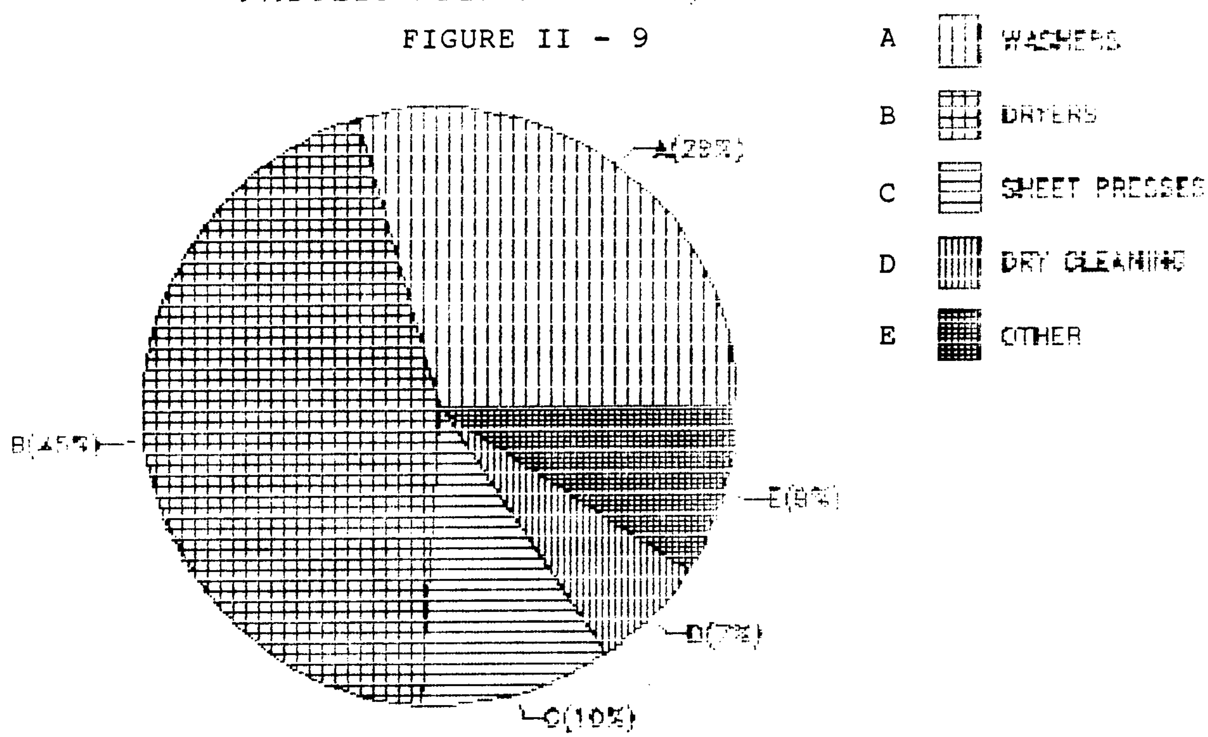



PERCENTAGE OF ANNUAL CONSUMPTION

BLDG 2352 - FT WOOD, MO

PROCESS FUEL USE - 25,065 MIL. BTU

FIGURE II - 9

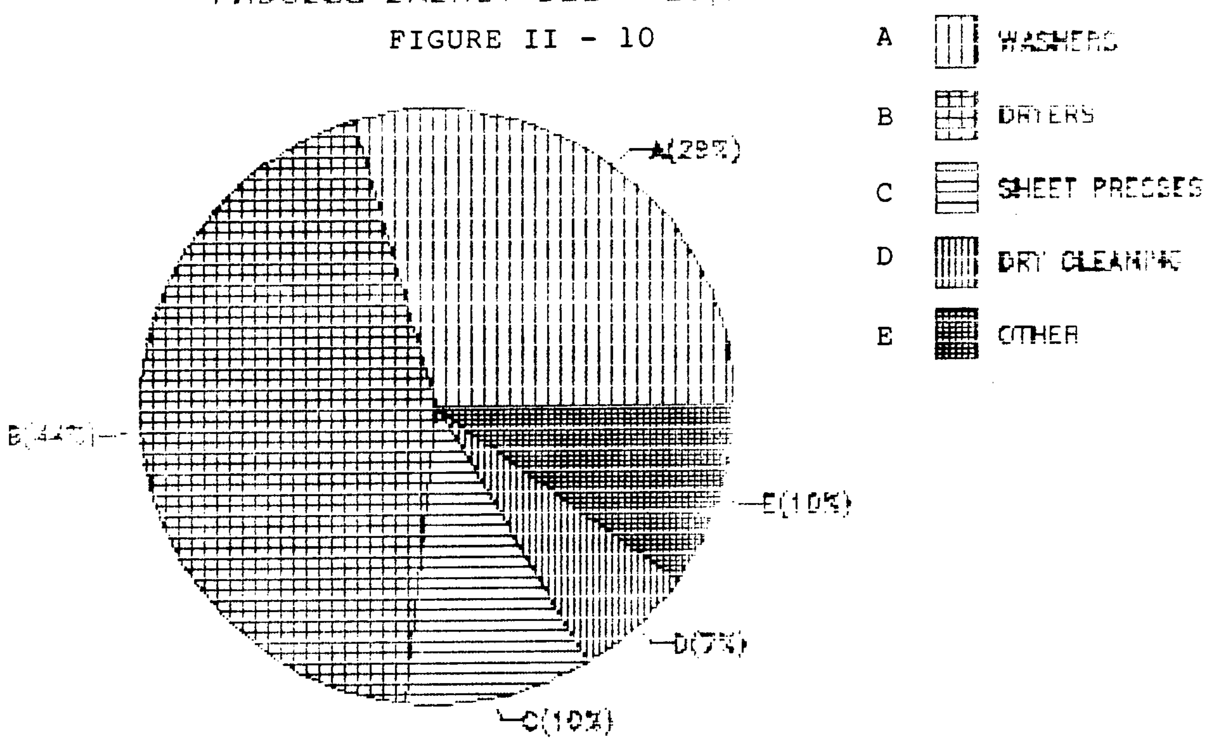



PERCENTAGE OF ANNUAL CONSUMPTION

# BLDG 2352 – FT WOOD, MO

## PROCESS ENERGY USE – 26,177 MIL. BTU

FIGURE II - 10




PERCENTAGE OF ANNUAL CONSUMPTION

## III. ENERGY CONSERVATION OPPORTUNITY (ECO) SUMMARY AND DESCRIPTION

Tables III-1 & III-2 show all of the energy conservation opportunities (ECO's) selected for analysis at the Fort Leonard Wood laundry facility. Table III-1 lists ECO's in ascending numerical order. Table III-2 lists ECO's in descending order of savings investment ratios.

The pages immediately following Table III-2 contain a brief description of each ECO selected for analysis.

TABLE III-1

ENERGY CONSERVATION OPPORTUNITY SUMMARY
BUILDING 2352 - FORT LEONARD WOOD, MO.

| ECO # | TITLE | FUEL SAVINGS (COST) MBTU | ELEC SAVINGS (COST) MBTU | FUEL SAVINGS (COST) $ | ELEC SAVINGS (COST) $ | TOTAL SAVINGS (COST) $ | INSTALLED COST | SIMPLE PAYBACK YEARS | SAVINGS INVESTMENT RATIO (SIR) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | REPAIR PIPE INSULATION | 901 | 0 | 2948.34 | .00 | 2948.34 | 17531 | 5.95 | 1.95 |
| 3 | CAULK & SEAL WINDOWS | 298 | 0 | 975.15 | .00 | 975.15 | 4814 | 4.94 | 1.37 |
| 6 | REDUCE WINDOW AREA | -1.7 | -.3 | -5.56 | -3.89 | -9.45 | 1 | -.11 | -148.00 |
| 7 | INSTALL GAS HW HEATER | 702.9 | 0 | 2300.10 | .00 | 2300.10 | 24702 | 10.74 | 1.50 |
| 8 | LIGHTING MODIFICATIONS | 0 | 54.23 | .00 | 703.36 | 703.36 | 7975 | 11.34 | .77 |
| 12 | INSTALL RADIANT HEATERS | 359.7 | 7.9 | 1177.05 | 102.46 | 1279.51 | 13754 | 10.75 | 1.06 |
| 14 | HEAT DESTRATIFICATION | 382 | -208 | 1250.02 | -2697.76 | -1447.74 | 5646 | -3.90 | -.76 |
| 15 | WASH WATER HEAT RECOVERY | 4375 | 0 | 14316.31 | .00 | 14316.31 | 120403 | 8.41 | 1.87 |
| 15A | WASH WATER HR WTH NEW HTR | 3954 | 0 | 12938.67 | .00 | 12938.67 | 110474 | 8.54 | 1.84 |
| 17 | LOWER HW SUPPLY TEMP | 941 | 0 | 3079.23 | .00 | 3079.23 | 119 | .04 | 418.31 |
| 19 | STEAM TRAP REPLACEMENT | 172 | 0 | 562.84 | .00 | 562.84 | 105 | .19 | 54.03 |
| 20 | INSTALL 1000 LB CBW | 2114.7 | 0 | 6919.93 | .00 | 6919.93 | 103847 | 15.01 | 1.08 |
| 20A | REPLACE STEAM DRYERS | 3123 | 2.8 | 10219.39 | 36.32 | 10255.71 | 84545 | 8.24 | 1.96 |
| 20B | REPLACE 400 LB DRYER | 638.8 | 28.5 | 2090.35 | 369.65 | 2459.99 | 51605 | 20.98 | .73 |
| 21 | INSTALL AIR CURTAIN | 393 | 0 | 1286.01 | .00 | 1286.01 | 794 | .62 | 10.92 |
| 23 | RECYCLE RINSE WATER | 2479 | 0 | 8112.03 | .00 | 8112.03 | 32704 | 4.03 | 3.82 |
| 24 | EXHAUST HR 100 LB DRYERS | 7678 | -153 | 25124.72 | -1984.41 | 23140.31 | 379122 | 16.38 | 1.00 |
| 24A | EXHAUST HR 400 LB DRYERS | 1273 | 0 | 4165.64 | .00 | 4165.64 | 57927 | 13.91 | 1.16 |
| 26 | THERMAL FLUID PRESSES | 1620 | 13.75 | 5301.13 | 178.34 | 5479.46 | 220006 | 40.15 | .42 |
| 27 | COLD WATER LAUNDERING | 2098 | -20 | 6865.29 | -259.40 | 6605.89 | 119 | .02 | 908.26 |
| 31 | TURN OFF STEAM | 1147 | 0 | 3753.33 | .00 | 3753.33 | 8910 | 2.37 | 6.80 |

TABLE III-2

ENERGY CONSERVATION OPPORTUNITY SUMMARY
BUILDING 2352 - FORT LEONARD WOOD, MO.

| ECO # | TITLE | FUEL SAVINGS (COST) MBTU | ELEC SAVINGS (COST) MBTU | FUEL SAVINGS (COST) $ | ELEC SAVINGS (COST) $ | TOTAL SAVINGS (COST) $ | INSTALLED COST | SIMPLE PAYBACK YEARS | SAVINGS INVESTMENT RATIO (SIR) |
|---|---|---|---|---|---|---|---|---|---|
| 27 | COLD WATER LAUNDERING | 2098 | -20 | 6865.29 | -259.40 | 6605.89 | 119 | .02 | 908.26 |
| 17 | LOWER HW SUPPLY TEMP | 941 | 0 | 3079.23 | .00 | 3079.23 | 119 | .04 | 418.31 |
| 19 | STEAM TRAP REPLACEMENT | 172 | 0 | 562.84 | .00 | 562.84 | 105 | .19 | 54.03 |
| 21 | INSTALL AIR CURTAIN | 393 | 0 | 1286.01 | .00 | 1286.01 | 794 | .62 | 10.92 |
| 31 | TURN OFF STEAM | 1147 | 0 | 3753.33 | .00 | 3753.33 | 8910 | 2.37 | 6.80 |
| 23 | RECYCLE RINSE WATER | 2479 | 0 | 8112.03 | .00 | 8112.03 | 32704 | 4.03 | 3.82 |
| 20A | REPLACE STEAM DRYERS | 3123 | 2.8 | 10219.39 | 36.32 | 10255.71 | 84545 | 8.24 | 1.96 |
| 1 | REPAIR PIPE INSULATION | 901 | 0 | 2948.34 | .00 | 2948.34 | 17531 | 5.95 | 1.95 |
| 15 | WASH WATER HEAT RECOVERY | 4375 | 0 | 14316.31 | .00 | 14316.31 | 120403 | 8.41 | 1.87 |
| 15A | WASH WATER HR WTH NEW HTR | 3954 | 0 | 12938.67 | .00 | 12938.67 | 110474 | 8.54 | 1.84 |
| 7 | INSTALL GAS HW HEATER | 702.9 | 0 | 2300.10 | .00 | 2300.10 | 24702 | 10.74 | 1.50 |
| 3 | CAULK & SEAL WINDOWS | 298 | 0 | 975.15 | .00 | 975.15 | 4814 | 4.94 | 1.37 |
| 24A | EXHAUST HR 400 LB DRYERS | 1273 | 0 | 4165.64 | .00 | 4165.64 | 57927 | 13.91 | 1.16 |
| 20 | INSTALL 1000 LB CBW | 2114.7 | 0 | 6919.93 | .00 | 6919.93 | 103847 | 15.01 | 1.08 |
| 12 | INSTALL RADIANT HEATERS | 359.7 | 7.9 | 1177.05 | 102.46 | 1279.51 | 13754 | 10.75 | 1.06 |
| 24 | EXHAUST HR 100 LB DRYERS | 7678 | -153 | 25124.72 | -1984.41 | 23140.31 | 379122 | 16.38 | 1.00 |
| 8 | LIGHTING MODIFICATIONS | 0 | 54.23 | .00 | 703.36 | 703.36 | 7975 | 11.34 | .77 |
| 20B | REPLACE 400 LB DRYER | 638.8 | 28.5 | 2090.35 | 369.65 | 2459.99 | 51605 | 20.98 | .73 |
| 26 | THERMAL FLUID PRESSES | 1620 | 13.75 | 5301.13 | 178.34 | 5479.46 | 220006 | 40.15 | .42 |
| 14 | HEAT DESTRATIFICATION | 382 | -208 | 1250.02 | -2697.76 | -1447.74 | 5646 | -3.90 | -.76 |
| 6 | REDUCE WINDOW AREA | -1.7 | -.3 | -5.56 | -3.89 | -9.45 | 1 | -.11 | -148.00 |

A. ECO #1 - PIPE INSULATION

Savings are based upon replacing approximately 10% of all piping insulation. It is assumed that damaged insulation provided no resistance to heat loss. This project has a payback period of approximately 6 years. Its SIR is 1.95.

B. ECO #3 - CAULK AND SEAL WINDOWS

Energy is wasted by air infiltrating through window cracks. The savings shown for this project are based upon estimates of crack width and length for all windows. This project shows considerable energy savings with a rapid payback of 4.94 years and a SIR of 1.37.

C. ECO #6 - WINDOW AREA REDUCTION

By reducing window area, summer cooling loads are decreased through a reduction in solar heat gains. If windows are replaced with materials having "U" values equal to those of the existing wall, then winter heating loads should also be reduced.

Savings for this ECO are estimated through computer simulation. The computer program shows there is no significant potential for conserving energy by reducing window area at the laundry facility.

D. ECO #7 - INSTALL GAS HW HEATER

Efficiency of hot water production is currently limited to the system efficiency of central plant equipment. The PVI Company produces a gas fired hot water heater that guarantees efficiencies in excess of 83%. The high efficiency is accomplished through direct contact heating elements and utilization of a stack economizer. The installation of such a heater will reduce energy consumption at the laundry facility by approximately 1367 MBTU per year and provide a payback period of less than 4 years.

E. ECO #8 - LIGHTING MODIFICATIONS

The laundry facility is currently lighted with standard suspended fluorescent light fixtures. There is only one 200 watt incandescent fixture in the building. Existing lighting efficiency can be improved by installing new ballasts and lamps and by reducing lighting levels in the accounting area.

ECO #8 will save approximately 54 MBTU of electrical energy. The payback period for this project is 11.34 years. The SIR is 0.77.

F. ECO #12 - INSTALL RADIANT HEATERS

Building heating efficiency can be improved by replacing existing steam unit heaters with infra-red radiant heaters. Infra-red heating provides comfort at reduced temperatures and eliminates the need for electrical energy.

ECO # 12 provides an estimated fuel savings of 360 MBTU and electricity savings of 7.86 MBTU each year. This project has a payback of 10.75 years and an SIR of 1.06.

G. ECO #14 - HEAT DESTRATIFICATION

This project involves installing circulating fans at ceiling level to force warm air back to floor level. The savings accomplished in fuel consumption are offset by additional electricity consumption.

H. ECO #15 & #15A - WASH WATER HR

This project involves the installation of a skid-mounted packaged heat recovery unit. The heat recovery unit directs waste water through a heat exhchanger and heats incoming cold water. The unit also has the capacity to store hot water and provide additional heat as needed.

ECO #15 provides an annual fuel savings of 4375 MBTU under existing conditions. If this project is implemented along with a more efficient hot water heater (ECO #15A), the annual savings are 3954 MBTU and the payback period is 8.54 years with an SIR of 1.84.

I. ECO #17 - LOWER HOT WATER TEMPERATURES

This project involves adjusting hot water supply temperature at the central plant and using existing booster heaters to achieve temperatures required at each washer. This project saves 941 MBTU each year with a payback of .04 years. This project should be tested before overall implementation. The exact capacity of existing booster heaters is unknown and required temperatures may not be achieved at each washer. One unit should be selected for testing before this project is implemented.

J. ECO #19 - STEAM TRAP REPLACEMENT

The savings estimated through steam trap replacement are based upon leakage of one trap. No faulty traps were identified during the audit process. This ECO is presented to emphasize the importance of a steam trap inspection program.

K. ECO #20 - INSTALL 1000 LB CBW

This project involves the installation of a continuous batch washer with a total capacity of 1000 pounds. This type of equipment reduces energy consumption by reducing hot water consumption. This project gives a payback of 15.01 years and a SIR of 1.08.

L. ECO #20A - REPLACE STEAM DRYERS

Existing 100 lb steam dryers have extremely low efficiency due to equipment design and resulting long drying cycles. All of the steam dryers now in place (20) can be replaced with two each 220 lb gas fired dryers without a reduction in total capacity.

ECO #20A provides an annual fuel savings of 3123 MBTU. Annual electricity savings are estimated to be 2.8 MBTU. The simple payback period is 8.24 years and the SIR is 1.96.

M. ECO #20B - REPLACE 400 LB GAS DRYERS

Advanced technology and design has produced gas dryers that can remove 1 lb of water for as little as 1800 BTU's. Existing dryers use approximately 2700 BTU's to remove 1 lb of water.

This ECO has a simple payback of over 20 years and an SIR of 0.73.

N. ECO #21 - INSTALL AIR CURTAIN

Considerable quantities of outside air infiltrate into the building through the loading dock area. Reducing this infiltration will also reduce overall energy consumption.

ECO #21 involves installing a PVC closure type curtain rather than a forced air type curtain. This project saves approximately 393 MBTU each year and pays for itself within 7 months. Since this is a low cost project with rapid payback it should be implemented as soon as possible.

O. ECO #23 - RECYCLE RINSE WATER

Energy can be conserved by recycling rinse water to following wash cycles. To accomplish water recycling diverting valves must be installed on existing washers. A collection sump, circulating pump and holding tank must be installed. Some control modifications are also required.

ECO #23 saves approximately 2479 MBTU of energy each year and a payback period of 4.03 years. Its SIR is 3.82.

P. ECO #24 - EXHAUST HEAT RECOVERY 100 LB DRYERS

Considerable energy is wasted from dryer exhaust air. The installation of an air to air heat exchanger will recover much of this wasted energy. Existing 100 lb dryers are exhausted through two separate lint filter systems. Heat exchangers could be installed at these two common points.

This ECO provides considerable energy savings potential. It is estimated that approximately 7678 MBTU of fuel could be saved each year through this project. However, high equipment costs cause this ECO to have a marginal payback of 16.38 years and an SIR of 1.00.

Q. ECO #24A - EXHAUST HEAT RECOVERY 400 LB DRYERS

Existing 400 lb dryers are exhausted separately and each dryer would require it's own heat recovery unit. "Energenics" Inc. manufacturers a package heat recovery and lint filter system. Installation of these units shows an energy savings potential of 1273 MBTU per year. However, the payback period for this project (13.91 years) is marginal and it has an SIR of 1.16.

R. ECO #26 - THERMAL FLUID PRESSES

Thermal fluid presses provide improved efficiency and production over existing steam presses. ECO #26 involves replacing existing sheet presses with new thermal fluid presses.

This project provides an estimated savings of 1620 MBTU per year in fuel energy and 13.75 MBTU in electrical energy. The payback period is in excess of 40 years and its SIR is 0.42.

S. ECO #27 - COLD WATER LAUNDERING

Energy required for water heating can be eliminated through cold water laundering. However, wash cycle times will increase slightly and the quality of product is usually not as good as achieved through hot water laundering. Although, this ECO provides energy savings and rapid payback, careful consideration should be given to the quality of the end product prior to implementing this ECO.

T. ECO #31 - SHUT OFF STEAM

Energy can be conserved by shutting of boilers when there is no requirement for steam. This procedure will eliminate boiler cycling to maintain system pressure during off use periods. This ECO saves energy and has a rapid payback period. However, the periodic shut down of central plant boilers causes thermal expansion and contraction in the steam distribution system. Repeated cycles of expansion and contraction can result in pipe system failure.

ECO # 1

DESCRIPTION: REPAIR PIPE INSULATION

SAVINGS POTENTIAL: PORTIONS OF STEAM SUPPLY AND CONDENSATE RETURN PIPING INSULATION ARE IN NEED OF REPLACEMENT. INSULATION REPAIR WILL REDUCE PIPING HEAT LOSSES AND IMPROVE SYSTEM EFFICIENCY.

A: ESTIMATED SAVINGS

POTENTIAL SAVINGS WERE BASED UPON THE FOLLOWING CONDITIONS:

AN ESTIMATED TEN PERCENT OF PIPING IS IN NEED OR REPAIR.

DAMAGED INSULATION IS REPRESENTED AS BARE EXPOSED PIPE FOR CALCULATION PURPOSES.

THE FOLLOWING SPREAD SHEETS CALCULATE HEAT LOSSES FOR THE TEN PERCENT OF BARE PIPE AND LOSSES AFTER INSULATION.

| | |
|---|---|
| HEAT LOSS FOR EXPOSED PIPE (MBTU) = | 965.93 |
| HEAT LOSS FOR INSULATED PIPE (MBTU) = | 64.74 |
| | ------- |
| TOTAL FUEL SAVINGS | 901.19 |
| $ SAVINGS = | 2946.89 |

HEAT LOSS DUE TO INSULATED PIPE

| PIPE SERVICE | NOMINAL PIPE SIZE (INCHES) | PIPE LENGTH (FEET) | 10% OF PIPE LENGTH | PIPE TEMPERATURE (F) | OUTSIDE TEMPERATURE (F) | ANNUAL USAGE (HOURS) | HEAT LOSS * (BTU/HR *FT) | TOTAL HEAT LOSS (MBTU) |
|---|---|---|---|---|---|---|---|---|
| STEAM | 8 | 112 | 11.2 | 325 | 80 | 8760 | 65.00 | 6.37728 |
| | 6 | 120 | 12 | 325 | 80 | 8760 | 54.00 | 5.67648 |
| | 5 | 49.5 | 4.95 | 325 | 80 | 8760 | 48.00 | 2.081376 |
| | 4 | 94.5 | 9.45 | 325 | 80 | 8760 | 42.00 | 3.476844 |
| | 3 | 27 | 2.7 | 325 | 80 | 8760 | 39.00 | .922428 |
| | 2.5 | 36 | 3.6 | 325 | 80 | 8760 | 31.00 | .977616 |
| | 2 | 162 | 16.2 | 325 | 80 | 8760 | 24.00 | 3.405888 |
| | 1.5 | 205 | 20.5 | 325 | 80 | 8760 | 33.00 | 5.92614 |
| | 1.25 | 139.5 | 13.95 | 325 | 80 | 8760 | 31.00 | 3.788262 |
| | 1 | 342 | 34.2 | 325 | 80 | 8760 | 30.00 | 8.98776 |
| | .75 | 297 | 29.7 | 325 | 80 | 8760 | 27.00 | 7.024644 |
| | .5 | 16 | 1.6 | 325 | 80 | 8760 | 24.00 | .336384 |
| CONDENSATE | 3.5 | 58.5 | 5.85 | 180 | 80 | 8760 | 18.00 | .922428 |
| | 3 | 162 | 16.2 | 180 | 80 | 8760 | 16.00 | 2.270592 |
| | 2.5 | 144 | 14.4 | 180 | 80 | 8760 | 15.00 | 1.89216 |
| | 2 | 18 | 1.8 | 180 | 80 | 8760 | 13.00 | .204984 |
| | 1.5 | 49.5 | 4.95 | 180 | 80 | 8760 | 14.00 | .607068 |
| | 1.25 | 207 | 20.7 | 180 | 80 | 8760 | 13.00 | 2.357316 |
| | 1 | 117 | 11.7 | 180 | 80 | 8760 | 11.00 | 1.127412 |
| | .75 | 729 | 72.9 | 180 | 80 | 8760 | 10.00 | 6.38604 |
| | | | | | | | TOTAL | 64.74910 |

* TAKEN FROM ASHRAE HANDBOOK OF FUNDAMENTALS

## HEAT LOSS DUE TO EXPOSED PIPE

| PIPE SERVICE | NOMINAL PIPE SIZE (INCHES) | PIPE LENGTH (FEET) | 10% OF PIPE LENGTH | PIPE TEMPERATURE (F) | OUTSIDE TEMPERATURE (F) | ANNUAL USAGE (HOURS) | HEAT LOSS * (BTU/HR *FT) | TOTAL HEAT LOSS (MBTU) |
|---|---|---|---|---|---|---|---|---|
| STEAM | 8 | 112 | 11.2 | 325 | 80 | 8760 | 1690.38 | 165.8466 |
| | 6 | 120 | 12 | 325 | 80 | 8760 | 1323.80 | 139.1579 |
| | 5 | 49.5 | 4.95 | 325 | 80 | 8760 | 1126.26 | 48.83689 |
| | 4 | 94.5 | 9.45 | 325 | 80 | 8760 | 925.92 | 76.64951 |
| | 3 | 27 | 2.7 | 325 | 80 | 8760 | 734.42 | 17.37050 |
| | 2.5 | 36 | 3.6 | 325 | 80 | 8760 | 612.66 | 19.32715 |
| | 2 | 162 | 16.2 | 325 | 80 | 8760 | 514.59 | 73.02650 |
| | 1.5 | 205 | 20.5 | 325 | 80 | 8760 | 419.47 | 75.32842 |
| | 1.25 | 139.5 | 13.95 | 325 | 80 | 8760 | 370.72 | 45.30273 |
| | 1 | 342 | 34.2 | 325 | 80 | 8760 | 299.69 | 89.78473 |
| | .75 | 297 | 29.7 | 325 | 80 | 8760 | 244.23 | 63.54181 |
| | .5 | 16 | 1.6 | 325 | 80 | 8760 | 199.40 | 2.794790 |
| CONDENSATE | 3.5 | 58.5 | 5.85 | 180 | 80 | 8760 | 243.90 | 12.43890 |
| | 3 | 162 | 16.2 | 180 | 80 | 8760 | 215.90 | 30.63860 |
| | 2.5 | 144 | 14.4 | 180 | 80 | 8760 | 180.50 | 22.76899 |
| | 2 | 16 | 1.8 | 180 | 80 | 8760 | 151.80 | 2.393562 |
| | 1.5 | 49.5 | 4.95 | 180 | 80 | 8760 | 123.90 | 5.372552 |
| | 1.25 | 207 | 20.7 | 180 | 80 | 8760 | 103.70 | 19.89212 |
| | 1 | 117 | 11.7 | 180 | 80 | 8760 | 88.80 | 9.101290 |
| | .75 | 729 | 72.9 | 180 | 80 | 8760 | 72.50 | 46.29673 |
| | | | | | | | TOTAL | 965.9325 |

* TAKEN FROM ASHRAE HANDBOOK OF FUNDAMENTALS

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007 PIPE INSULATION
FISCAL YEAR: 1989 ECO #,s 1
ANALYSIS DATE: ECON LIFE 15

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 17531 | |
| B. | SIOH | 964 | |
| C. | DESIGN COST | 1052 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 17592 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 17592 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | 0 | 0 | 8.69 | 0 | |
| B. | DIST | 4.34 | 0 | 0 | 12.42 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 12.21 | 0 | |
| D. | LPG | 3.27 | 901 | 2946 | 11.67 | 34383 | |
| E. | WOOD | 2.00 | 0 | 0 | 10.17 | 0 | |
| F. | TOTAL | | 901 | 2946 | | | 34383 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

| | | |
|---|---|---|
| A. | ANNUAL RECURRING | 0 |
| | (1) DISCOUNT FACTOR (TABLE A) * | 9.11 |
| | (2) DISCOUNTED SAVINGS/COST (3A X 3A1) | 0 |

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST 0

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33) 11346
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE)) 2946

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C) 34383

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F) 1.95

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

## COST ESTIMATE ANALYSIS

For use of this form, see TM 5-800-2; the proponent agency is USACE.

PROJECT: REPLACE PIPING INSULATION (100%)

LOCATION: FORT LEONARD WOOD

INVITATION/CONTRACTOR:

CODE (Check one): ☐ A ☐ B ☐ C ☐ OTHER

EFFECTIVE PRICING DATE:

DRAWING NO.:

ESTIMATOR:

DATE PREPARED: 24 MAY 89

SHEET 1 OF 1 SHEETS

CHECKED BY:

ECO #1

| TASK DESCRIPTION | QUANTITY: NO. OF UNITS | QUANTITY: UNIT MEAS | LABOR: MH UNIT | LABOR: TOTAL HRS | LABOR: UNIT PRICE | LABOR: COST | EQUIPMENT: UNIT PRICE | EQUIPMENT: COST | MATERIAL: UNIT PRICE | MATERIAL: COST | TOTAL | SHIPPING: UNIT WT | SHIPPING: TOTAL WT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FIBERGLASS INSULATION | | | | | | | | | | | | | |
| w/ ALL SERVICE JACKET 8" | 112 | LF | | | 4.10 | 459.20 | | | 7.35 | 823.20 | 1282- | | |
| 6" | 120 | LF | | | 3.28 | 393.60 | | | 5.92 | 710.40 | 1104- | | |
| 5" | 49.5 | LF | | | 2.73 | 135.14 | | | 5.80 | 287.10 | 422- | | |
| 4" | 94.5 | LF | | | 2.52 | 238.14 | | | 5.11 | 482.90 | 721- | | |
| 3½" | 58.5 | LF | | | 2.18 | 127.53 | | | 4.76 | 278.46 | 406- | | |
| 3" | 189 | LF | | | 2.05 | 387.45 | | | 4.40 | 831.60 | 1219- | | |
| 2½" | 180 | LF | | | 1.93 | 347.40 | | | 4.13 | 743.40 | 1091- | | |
| 2" | 180 | LF | | | 1.82 | 327.60 | | | 3.83 | 689.40 | 1017- | | |
| 1½" | 254.5 | LF | | | 1.72 | 437.74 | | | 3.66 | 931.47 | 1369- | | |
| 1¼" | 346.5 | LF | | | 1.72 | 595.98 | | | 3.51 | 1216.22 | 1812- | | |
| 1" | 459 | LF | | | 1.64 | 752.76 | | | 3.30 | 1514.70 | 2267- | | |
| ¾" | 1026 | LF | | | 1.56 | 1600.56 | | | 3.07 | 3149.82 | 4750- | | |
| ½" | 16 | LF | | | 1.49 | 23.84 | | | 2.96 | 47.36 | 71- | | |
| | | | | | | | | | | | | | |
| TOTAL THIS SHEET | | | | | | | | | | | $17,531 | | |

DA FORM 5418-R, Apr 85

ECO # 3

DESCRIPTION: CAULK & SEAL WINDOWS

SAVINGS POTENTIAL: CAULKING AND SEALING OF WINDOWS WILL REDUCE THE AMOUNT OF OUTSIDE AIR INFILTRATING INTO THE BUILDING. REDUCTION OF INFILTRATION WILL ALSO REDUCE BUILDING HEAT LOADS AND TOTAL FUEL CONSUMPTION.

A: ESTIMATED SAVINGS

POTENTIAL SAVINGS WERE BASED UPON THE FOLLOWING CONDITIONS:

| # OF WINDOWS | CRACK LENGTH |
|---|---|
| 486 | 9 |
| 95 | 12 |

AVERAGE CRACK LENGTH = 9.5 FEET

INFILTRATION (CFM) = Q/P X P

Q/P = INFILTRATION PER FOOT OF CRACK
P = PERIMETER OF CRACK

FROM ASHRAE TABLE 5.6 LOAD MANUAL

Q/P = .25 TIGHT FITTING WINDOW
Q/P = .5 AVERAGE FITTING WINDOW

CFM PER WINDOW = .5 X 9.5 = 5
CFM PER WINDOW = .25 X 9.5 = 2

HEAT LOSS PER DEGREE

Q = 1.08 CFM DELTA T

Q = 5.13 DELTA T AVERAGE FITTING WINDOW
Q = 2.57 DELTA T TIGHT FITTING WINDOW

THE HEAT LOSS PER DEGREE WAS USED IN THE FOLLOWING BIN CALCULATIONS TO DETERMINE THE ANNUAL HEAT LOSS PER WINDOW FOR TIGHT AND AVERAGE FITS.

| | |
|---|---|
| ENERGY LOSS AVERAGE FIT = | 1027368 |
| ENERGY LOSS TIGHT FIT = | 514685 |
| SAVINGS PER WINDOW = | 512683 |
| # OF WINDOWS = | 581 |
| TOTAL ENERGY SAVINGS (MBTU) | 298 |
| TOTAL $ SAVINGS = | 975.13 |

ENERGY CALCULATIONS FOR HEAT LOSS DUE TO WINDOW INFILTRATION
(TYPICAL WINDOW WITH WEATHERSTRIPPING)

| -A- | -B- | -C- | --D-- | --E-- | ---F--- | ---G--- | -H- | ---J--- |
|---|---|---|---|---|---|---|---|---|
| 102 | 0 | 0 | 0 | 1640000 | 2045000 | 0 | 2 | .00 |
| 97 | 0 | 0 | 0 | 1640000 | 2045000 | 0 | 22 | .00 |
| 92 | 0 | 0 | 0 | 1640000 | 2045000 | 0 | 94 | .00 |
| 87 | 0 | 0 | 0 | 1640000 | 2045000 | 0 | 262 | .00 |
| 82 | 0 | 0 | 0 | 1640000 | 2045000 | 0 | 474 | .00 |
| 77 | 0 | 0 | 0 | 1640000 | 2045000 | 0 | 676 | .00 |
| 72 | 0 | 0 | 0 | 1640000 | 2045000 | 0 | 902 | .00 |
| 67 | 2.57 | 5 | 12.85 | 1640000 | 2045000 | .0000078 | 900 | 14420.99 |
| 62 | 2.57 | 10 | 25.7 | 1640000 | 2045000 | .0000157 | 794 | 25445.04 |
| 57 | 2.57 | 15 | 38.55 | 1640000 | 2045000 | .0000235 | 706 | 33937.40 |
| 52 | 2.57 | 20 | 51.4 | 1640000 | 2045000 | .0000313 | 642 | 41147.89 |
| 47 | 2.57 | 25 | 64.25 | 1640000 | 2045000 | .0000392 | 557 | 44624.96 |
| 42 | 2.57 | 30 | 77.1 | 1640000 | 2045000 | .0000470 | 593 | 57010.98 |
| 37 | 2.57 | 35 | 89.95 | 1640000 | 2045000 | .0000548 | 565 | 63372.24 |
| 32 | 2.57 | 40 | 102.8 | 1640000 | 2045000 | .0000627 | 583 | 74732.78 |
| 27 | 2.57 | 45 | 115.65 | 1640000 | 2045000 | .0000705 | 396 | 57107.12 |
| 22 | 2.57 | 50 | 128.5 | 1640000 | 2045000 | .0000784 | 286 | 45826.70 |
| 17 | 2.57 | 55 | 141.35 | 1640000 | 2045000 | .0000862 | 156 | 27496.02 |
| 12 | 2.57 | 60 | 154.2 | 1640000 | 2045000 | .0000940 | 78 | 14997.83 |
| 7 | 2.57 | 65 | 167.05 | 1640000 | 2045000 | .0001019 | 40 | 8332.13 |
| 2 | 2.57 | 70 | 179.9 | 1640000 | 2045000 | .0001097 | 18 | 4037.88 |
| -3 | 2.57 | 75 | 192.75 | 1640000 | 2045000 | .0001175 | 7 | 1682.45 |
| -8 | 2.57 | 80 | 205.6 | 1640000 | 2045000 | .0001254 | 2 | 512.75 |
| | | | | | | | | 514685.16 |

-A- OUTDOOR TEMPERATURE
-B- HEAT LOSS PER DEGREE FARENHEIT FOR A TYPICAL WINDOW
-C- DIFFERENCE BETWEEN INDOOR DESIGN AND OUTDOOR TEMPERATURE
-D- HEAT LOSS
-E- EQUIPMENT CAPACITY
-F- FUEL INPUT
-G- EQUIPMENT ON TIME
-H- HOURS AT OUTDOOR TEMPERATURE
-J- TOTAL HEAT LOSS (BTU)

ENERGY CALCULATIONS FOR HEAT LOSS DUE TO WINDOW INFILTRATION
(TYPICAL WINDOW WITHOUT WEATHERSTRIPPING)

| -A- | -B- | -C- | --D-- | --E-- | ---F--- | ---G--- | -H- | ---J--- |
|---|---|---|---|---|---|---|---|---|
| 102 | 0 | 0 | 0 | 1640000 | 2045000 | 0 | 2 | .00 |
| 97 | 0 | 0 | 0 | 1640000 | 2045000 | 0 | 22 | .00 |
| 92 | 0 | 0 | 0 | 1640000 | 2045000 | 0 | 94 | .00 |
| 87 | 0 | 0 | 0 | 1640000 | 2045000 | 0 | 262 | .00 |
| 82 | 0 | 0 | 0 | 1640000 | 2045000 | 0 | 474 | .00 |
| 77 | 0 | 0 | 0 | 1640000 | 2045000 | 0 | 676 | .00 |
| 72 | 0 | 0 | 0 | 1640000 | 2045000 | 0 | 902 | .00 |
| 67 | 5.13 | 5 | 25.65 | 1640000 | 2045000 | .0000156 | 900 | 28785.87 |
| 62 | 5.13 | 10 | 51.3 | 1640000 | 2045000 | .0000313 | 794 | 50791.07 |
| 57 | 5.13 | 15 | 76.95 | 1640000 | 2045000 | .0000469 | 706 | 67742.74 |
| 52 | 5.13 | 20 | 102.6 | 1640000 | 2045000 | .0000626 | 642 | 82135.68 |
| 47 | 5.13 | 25 | 128.25 | 1640000 | 2045000 | .0000782 | 557 | 89076.27 |
| 42 | 5.13 | 30 | 153.9 | 1640000 | 2045000 | .0000938 | 593 | 113800.14 |
| 37 | 5.13 | 35 | 179.55 | 1640000 | 2045000 | .0001095 | 565 | 126497.90 |
| 32 | 5.13 | 40 | 205.2 | 1640000 | 2045000 | .0001251 | 583 | 149174.77 |
| 27 | 5.13 | 45 | 230.85 | 1640000 | 2045000 | .0001408 | 396 | 113992.04 |
| 22 | 5.13 | 50 | 256.5 | 1640000 | 2045000 | .0001564 | 286 | 91475.09 |
| 17 | 5.13 | 55 | 282.15 | 1640000 | 2045000 | .0001720 | 156 | 54885.06 |
| 12 | 5.13 | 60 | 307.8 | 1640000 | 2045000 | .0001877 | 78 | 29937.30 |
| 7 | 5.13 | 65 | 333.45 | 1640000 | 2045000 | .0002033 | 40 | 16631.84 |
| 2 | 5.13 | 70 | 359.1 | 1640000 | 2045000 | .0002190 | 18 | 8060.04 |
| -3 | 5.13 | 75 | 384.75 | 1640000 | 2045000 | .0002346 | 7 | 3358.35 |
| -8 | 5.13 | 80 | 410.4 | 1640000 | 2045000 | .0002502 | 2 | 1023.50 |
| | | | | | | | | 1027367.66 |

-A- OUTDOOR TEMPERATURE
-B- HEAT LOSS PER DEGREE FARENHEIT FOR A TYPICAL WINDOW
-C- DIFFERENCE BETWEEN INDOOR DESIGN AND OUTDOOR TEMPERATURE
-D- HEAT LOSS
-E- EQUIPMENT CAPACITY
-F- FUEL INPUT
-G- EQUIPMENT ON TIME
-H- HOURS AT OUTDOOR TEMPERATURE
-J- TOTAL HEAT LOSS (BTU)

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007 CAULKING & SEALING
FISCAL YEAR: 1989 ECO #,s 3
ANALYSIS DATE: ECON LIFE 8

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 4797 | |
| B. | SIOH | 264 | |
| C. | DESIGN COST | 288 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 4814 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 4814 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | 0 | 0 | 5.74 | 0 | |
| B. | DIST | 4.34 | 0 | 0 | 7.18 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 6.79 | 0 | |
| D. | LPG | 3.27 | 298 | 974 | 6.75 | 6578 | |
| E. | WOOD | 2.00 | 0 | 0 | 6.41 | 0 | |
| F. | TOTAL | | 298 | 974 | | | 6578 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

A. ANNUAL RECURRING 0
(1) DISCOUNT FACTOR (TABLE A) * 5.97
(2) DISCOUNTED SAVINGS/COST (3A X 3A1) 0

B. NON RECURRING

| ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST 0

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33) 2171
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE)) 974

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C) 6578

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F) 1.37

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

## COST ESTIMATE ANALYSIS

For use of this form, see TM 5 800-2; the proponent agency is USACE.

| | |
|---|---|
| PROJECT | WINDOW CAULKING |
| LOCATION | FORT LEONARD WOOD |
| INVITATION/CONTRACTOR | |
| CODE (Check one) | ☐ A ☐ B ☐ C ☐ OTHER |
| EFFECTIVE PRICING DATE | |
| DRAWING NO. | |
| ESTIMATOR | |
| DATE PREPARED | 6·1·89 |
| SHEET | 1 OF 1 SHEETS |
| CHECKED BY | |

ECO # 3

| TASK DESCRIPTION | QUANTITY | | LABOR | | | | EQUIPMENT | | MATERIAL | | TOTAL | SHIPPING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NO. OF UNITS | UNIT MEAS | MH UNIT | TOTAL HRS | UNIT PRICE | COST | UNIT PRICE | COST | UNIT PRICE | COST | | UNIT WT | TOTAL WT |
| CAULKING | 5514 | LF | | | .74 | 4080 | | | .13 | 717 | 4797 | | |
| TOTAL THIS SHEET | | | | | | | | | | | $4797 | | |

DA FORM 5418-R, Apr 85

ECO # 6

DESCRIPTION: REDUCE WINDOW AREA

SAVINGS POTENTIAL: REDUCTION OF WINDOW AREA PROVIDES SAVINGS POTENTIAL BY DECREASING SOLAR LOADS IN THE SUMMER AND INCREASING WALL "U" VALUES TO DECREASE WINTER HEATING LOADS.

A: ESTIMATED SAVINGS

POTENTIAL SAVINGS WERE ESTIMATED THRU COMPUTER SIMULATION. THE FOLLOWING PAGE SHOWS MONTHLY ENERGY CONSUMPTION AFTER WINDOW AREA REDUCTION. WINDOW AREAS WERE REPLACED WITH MATERIALS HAVING "U" VALUES THE SAME AS EXISTING WALLS. AS SHOWN ENERGY CONSUMPTION INCREASED SLIGHTLY OVER THE 12 MONTH PERIOD. THIS IS BECAUSE NO COOLING SAVINGS WERE REALIZED BECAUSE THE BUILDING IS NOT AIR CONDITIONED AND WINTER HEAT LOADS INCREASED BECAUSE OF THE REDUCTION IN SOLAR HEAT GAIN.

| | |
|---|---|
| ANNUAL FUEL CONSUMPTION BEFORE WINDOW AREA REDUCTION = | 29147.1 |
| ANNUAL FUEL CONSUMPTION AFTER WINDOW AREA REDUCTION = | 29148.8 |
| ANNUAL SAVINGS (COST) MBTU | -1.7 |
| $ COST AT 3.27 PER MBTU | -5.56 |

| | |
|---|---|
| ANNUAL ELEC CONSUMPTION BEFORE WINDOW AREA REDUCTION = | 2143.4 |
| ANNUAL ELEC CONSUMPTION AFTER WINDOW AREA REDUCTION = | 2143.7 |
| ANNUAL SAVINGS (COST) MBTU | -.3 |
| $ COST AT 12.97 PER MBTU | -3.89 |

COMPUTER SIMULATION RESULTS
FOR
WINDOW AREA REDUCTION

| | COMPUTER MODEL | | WINDOW REDUCTION | |
|---|---|---|---|---|
| | TOTAL FUEL INPUT | TOTAL ELECTRICAL USE | TOTAL FUEL INPUT | TOTAL ELECTRICAL USE |
| JAN 87 | 2564 | 185.5 | 2559.8 | 185.3 |
| FEB 87 | 2344.6 | 169.2 | 2342.5 | 169.1 |
| MAR 87 | 2658.2 | 192.9 | 2659.4 | 193 |
| APR 87 | 2517.4 | 185.5 | 2522.7 | 185.8 |
| MAY 87 | 2248.6 | 166.5 | 2254.1 | 166.8 |
| JUNE 87 | 2433 | 181 | 2433.5 | 181.1 |
| JULY 87 | 2432.8 | 181 | 2432.8 | 181 |
| AUG 87 | 2322.2 | 172.8 | 2322.2 | 172.8 |
| SEPT 87 | 2432.8 | 181 | 2432.8 | 181 |
| OCT 87 | 2352.8 | 174.4 | 2354 | 174.5 |
| NOV 87 | 2181.4 | 160.6 | 2181.4 | 160.6 |
| DEC 87 | 2659.3 | 193 | 2653.6 | 192.7 |
| TOTAL | 29147.1 | 2143.4 | 29148.8 | 2143.7 |

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO  REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007  WINDOW AREA REDUCTION
ISCAL YEAR: 1989  ECO #,s 6
ANALYSIS DATE:  ECON LIFE 25

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 1 | |
| B. | SIOH | 0 | |
| C. | DESIGN COST | 0 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 1 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 1 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | -.3 | -4 | 11.16 | -43 | |
| B. | DIST | 4.34 | 0 | 0 | 17.19 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 17.12 | 0 | |
| D. | LPG | 3.27 | -1.7 | -6 | 16.15 | -90 | |
| E. | WOOD | 2.00 | 0 | 0 | 13.47 | 0 | |
| F. | TOTAL | | -2 | -9 | | | -133 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

A. ANNUAL RECURRING 0
(1) DISCOUNT FACTOR (TABLE A) * 11.65
(2) DISCOUNTED SAVINGS/COST (3A X 3A1) 0

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST 0

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33) -44
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE)) -9

. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C) -133

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F) -148.00

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

ECO # 7

DESCRIPTION: INSTALL EFFICIENT GAS FIRED HOT WATER HEATER

SAVINGS POTENTIAL: EXISTING HOT WATER PRODUCTION IS LIMITED TO THE EFFICIENCY OF THE CENTRAL BOILERS. AN ENERGY EFFICIENT HOT WATER HEATER WILL IMPROVE EFFICIENCY AND REDUCE ENERGY CONSUMPTION.

A: ESTIMATED SAVINGS

SAVINGS ESTIMATES ARE BASED UPON THE FOLLOWING CONDITIONS:

| | |
|---|---|
| AVERAGE TEMPERATURE OF SUPPLY HOT WATER = | 160 DEG F |
| AVERAGE TEMPERATURE OF SUPPLY COLD WATER = | 60 DEG F |
| EXISTING PLANT EFFICIENCY = | 75 % |
| EFFICIENCY OF NEW HOT WATER HEATER = | 83 % |

EXISTING ENERGY USE FOR HOT WATER

$$\text{MBTU} = \frac{\text{GALLONS HOT WATER} \times 8.33 \times \text{DELTA T}}{1,000,000}$$

| | | |
|---|---|---|
| GALLONS HOT WATER = | 6565600 | |
| DELTA T = | 100 | |
| MBTU = | 5469.145 | NOT ACCOUNTING FOR PLANT EFFICIENCY |
| MBTU = | 7292.193 | USING 75% PLANT EFF. |
| MBTU = | 6589.331 | WITH 83 % EFFICIENT HOT WATER HEATER |
| SAVING MBTU = | 702.8620 | |
| $ SAVINGS = | 2300.38 | |

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO    REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007    INSTALL GAS HW HEATER
ISCAL YEAR: 1989    ECO #,s 7
ANALYSIS DATE:    ECON LIFE 25

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 24616 | |
| B. | SIOH | 1354 | |
| C. | DESIGN COST | 1477 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 24702 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 24702 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | 0 | 0 | 11.16 | 0 | |
| B. | DIST | 4.34 | 0 | 0 | 17.19 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 17.12 | 0 | |
| D. | LPG | 3.27 | 702.9 | 2298 | 16.15 | 37121 | |
| E. | WOOD | 2.00 | 0 | 0 | 13.47 | 0 | |
| F. | TOTAL | | 702.9 | 2298 | | | 37121 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

| | | |
|---|---|---|
| A. | ANNUAL RECURRING | 0 |
| | (1) DISCOUNT FACTOR (TABLE A) * | 11.65 |
| | (2) DISCOUNTED SAVINGS/COST (3A X 3A1) | 0 |

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST    0

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33)    12250
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE))    2298

. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C)    37121

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F)    1.50

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

## COST ESTIMATE ANALYSIS

For use of this form, see TM 5 800-2; the proponent agency is USACE.

| | | | |
|---|---|---|---|
| PROJECT: INSTALL GAS HOT WATER HEATER | INVITATION/CONTRACTOR | EFFECTIVE PRICING DATE | DATE PREPARED: 24 MAY 89 |
| LOCATION: FORT LEONARD WOOD | CODE (Check one) ☐ A ☐ B ☐ C ☐ OTHER | DRAWING NO. | SHEET 1 OF 1 SHEETS |
| | | ESTIMATOR | CHECKED BY |

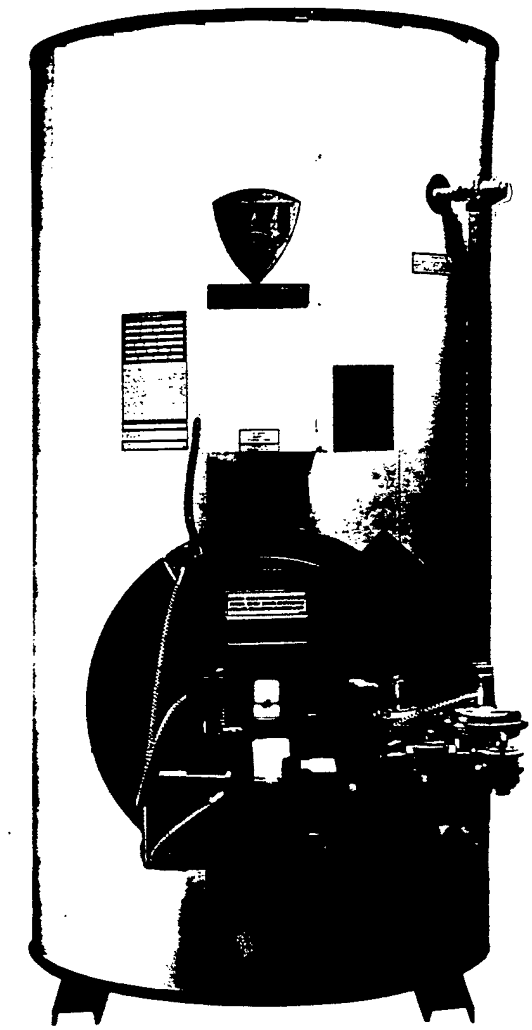
| ECO #7 TASK DESCRIPTION | QUANTITY NO. OF UNITS | QUANTITY UNIT MEAS | LABOR MH UNIT | LABOR TOTAL HRS | LABOR UNIT PRICE | LABOR COST | EQUIPMENT UNIT PRICE | EQUIPMENT COST | MATERIAL UNIT PRICE | MATERIAL COST | TOTAL | SHIPPING UNIT WT | SHIPPING TOTAL WT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BURNER | 1 | EA | | | | 1100- | | 9765-* | | | 10,865- | | |
| TANK | 1 | EA | | | | 1200- | | 11,000-* | | | 12,200- | | |
| | | | | | | | | | | | | | |
| GAS PIPING 1" | 80 | LF | | | 3.40 | 272- | | | 1.39 | 111- | 383- | | |
| | | | | | | | | | | | | | |
| HW PIPING 3" | 50 | LF | | | 7.55 | 377- | | | 5.81 | 290- | 668- | | |
| | | | | | | | | | | | | | |
| ELEC. SERVICE | | LS | | | | | | | | | 500- | | |
| | | | | | | | | | | | $24,616 | | |
| TOTAL THIS SHEET | | | | | | | | | | | | | |

DA FORM 5418-R, Apr 85

* INCLUDES OVERHEAD & PROFIT

# "High efficiency" doesn't necessarily mean you'll ever save a dollar on fuel cost.

# But high *fuel-to-water* efficiency is saving thousands every day.



PVI guarantees that for every dollar spent on fuel, at least 83¢ will go directly into heating the water.

PVI®

TURBOPOWER®
Water Heaters

# Here's how PVI's Turbopower® water heater did in the lab...

UL

**UNDERWRITERS LABORATORIES INC.**

333 PFINGSTEN ROAD · NORTHBROOK, ILLINOIS 60062

*an independent, not-for-profit organization testing for public safety*

May 13, 1987

PVI Industries, Inc.
Mr. D. A. Varalla
P.O. Box 7124
Fort Worth, TX 76111

Our Reference: MH11050, 87NK9584

Subject: Thermal Efficiency Testing

Dear Mr. Varalla:

This will Report the results of thermal efficiency testing of Turbopower heat source modules conducted at your factory and witnessed by the writer during the weeks of April 27 and May 4, 1987.

Testing was witnessed on representative Turbopower Module Sizes 250TP, 500TP, 1000TP, 2500TP, and 4000TP. Results are considered representative of the remaining ten sizes not tested. The thermal efficiency test was conducted following the guidelines in Part II, Par. 2.8, Addenda Pages 6, 7, and 8, ANSI Z21.10.3B-1986. Results of tests on all sizes indicate a thermal efficiency not less than 83.0 percent.

This letter completes our work in connection with Project 87NK9584 and we have notified our Accounting Department to submit an invoice for the charges incurred.

If you have any comments or questions, please do not hesitate to contact the undersigned.

Very truly yours,

T. K. Thompson

T. K. THOMPSON (Ext. 3270)
Engineering Associate
Heating, Air Conditioning
and Refrigeration Department

Reviewed by:

J. Hughes

J. HUGHES (Ext. 2472)
Engineering Group Leader
Heating, Air Conditioning
and Refrigeration Department

TKT:jp

ANSI Z21.10.3 is a recognized water heater standard. It sets an incoming water temperature, sets a specific temperature rise, measures all gas consumed during testing and actually weighs the heated water to obtain its BTU content. This BTU content when compared to the total BTUs of gas consumed during testing determines the exact percentage of energy that was directly absorbed by the water. Because it calculates only the energy absorbed by the water, ANSI Z21.10.3 is a true measure of a heater's fuel-to-water efficiency and is far more accurate than efficiency determined from flue gas temperature and $CO_2$ analysis without any water temperature parameters, such as ANSI Z21.13. Almost every advertised water heater efficiency rate is determined by the less accurate flue gas temperature and $CO_2$ analysis.

# A Comparison of Efficiency Tests

## Fuel-to-Water Efficiency

### ANSI Z21.10.3: "Gas Water Heaters"

- incoming water temperature is established at 70°F ± 2°F
- temperature rise is established at 70°F ± 2°F
- flow rate is such that there is no variation in outlet temperature greater than ± 1°F, once temperature rise is set
- inlet and outlet temperatures are recorded every minute
- test runs for 30 minutes
- heated water is weighed at the end of the test to determine exact volume which in turn determines its BTU content

ANSI Z21.10.3 determines thermal efficiency by isolating the BTUs absorbed directly into the water. The result is true fuel-to-water efficiency, accurate recovery rates and a more accurate determination of fuel use in given installations.

## Flue Analysis Efficiency

### ANSI Z21.13: "Gas-fired low pressure steam and hot water boilers."

- no incoming water temperature specified
- no temperature rise specified
- flow rate is such that outlet temperature can vary by ± 4°F
- no check of inlet and outlet temperatures
- no specified test length for indoor hot water boilers
- no weighing of heated water

Flue gas analysis derives efficiency from a test without parameters. All that is measured is flue temperature and flue gas $CO_2$ level. This determines only the percentage of BTUs lost through the flue and does not isolate the BTUs absorbed into the water. The result are recovery rates and suggested fuel savings that are both suspect in accuracy. Most advertised water heater efficiencies are derived from flue gas analysis.

[redacted]

For more information on Turbopower® or any of the other quality PVI® water heater and boiler products, return this card.

TP 1

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

**BUSINESS REPLY MAIL**

FIRST CLASS PERMIT NO. 1783 FORT WORTH, TX

POSTAGE WILL BE PAID BY ADDRESSEE

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PVI®

PVI INDUSTRIES INCORPORATED
PO BOX 7124
FORT WORTH TX 76111-9963

# Other Advantages of Turbopower®

## Superior Tank Linings

To ensure rust-free hot water, PVI offers NICKELSHIELD® and POLYSHIELD™ tank linings. Applied only after complete tank fabrication, the linings are holiday-free with no exposed welds and no need for sacrificial anodes or maintenance.

NICKELSHIELD® The premium tank lining in the industry, NICKELSHIELD® is a 97% pure nickel coating applied by an electroless chemical bath process. The result is an even and continuous non-ferrous metallic lining which is applicable to all water conditions and is the superior choice in high temperature potable water systems.

POLYSHIELD.™ When lower first cost is a primary consideration, PVI offers POLYSHIELD™ – a polymerized flourocarbon plastic. Unlike competitively priced porcelain enamel or "glass" linings, POLYSHIELD™ is non-porous and non eroding and means extended life in a lower-cost lining.

## Durable Heating Section

TURBOPOWER®'s heating section is completely non-ferrous on the waterside with solid copper fire tubes and a copper-clad combustion chamber for corrosion resistance and long life.

## Ease of Maintenance

TURBOPOWER®'s burner and entire heating section can be removed with ordinary hand tools and without disturbing the tank for routine cleaning, maintenance and repair. Also, all units have a minimum 23" manway for waterside access.

## Guaranteed Against Thermal Shock

The "floating" fire tube design allows for unhindered expansion and contraction in response to temperature changes.

## Lower Venting Costs

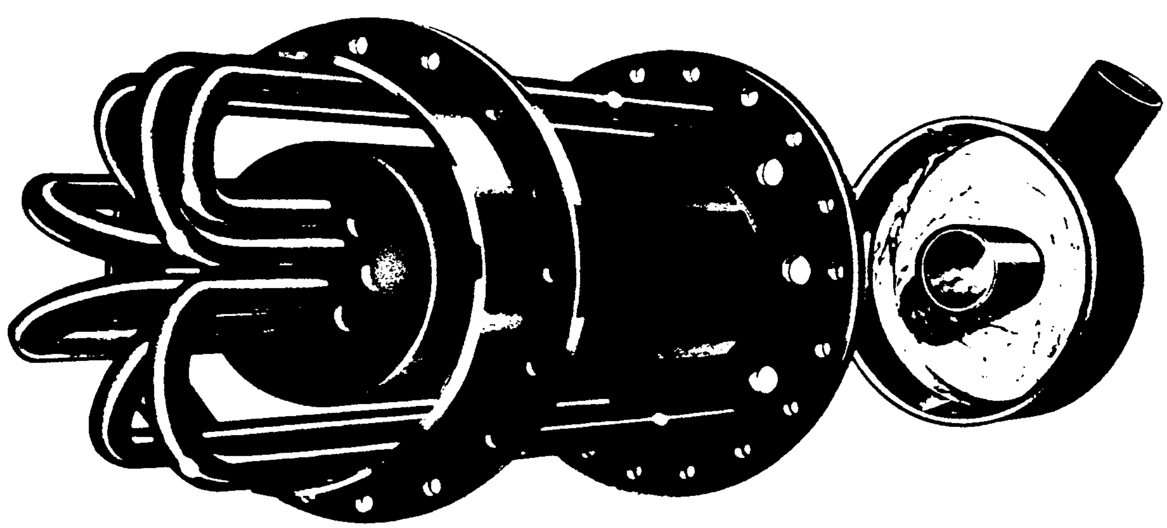
TURBOPOWER® is U.L. listed for less expensive type "B" venting which can save hundreds of dollars in up front costs.

## Ease of Installation

PVI's SUPERTANK™ design allows certain units with up to 1500 gallons of storage to be installed through standard 36" doors. Ideal for retrofit.

## Non-Condensing

Because TURBOPOWER® operates at an efficiency level slightly below the level where water vapor condenses, there is no need for the expensive lined flue pipes and collectors needed to deal with acidic condensate.



**TURBOPOWER'S® patented, totally submerged 2-pass combustion chamber and firetubes.**

# And here's how it's doing in the field.

## $12,500 saved in nine months.

On October 15, 1985, the owners of an Austin, Texas apartment complex replaced two 1200 MBH atmospheric watertube boilers with two 1200 MBH TURBOPOWER® gas water heaters. The apartment complex has 200 units with central laundry and almost 100% occupancy each year. Comparison of gas bills for the same nine months before and after TURBOPOWER® installation showed a 31.6% reduction in fuel use and a $12,500 fuel savings, even with a gas price increase! These savings made up the cost difference between the superior TURBOPOWER® heaters and some less expensive atmospheric substitutes in less than a year, with all subsequent savings going into the owner's pocket.

## $5685 saved in five months.

Owners of a hotel in Gainesville, Georgia replaced an atmospheric boiler and storage tank with two 500 MBH TURBOPOWER® gas water heaters on April 10, 1988. The hotel has 79 guest rooms and a house laundry. Comparison of gas bills from the same time the previous year indicated an average monthly fuel savings of $1100 and an incredible 45% average monthly reduction in fuel use!

## $7742 saved in six months.

In May 1986, owners of a residential hi-rise in Pittsburgh replaced four 500 MBH atmospheric boilers and separate storage with two 1600 MBH TURBOPOWER® water heaters. Comparing gas bills from May to October 1986 with those from May to October 1987 shows a 26% reduction in fuel use and a $7742 fuel savings!

And they're all still saving!

**About two years ago, PVI decided to do something that no other water heater manufacturer had done – acquire independent third party certification of our efficiency rate. We did this to help alleviate all the confusion surrounding water heater efficiency claims and to let engineers and business owners know that they didn't just have to take our word for it.**

**If they never learned a thing about fuel-to-water efficiency, it's okay, because these owners have since discovered the most important thing about PVI's TURBOPOWER.® It saves them money. Big money! And the fuel savings quickly pay back any cost difference between TURBOPOWER® and less expensive atmospheric substitutes, with the owners pocketing all the future savings.**

**So if you're involved in new construction or are considering replacing your existing hot water system, you owe it to yourself to look into PVI. The efficiency is not just a claim, it's verified and guaranteed. And the system is a proven money saver.**

**Incidentally, only one other manufacturer has since had their efficiency claim certified by an independent third party. As for all the others, we guess you'll just have to take their word for it.**


**1-800-433-5654**

PVI®

PVI INDUSTRIES INCORPORATED
P.O. BOX 7124 • FORT WORTH, TEXAS 76111

ECO # 8

DESCRIPTION: LIGHTING MODIFICATIONS

SAVINGS POTENTIAL: ELECTRICITY CONSUMPTION CAN BE REDUCED THRU MORE EFFICIENT LIGHTING AND REDUCTION OF LIGHT LEVELS.

A: ESTIMATED SAVINGS

SAVINGS ESTIMATES ARE BASED UPON THE FOLLOWING CONDITIONS:

EXISTING FLUORESCENT FIXTURES ARE MODIFIED WITH ENERGY EFFICIENT BALLASTS AND LAMPS.

EXISTING INCANDESCENT FIXTURE IS REPLACED WITH ENERGY EFFICIENT FLUORESCENT FIXTURE.

LIGHTING LEVELS CAN BE REDUCED IN THE ACCOUNTING AREA WHERE TWO FIXTURES CAN BE REMOVED.

ENERGY SAVINGS THRU LIGHTING MODIFICATIONS

THE FOLLOWING SPREAD SHEETS SHOW EXISTING ELECTRICITY USE DUE TO LIGHTING AND CONSUMPTION AFTER MODIFICATIONS ARE MADE.

| | | |
|---|---|---|
| EXISTING CONSUMPTION = | 61718 | KWH |
| CONSUMPTION AFTER MOD. = | 46126 | KWH |
| | --------- | |
| SAVINGS (KWH) = | 15592 | |
| SAVINGS (MBTU) = | 53.21502 | |
| $ SAVINGS = | 690.1988 | |
| | | |
| CONSUMPTION AFTER MOD. & RED. = | 45826 | |
| SAVINGS (KWH) = | 15892 | |
| SAVINGS (MBTU) = | 54.23891 | |
| $ SAVINGS = | 703.4786 | |

| TYPE OF FIXTURE | NUMBER OF FIXTURE | WATTS PER FIXTURE | TOTAL WATTS | MODIFIED WATTS PER FIXTURE | MODIFIED TOTAL WATTS | HOURS PER YEAR | TOTAL KWH | MODIFIED TOTAL KWH | SAVINGS KWH | SAVINGS $ |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 307 | 96 | 29472 | 72 | 22104 | 2080 | 61301.76 | 45976.3 | 15325.44 | |
| B | 1 | 200 | 200 | 72 | 72 | 2080 | 416 | 149.76 | 266.24 | |

FIXTURE TYPES: A - FLUORESCENT 2 - 40W BULB FIXTURE
B - INCANDESCENT 200W BULB

LIGHT

| TYPE OF FIXTURE | NUMBER OF FIXTURE | WATTS PER FIXTURE | TOTAL WATTS | MODIFIED WATTS PER FIXTURE | MODIFIED TOTAL WATTS | HOURS PER YEAR | TOTAL KWH | MODIFIED TOTAL KWH | SAVINGS KWH | SAVINGS $ |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 307 | 96 | 29472 | 72 | 21360 | 2080 | 61301.76 | 45676.8 | 15624.96 | |
| B | 1 | 200 | 200 | 72 | 72 | 2080 | 416 | 149.76 | 266.24 | |

FIXTURE TYPES: A - FLUORESCENT 2 - 40W BULB FIXTURE
B - INCANDESCENT 200W BULB

CALCULATION CONTAINS REDUCTION OF LIGHTING IN ACCOUNTING AREA

LIGHT

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO    REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007    LIGHTING MODIFICATIONS
FISCAL YEAR: 1989    ECO #,s 8
ANALYSIS DATE:    ECON LIFE 15

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 7947 | |
| B. | SIOH | 437 | |
| C. | DESIGN COST | 477 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 7975 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 7975 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | 54.23 | 703 | 8.69 | 6112 | |
| B. | DIST | 4.34 | 0 | 0 | 12.42 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 12.21 | 0 | |
| D. | LPG | 3.27 | 0 | 0 | 11.67 | 0 | |
| E. | WOOD | 2.00 | 0 | 0 | 10.17 | 0 | |
| F. | TOTAL | | 54.23 | 703 | | | 6112 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

| | | |
|---|---|---|
| A. | ANNUAL RECURRING | 0 |
| | (1) DISCOUNT FACTOR (TABLE A) * | 9.11 |
| | (2) DISCOUNTED SAVINGS/COST (3A X 3A1) | 0 |

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST    0

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33)    2017
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE))    703

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C)    6112

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F)    .77

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

## COST ESTIMATE ANALYSIS

For use of this form, see TM 5-800-2; the proponent agency is USACE.

| | |
|---|---|
| PROJECT | INSTALL EFFICIENT LAMPS & BALLASTS |
| LOCATION | FORT LEONARD WOOD |
| INVITATION/CONTRACTOR | |
| CODE (Check one) | ☐ A ☐ B ☐ C ☐ OTHER |
| EFFECTIVE PRICING DATE | |
| DRAWING NO. | |
| ESTIMATOR | |
| DATE PREPARED | 24 MAY 89 |
| SHEET | 1 OF 1 SHEETS |
| CHECKED BY | |

ECO#8

| TASK DESCRIPTION | QUANTITY NO. OF UNITS | QUANTITY UNIT MEAS | LABOR MH UNIT | LABOR TOTAL HRS | LABOR UNIT PRICE | LABOR COST | EQUIPMENT UNIT PRICE | EQUIPMENT COST | MATERIAL UNIT PRICE | MATERIAL COST | TOTAL | SHIPPING UNIT WT | SHIPPING TOTAL WT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| INSTALL BALLAST | 307 | EA | | | 7.50 | 2302.50 | | | 12.97 | 3982- | 6285- | | |
| (72 WATT) | | | | | | | | | | | | | |
| INSTALL LAMP | 614 | EA | | | .50 | 317- | | | 1.60 | 982- | 1289- | | |
| (34 WATT) | | | | | | | | | | | | | |
| REMOVE INCAND. FIXTURE | 1 | EA | | | 5 | 5 | | | | | 5 | | |
| | | | | | | | | | | | | | |
| INSTALL FLUOR. FIXTURE | 1 | EA | | | 321 | 321 | | | 47 | 47 | 368 | | |
| | | | | | | | | | | | $7947- | | |
| TOTAL THIS SHEET | | | | | | | | | | | | | |

DA FORM 5418-R, Apr 85

ECO # 12

SCRIPTION: INSTALL RADIANT HEATERS IN PLACE OF STEAM UNIT HEATERS.

SAVINGS POTENTIAL: INFRA RED HEATERS PROVIDE A FEELING OF COMFORT AT REDUCED TEMPERATURES AND ELIMINATE THE PROBLEM OF HEAT STRATIFICATION NEAR THE ROOF. THE RADIANT HEATER IS ALSO MORE ADAPTABLE TO ZONE CONTROL IN LARGE OPEN AREAS. A 30% SAVINGS IN FUEL COSTS IS ASSUMED FOR CALCULATIONS. THIS AMOUNT IS LESS THAN THE 33% PROJECTED BY ASHRAE PROCEDURES AND LESS THAN THE 32-50% SHOWN IN PRODUCT CATALOGS.

A: ESTIMATED SAVINGS

THE FOLLOWING SPREAD SHEET USES THE BIN METHOD TO ESTIMATE EXISTING ENERGY CONSUMPTION. THE SPREAD SHEET PROVIDES A CHECK OF ESTIMATES PROVIDED IN THE COMPUTER SIMULATION.

| | | |
|---|---|---|
| FUEL CONSUMPTION (SPREAD SHEET) = | 1199 | MBTU |
| FUEL CONSUMPTION (COMPUTER SIMULATION) = | 1170 | MBTU |
| (USE 1199 MBTU) | | |

| | | |
|---|---|---|
| SAVINGS = 1199 X .3 = | 359.7 | MBTU |
| $ SAVINGS @ 3.27 PER MBTU = | 1176.22 | |

ELECTRICITY SAVINGS

21 UNIT HEATERS WITH .25 HP MTRS

| | |
|---|---|
| KWH SAVED = (21)(.25)(.746)(588 HRS) = | 2302.902 |
| MBTU SAVED = | 7.859805 |
| $ SAVINGS AT 12.97 PER MBTU = | 102.46 |

TOTAL FUEL USED FOR SPACE HEAT

| -A- | -B- | -C- | --D-- | --D1-- | --D2-- | --E-- | ---F--- | ---G--- | -H- | ---J--- |
|---|---|---|---|---|---|---|---|---|---|---|
| 102 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 2 | .00 |
| 97 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 22 | .00 |
| 92 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 94 | .00 |
| 87 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 262 | .00 |
| 82 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 474 | .00 |
| 77 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 676 | .00 |
| 72 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 902 | .00 |
| 67 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 900 | .00 |
| 62 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 794 | .00 |
| 57 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 706 | .00 |
| 52 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 642 | .00 |
| 47 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 557 | .00 |
| 42 | 22000 | 5 | 110000 | 2580 | 112580 | 1640000 | 2045000 | .07 | 593 | 83246388.60 |
| 37 | 22000 | 10 | 220000 | 5160 | 225160 | 1640000 | 2045000 | .14 | 565 | 158631398.17 |
| 32 | 22000 | 15 | 330000 | 7740 | 337740 | 1640000 | 2045000 | .21 | 583 | 245527712.74 |
| 27 | 22000 | 20 | 440000 | 10320 | 450320 | 1640000 | 2045000 | .27 | 396 | 222364720.98 |
| 22 | 22000 | 25 | 550000 | 12900 | 562900 | 1640000 | 2045000 | .34 | 286 | 200745928.66 |
| 17 | 22000 | 30 | 660000 | 15480 | 675480 | 1640000 | 2045000 | .41 | 156 | 131397335.12 |
| 12 | 22000 | 35 | 770000 | 18060 | 788060 | 1640000 | 2045000 | .48 | 78 | 76648445.49 |
| 7 | 22000 | 40 | 880000 | 20640 | 900640 | 1640000 | 2045000 | .55 | 40 | 44922165.85 |
| 2 | 22000 | 45 | 990000 | 23220 | 1013220 | 1640000 | 2045000 | .62 | 18 | 22741846.46 |
| -3 | 22000 | 50 | 1100000 | 25800 | 1125800 | 1640000 | 2045000 | .69 | 7 | 9826723.78 |
| -8 | 22000 | 55 | 1210000 | 28380 | 1238380 | 1640000 | 2045000 | .76 | 2 | 3088398.90 |
| | | | | | | | | | | 1199141064.76 |

-A- OUTSIDE AIR TEMPERATURE
-B- BUILDING HEAT LOSS (BTU/HR*F)
-C- TEMPERATURE DIFFERENCE
-D- B*C
-D1- INFILTRATION LOAD
-D2- D+D1
-E- EQUIPMENT CAPACITY
-F- EQUIPMENT FUEL INPUT
-G- EQUIPMENT RUN TIME
-H- HOURS OF OCCURANCE FOR OUTSIDE AIR TEMPERATURE
-J- TOTAL FUEL USED (BTU)

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007 INSTALL RADIANT HEATERS
ISCAL YEAR: 1989 ECO #,s 12
ANALYSIS DATE: ECON LIFE 15

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 13706 | |
| B. | SIOH | 754 | |
| C. | DESIGN COST | 822 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 13754 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 13754 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | 7.9 | 102 | 8.69 | 890 | |
| B. | DIST | 4.34 | 0 | 0 | 12.42 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 12.21 | 0 | |
| D. | LPG | 3.27 | 359.7 | 1176 | 11.67 | 13726 | |
| E. | WOOD | 2.00 | 0 | 0 | 10.17 | 0 | |
| F. | TOTAL | | 367.6 | 1279 | | | 14617 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

| | | |
|---|---|---|
| A. | ANNUAL RECURRING | 0 |
| | (1) DISCOUNT FACTOR (TABLE A) * | 9.11 |
| | (2) DISCOUNTED SAVINGS/COST (3A X 3A1) | 0 |

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST 0

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33) 4824
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE)) 1279

. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C) 14617

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F) 1.06

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

## COST ESTIMATE ANALYSIS

For use of this form, see TM 5 800-2; the proponent agency is USACE.

| | |
|---|---|
| INVITATION/CONTRACTOR | |
| EFFECTIVE PRICING DATE | |
| DATE PREPARED | 24 MAY 89 |
| PROJECT | INSTALL RADIANT HEATERS |
| CODE (Check one) | ☐ A ☐ B ☐ C ☐ OTHER |
| DRAWING NO. | |
| SHEET | 1 OF 1 SHEETS |
| LOCATION | FORT LEONARD WOOD |
| ESTIMATOR | |
| CHECKED BY | |

ECO #2

| TASK DESCRIPTION | QUANTITY | | LABOR | | | | EQUIPMENT | | MATERIAL | | TOTAL | SHIPPING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NO. OF UNITS | UNIT MEAS | MH UNIT | TOTAL HRS | UNIT PRICE | COST | UNIT PRICE | COST | UNIT PRICE | COST | | UNIT WT | TOTAL WT |
| RADIANT HEATERS | 20 | EA | | | 66- | 1320- | | | 380- | 7600- | 8920- | | |
| (SUSPENDED GAS FIRED | | | | | | | | | | | | | |
| 45 MBH) | | | | | | | | | | | | | |
| GAS PIPING 1" | 950 | LF | | | 3.40 | 3230- | | | 1.39 | 1320- | 4550- | | |
| GAS PIPING 3/4" | 60 | LF | | | 2.96 | 178- | | | .96 | 58- | 236- | | |
| | | | | | | | | | | | $13706 | | |
| TOTAL THIS SHEET | | | | | | | | | | | | | |

DA FORM 5418-R, Apr 85

ECO # 14

DESCRIPTION: HEAT DESTRATIFICATION

SAVINGS POTENTIAL: HEAT TENDS TO RISE IN AREAS WITH ELEVATED CEILINGS CAUSING HIGHER TEMPERATURES NEAR THE ROOF. IF THIS OVER HEATED AIR CAN BE FORCED BACK TO THE FLOOR LEVEL WHERE HEATING IS REQUIRED A REDUCTION IN ENERGY USE MAY BE REALIZED.

A: ESTIMATED SAVINGS

SAVINGS ESTIMATES ARE BASED UPON THE FOLLOWING CONDITIONS:

TEMPERATURE AT THE ROOF LEVEL IS 5 DEGREES HIGHER THAN AT FLOOR LEVEL

TEN FANS WITH A CAPACTIY OF 18000 CFM EACH WILL BE REQUIRED TO FORCE OVER HEATED AIR BACK TO FLOOR LEVEL.

FANS WILL OPERATE FOR 2724 HOURS PER YEAR

SAVINGS WERE CALCULATED USING THE BIN METHOD THE FOLLOWING PAGES SHOW EXISTING ENERGY CONSUMPTION AND CONSUMPTION WITH DESTRATIFICATION FANS INSTALLED.

FUEL SAVINGS

| | | |
|---|---|---|
| EXISTING USE = | 1199 | MBTU |
| USE AFTER MODIFICATIONS = | 817 | MBTU |
| | -------- | |
| SAVINGS | 382 | |
| $ SAVINGS | 1250.17 | |

ELECTRICAL COST

| | | |
|---|---|---|
| 10 FANS X 3HP .746 KW/HP = | 22.38 | KW |
| HOURS = | 2724 | |
| KWH COST = | 60963.12 | |
| MBTU COST = | 208.0671 | |
| $ COST | 2697.76 | |

TOTAL FUEL USED FOR SPACE HEAT

| -A- | -B- | -C- | --D-- | --D1-- | --D2-- | --E-- | ---F--- | ---G--- | -H- | ---J--- |
|---|---|---|---|---|---|---|---|---|---|---|
| 102 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 2 | .00 |
| 97 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 22 | .00 |
| 92 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 94 | .00 |
| 87 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 262 | .00 |
| 82 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 474 | .00 |
| 77 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 676 | .00 |
| 72 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 902 | .00 |
| 67 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 900 | .00 |
| 62 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 794 | .00 |
| 57 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 706 | .00 |
| 52 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 642 | .00 |
| 47 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 557 | .00 |
| 42 | 22000 | 5 | 110000 | 2580 | 112580 | 1640000 | 2045000 | .07 | 593 | 83246388.60 |
| 37 | 22000 | 10 | 220000 | 5160 | 225160 | 1640000 | 2045000 | .14 | 565 | 158631398.17 |
| 32 | 22000 | 15 | 330000 | 7740 | 337740 | 1640000 | 2045000 | .21 | 583 | 245527712.74 |
| 27 | 22000 | 20 | 440000 | 10320 | 450320 | 1640000 | 2045000 | .27 | 396 | 222364720.98 |
| 22 | 22000 | 25 | 550000 | 12900 | 562900 | 1640000 | 2045000 | .34 | 286 | 200745928.66 |
| 17 | 22000 | 30 | 660000 | 15480 | 675480 | 1640000 | 2045000 | .41 | 156 | 131397335.12 |
| 12 | 22000 | 35 | 770000 | 18060 | 788060 | 1640000 | 2045000 | .48 | 78 | 76648445.49 |
| 7 | 22000 | 40 | 880000 | 20640 | 900640 | 1640000 | 2045000 | .55 | 40 | 44922165.85 |
| 2 | 22000 | 45 | 990000 | 23220 | 1013220 | 1640000 | 2045000 | .62 | 18 | 22741846.46 |
| -3 | 22000 | 50 | 1100000 | 25800 | 1125800 | 1640000 | 2045000 | .69 | 7 | 9826723.78 |
| -8 | 22000 | 55 | 1210000 | 28380 | 1238380 | 1640000 | 2045000 | .76 | 2 | 3088398.90 |
| | | | | | | | | | | 1199141064.76 |

-A- OUTSIDE AIR TEMPERATURE
-B- BUILDING HEAT LOSS (BTU/HR*F)
-C- TEMPERATURE DIFFERENCE
-D- B*C
-D1- INFILTRATION LOAD
-D2- D+D1
-E- EQUIPMENT CAPACITY
-F- EQUIPMENT FUEL INPUT
-G- EQUIPMENT RUN TIME
-H- HOURS OF OCCURANCE FOR OUTSIDE AIR TEMPERATURE
-J- TOTAL FUEL USED (BTU)

TOTAL FUEL USED FOR SPACE HEAT
WITH DESTRATIFICATION

| -A- | -B- | -C- | --D-- | --D1-- | --D2-- | --E-- | ---F--- | ---G--- | -H- | ---J--- |
|---|---|---|---|---|---|---|---|---|---|---|
| 102 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 2 | .00 |
| 97 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 22 | .00 |
| 92 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 94 | .00 |
| 87 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 262 | .00 |
| 82 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 474 | .00 |
| 77 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 676 | .00 |
| 72 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 902 | .00 |
| 67 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 900 | .00 |
| 62 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 794 | .00 |
| 57 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 706 | .00 |
| 52 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 642 | .00 |
| 47 | 0 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 557 | .00 |
| 42 | 22000 | 0 | 0 | 0 | 0 | 1640000 | 2045000 | .00 | 593 | .00 |
| 37 | 22000 | 5 | 110000 | 2580 | 112580 | 1640000 | 2045000 | .07 | 565 | 79315693.03 |
| 32 | 22000 | 10 | 220000 | 5160 | 225160 | 1640000 | 2045000 | .14 | 563 | 163685141.83 |
| 27 | 22000 | 15 | 330000 | 7740 | 337740 | 1640000 | 2045000 | .21 | 396 | 166773540.73 |
| 22 | 22000 | 20 | 440000 | 10320 | 450320 | 1640000 | 2045000 | .27 | 286 | 160536742.93 |
| 17 | 22000 | 25 | 550000 | 12900 | 562900 | 1640000 | 2045000 | .34 | 156 | 109437779.27 |
| 12 | 22000 | 30 | 660000 | 15480 | 675480 | 1640000 | 2045000 | .41 | 78 | 65698667.56 |
| 7 | 22000 | 35 | 770000 | 18060 | 788060 | 1640000 | 2045000 | .48 | 40 | 39306895.12 |
| 2 | 22000 | 40 | 880000 | 20640 | 900640 | 1640000 | 2045000 | .55 | 18 | 20214974.63 |
| -3 | 22000 | 45 | 990000 | 23220 | 1013220 | 1640000 | 2045000 | .62 | 7 | 8844051.40 |
| -8 | 22000 | 50 | 1100000 | 25800 | 1125800 | 1640000 | 2045000 | .69 | 2 | 2807635.37 |
| | | | | | | | | | | 816741127.93 |

-A- OUTSIDE AIR TEMPERATURE
-B- BUILDING HEAT LOSS (BTU/HR*F)
-C- TEMPERATURE DIFFERENCE
-D- B*C
-D1- INFILTRATION LOAD
-D2- D+D1
-E- EQUIPMENT CAPACITY
-F- EQUIPMENT FUEL INPUT
-G- EQUIPMENT RUN TIME
-H- HOURS OF OCCURANCE FOR OUTSIDE AIR TEMPERATURE
-J- TOTAL FUEL USED (BTU)

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007 HEAT DESTRATIFICATION
FISCAL YEAR: 1989 ECO #,s 14
ANALYSIS DATE: ECON LIFE 15

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 5626 | |
| B. | SIOH | 309 | |
| C. | DESIGN COST | 338 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 5646 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 5646 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | -208 | -2698 | 8.69 | -23444 | |
| B. | DIST | 4.34 | 0 | 0 | 12.42 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 12.21 | 0 | |
| D. | LPG | 3.27 | 382 | 1249 | 11.67 | 14577 | |
| E. | WOOD | 2.00 | 0 | 0 | 10.17 | 0 | |
| F. | TOTAL | | 174 | -1449 | | | -8866 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

A. ANNUAL RECURRING 500
(1) DISCOUNT FACTOR (TABLE A) * 9.11
(2) DISCOUNTED SAVINGS/COST (3A X 3A1) 4555

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST 4555

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33) -2926
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE)) -949

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C) -4311

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F) -.76

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

## COST ESTIMATE ANALYSIS

For use of this form, see TM 5 800-2; the proponent agency is USACE.

INVITATION/CONTRACTOR

EFFECTIVE PRICING DATE

DATE PREPARED: 6-2-89

PROJECT: HEAT DESTRATIFICATION FANS

CODE (Check one): ☐ A ☐ B ☐ C ☐ OTHER

DRAWING NO.

SHEET 1 OF 1 SHEETS

LOCATION: FORT LEONARD WOOD

ESTIMATOR

CHECKED BY

| ECO # 14 TASK DESCRIPTION | QUANTITY NO. OF UNITS | QUANTITY UNIT MEAS | LABOR MH UNIT | LABOR TOTAL HRS | LABOR UNIT PRICE | LABOR COST | EQUIPMENT UNIT PRICE | EQUIPMENT COST | MATERIAL UNIT PRICE | MATERIAL COST | TOTAL | SHIPPING UNIT WT | SHIPPING TOTAL WT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CEILING FAN - 18000 CFM | 10 | EA | 2.5 | 25 | 33.60 | 840- | 200 | 2000- | 28.- | 280- | 3120- | | |
| ELECTRICAL SERVICE | | | | | | | | | | | | | |
| COND & WIRE | 500 | FT | | | 3.10 | 1550- | | | .56 | 280- | 1830- | | |
| CONN TO EXIST. | 2 | EA | | | 45- | 90- | | | | | 90- | | |
| DISCONNECT SW. | 2 | EA | | | 73.20 | 146- | | | 45- | 90- | 236- | | |
| TEMP CONTROL | 10 | EA | | | 35- | 350- | | | | | 350- | | |
| STARTER | (INCLUDED | | WITH | | FAN) | | | | | | | | |
| | | | | | | | | | | | $5626 | | |
| TOTAL THIS SHEET | | | | | | | | | | | | | |

DA FORM 5418-R, Apr 85

ECO # 15

DESCRIPTION: HEAT RECOVERY OF WASTE WATER

SAVINGS POTENTIAL: UPON COMPLETION OF A WASH CYCLE HOT WATER DISCHARGES INTO THE SEWER. A HEAT RECOVERY UNIT CAN BE USED TO RECLAIM MOST OF THE HEAT LOST IN HOT WASTE WATER.

A: ESTIMATED SAVINGS

SAVINGS ESTIMATES ARE BASED UPON THE FOLLOWING CONDITIONS:

| | | |
|---|---|---|
| AVERAGE TEMPERATURE OF WASTE WATER = | 130 | DEG F |
| AVERAGE TEMPERATURE OF SUPPLY HOT WATER = | 160 | DEG F |
| AVERAGE TEMPERATURE OF SUPPLY COLD WATER = | 60 | DEG F |
| AVERAGE WATER TEMP. AFTER HEAT RECLAIM = | 120 | DEG F |

EXISTING ENERGY USE FOR HOT WATER

$$\text{MBTU} = \frac{\text{GALLONS HOT WATER} \times 8.33 \times \text{DELTA T}}{1{,}000{,}000}$$

GALLONS HOT WATER = 6565600
DELTA T = 100

MBTU = 5469.145 NOT ACCOUNTING FOR PLANT EFFICIENCY
MBTU = 7292.193 USING 75% PLANT EFF.

ENERGY USE WITH HEAT RECOVERY

$$\text{MBTU} = \frac{\text{GALLONS HOT WATER} \times 8.33 \times \text{DELTA T}}{1{,}000{,}000}$$

GALLONS HOT WATER = 6565600
DELTA T = 40

MBTU = 2187.658 NOT ACCOUNTING FOR PLANT EFFICIENCY
MBTU = 2916.877 USING 75% PLANT EFF.

MTU SAVINGS = 4375.316
$ SAVINGS = 14316.31

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007 INSTALL HEAT RECOVERY UNIT
FISCAL YEAR: 1989 ECO #,s 15
ANALYSIS DATE: ECON LIFE 25

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 120403 | |
| B. | SIOH | 6170 | |
| C. | DESIGN COST | 7400 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 120576 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 120576 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | 0 | 0 | 11.16 | 0 | |
| B. | DIST | 4.34 | 0 | 0 | 17.19 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 17.12 | 0 | |
| D. | LPG | 3.27 | 4375 | 14306 | 16.15 | 231046 | |
| E. | WOOD | 2.00 | 0 | 0 | 13.47 | 0 | |
| F. | TOTAL | | 4375 | 14306 | | | 231046 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

A. ANNUAL RECURRING -500
(1) DISCOUNT FACTOR (TABLE A) * 11.65
(2) DISCOUNTED SAVINGS/COST (3A X 3A1) -5825

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST -5825

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33) 76245
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE)) 13806

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C) 225221

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F) 1.87

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

# COST ESTIMATE ANALYSIS

For use of this form, see TM 5-800-2; the proponent agency is USACE.

| | | | |
|---|---|---|---|
| PROJECT: WASH WATER HEAT RECOVERY SYSTEM | INVITATION/CONTRACTOR | EFFECTIVE PRICING DATE | DATE PREPARED: 25 MAY 89 |
| LOCATION: FORT LEONARD WOOD ECO #15 | CODE (Check one) ☐ A ☐ B ☐ C ☐ OTHER | DRAWING NO. | SHEET 1 OF 1 SHEETS |
| | | ESTIMATOR | CHECKED BY |

| TASK DESCRIPTION | QUANTITY | | LABOR | | | | EQUIPMENT | | MATERIAL | | TOTAL | SHIPPING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NO. OF UNITS | UNIT MEAS | MH UNIT | TOTAL HRS | UNIT PRICE | COST | UNIT PRICE | COST | UNIT PRICE | COST | | UNIT WT | TOTAL WT |
| HEAT RECOVERY SYSTEM | 1 | EA | | | | 9500 | | 100,000 | * | | 109500- | | |
| | | | | | | | | | | | | | |
| PIPING - WASTE | 100 | LF | | | 16.30 | 1630- | | | 24.04 | 2404 | 4034- | | |
| STEAM | 50 | LF | | | 5.05 | 253- | | | 2.76 | 138- | 391- | | |
| SEWER | 60 | LF | | | 2.75 | 165- | | | 1.90 | 114- | 279- | | |
| | | | | | | | | | | | | | |
| ELEC SERVICE | | LS | | | | | | | | | 500- | | |
| | | | | | | | | | | | | | |
| SUMP | 1 | EA | | | | 2200- | | | | 3500- | 5700- | | |
| | | | | | | | | | | | 120,403 | | |
| TOTAL THIS SHEET | | | | | | | | | | | | | |

DA FORM 5418-R, Apr 85 * INCLUDES OVERHEAD & PROFIT

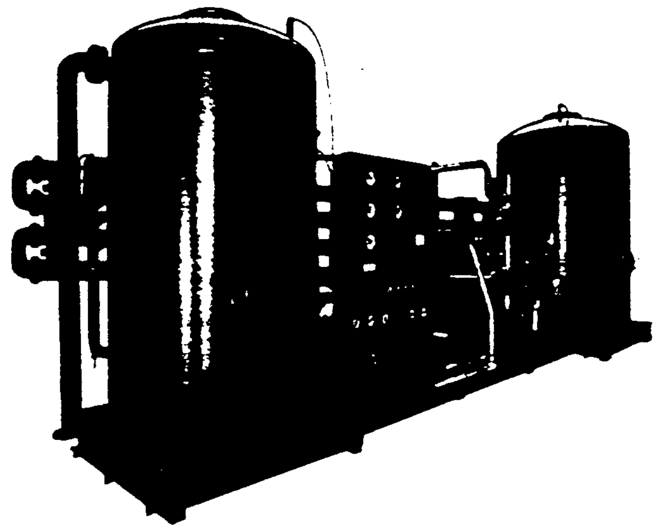
# Ludell supplies the ideas and the components to build the most efficient customized system you can buy!

The schematic flow diagram illustrates the many ways Ludell Water and Heat Recovery Equipment can save you time, energy and money. Each system will vary with plant requirements and function. Each is designed to save initial installation and operating costs as well as to increase existing boiler equipment efficiency. Each is built around the exclusive design of Ludell Heat Reclaimers which recover costly BTU's from waste hot water to heat incoming cold water. Efficiently, Ludell Heat reclaimers can reduce water heating load by up to 50% and lower fuel costs and boiler requirements at the same time.

A Ludell hot water and heat recovery system guarantees all the hot water you need, even during peak load periods. Efficiently and economically.

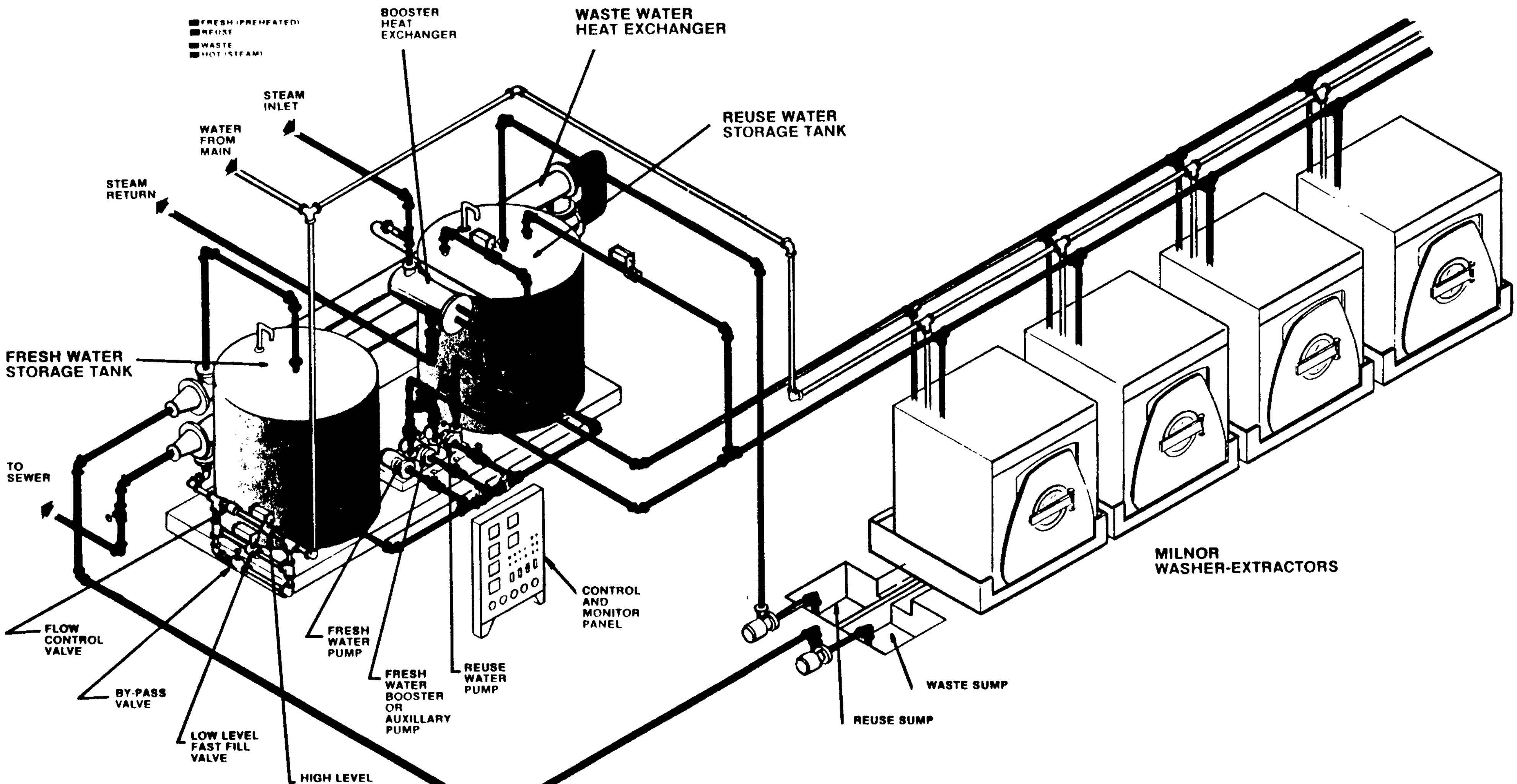
# Or, Plug in a Ludell "Total Package" System.

Complete assembly and fabrication of a Ludell Water and Heat Recovery System — built to your specifications within our own plant — can save you expensive installation costs. You simply "plug in" the plumbing and electrical connections. It's that easy!



How do we do it? First, by inspecting and evaluating your plant needs. In many cases we find that the "Total Package System" can be the most economical way to go. Then we design it and build it to your needs. And ship it to your plant pre-assembled, ready to start saving you money as soon as you install it. And, we back it with Ludell dependability.

You'll benefit with faster fill up rates and a constant supply of hot water. You'll reduce your boiler load by up to one-third! And you'll save up to 50% on your water heating fuel bill. We'll even help you estimate how long it'll take the Ludell Total Package System to pay for itself!




MILNOR® WATER & HEAT RECOVERY SYSTEM



LITHO IN U.S.A. B22SL75003/75143

ECO # 15A

DESCRIPTION: HEAT RECOVERY OF WASTE WATER WITH NEW BOILER INSTALLED

SAVINGS POTENTIAL: UPON COMPLETION OF A WASH CYCLE HOT WATER DISCHARGES INTO THE SEWER. A HEAT RECOVERY UNIT CAN BE USED TO RECLAIM MOST OF THE HEAT LOST IN HOT WASTE WATER.

A: ESTIMATED SAVINGS

SAVINGS ESTIMATES ARE BASED UPON THE FOLLOWING CONDITIONS:

| | | |
|---|---|---|
| NEW BOILER EFFICIENCY = | 83 | % |
| AVERAGE TEMPERATURE OF WASTE WATER = | 130 | DEG F |
| AVERAGE TEMPERATURE OF SUPPLY HOT WATER = | 160 | DEG F |
| AVERAGE TEMPERATURE OF SUPPLY COLD WATER = | 60 | DEG F |
| AVERAGE WATER TEMP. AFTER HEAT RECLAIM = | 120 | DEG F |

EXISTING ENERGY USE FOR HOT WATER

$$\text{MBTU} = \frac{\text{GALLONS HOT WATER X 8.33 X DELTA T}}{1{,}000{,}000}$$

GALLONS HOT WATER = 6565600
DELTA T = 100

MBTU = 5469.145 NOT ACCOUNTING FOR PLANT EFFICIENCY
MBTU = 6589.331 USING 83% PLANT EFF

ENERGY USE WITH HEAT RECOVERY

$$\text{MBTU} = \frac{\text{GALLONS HOT WATER X 8.33 X DELTA T}}{1{,}000{,}000}$$

GALLONS HOT WATER = 6565600
DELTA T = 40

MBTU = 2187.658 NOT ACCOUNTING FOR PLANT EFFICIENCY
MBTU = 2635.732 USING 83% PLANT EFF.

MTU SAVINGS = 3953.599
$ SAVINGS = 12938.67

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO    REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007    INSTALL HEAT RECOVERY UNIT
FISCAL YEAR: 1989    ECO #,s 15A
ANALYSIS DATE:    ECON LIFE 25

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 120403 | |
| B. | SIOH | 1122 | |
| C. | DESIGN COST | 1224 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 110474 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 110474 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | 0 | 0 | 11.16 | 0 | |
| B. | DIST | 4.34 | 0 | 0 | 17.19 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 17.12 | 0 | |
| D. | LPG | 3.27 | 3954 | 12930 | 16.15 | 208813 | |
| E. | WOOD | 2.00 | 0 | 0 | 13.47 | 0 | |
| F. | TOTAL | | 3954 | 12930 | | | 208813 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

| | | |
|---|---|---|
| A. | ANNUAL RECURRING | -500 |
| | (1) DISCOUNT FACTOR (TABLE A) * | 11.65 |
| | (2) DISCOUNTED SAVINGS/COST (3A X 3A1) | -5825 |

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST    -5825

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33)    68908
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE))    12430

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C)    202988

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F)    1.84

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

## COST ESTIMATE ANALYSIS

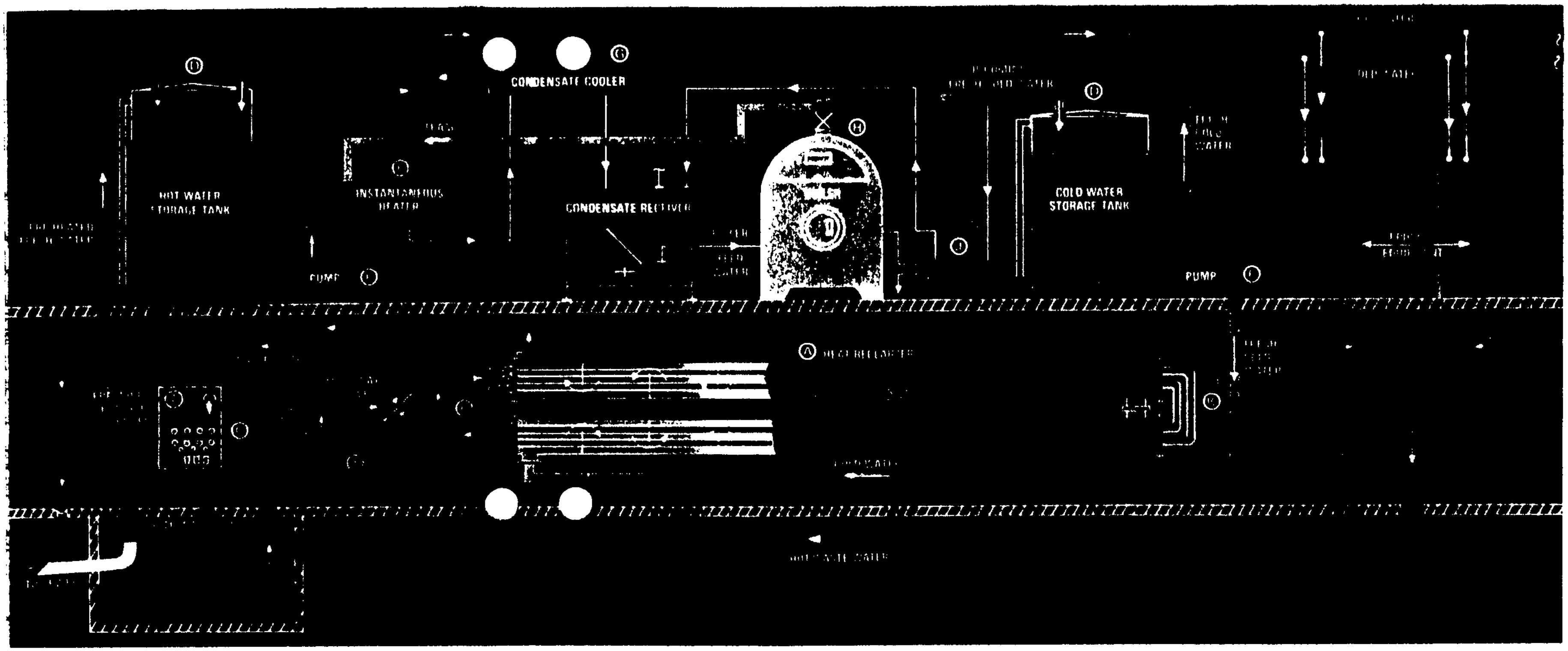
For use of this form, see TM 5 800-2; the proponent agency is USACE.

| | |
|---|---|
| PROJECT | WASH WATER HEAT RECOVERY SYSTEM |
| LOCATION | FORT LEONARD WOOD |
| INVITATION/CONTRACTOR | |
| CODE (Check one) | ☐ A ☐ B ☐ C ☐ OTHER |
| EFFECTIVE PRICING DATE | |
| DRAWING NO. | |
| ESTIMATOR | |
| DATE PREPARED | 25 MAY 89 |
| SHEET | 1 OF 1 SHEETS |
| CHECKED BY | |

ECO 15 A

| TASK DESCRIPTION | QUANTITY | | LABOR | | | | EQUIPMENT | | MATERIAL | | TOTAL | SHIPPING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NO. OF UNITS | UNIT MEAS | MH UNIT | TOTAL HRS | UNIT PRICE | COST | UNIT PRICE | COST | UNIT PRICE | COST | | UNIT WT | TOTAL WT |
| HEAT RECOVERY SYSTEM | 1 | EA | | | | 9500 | | 100,000 | * | | 109500- | | |
| | | | | | | | | | | | | | |
| PIPING - WASTE | 100 | LF | | | 16.30 | 1630- | | | 24.04 | 2404 | 4034- | | |
| STEAM | 50 | LF | | | 5.05 | 253- | | | 2.76 | 138- | 391- | | |
| SEWER | 60 | LF | | | 2.75 | 165- | | | 1.90 | 114- | 279- | | |
| | | | | | | | | | | | | | |
| ELEC SERVICE | | LS | | | | | | | | | 500- | | |
| | | | | | | | | | | | | | |
| SUMP | 1 | EA | | | | 2200- | | | | 3500- | 5700- | | |
| | | | | | | | | | | | 120,403 | | |
| TOTAL THIS SHEET | | | | | | | | | | | | | |

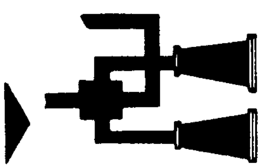
DA FORM 5418-R, Apr 85 * INCLUDES OVERHEAD & PROFIT




Ⓐ **LUDELL HEAT RECLAIMERS** – Ludell, the originator of continuous tube reclaimers, offers a wide range of designs and sizes to fit every application. They are built to operate continuously and function automatically without fouling or plugging and reduce downtime in laundry, textile, paper mill and other applications where time spells loss or profit. Most important, Ludell Heat Reclaimers are built for years of trouble-free service and will repay the initial installation cost many times in fuel savings. And each Ludell heat reclaimer system is expandable to meet increases in production and process operation as your plant size increases.

Ⓑ **AUTOMATIC BACKFLUSH**
The 4 way valve is automatically timed to the system operation to backflush muck, dirt and solids before they have a chance to plug causing inefficiency and downtime. Ludell's exclusive continuous tube feature with backflushing operation guarantees that plugging will never occur.

Ⓒ **PRE-WIRED CONTROL PANEL** – Attractively packaged Ludell Control Panel assures that all pneumatic and electric connections are properly made. All panels are built and tested to fit your individual specifications. In addition, Pre-Wired Panels eliminate complicated hookup procedures and reduce installation expense.



Ⓓ **WATER STORAGE TANKS** – Filament wound fiberglass reinforced plastic tanks are non-corrosive for use with cold or hot water temperatures to 200°F. Capacity of vertical or horizontally placed tanks ranges from 500 to 45,000 gallons to permit full capacity production draw independent of incoming fresh water GPM. Additional on-site tank construction available for larger scale Ludell Water and Heat Recovery Systems.

Ⓔ **DELIVERY and RECIRCULATION PUMPS** – Ludell matches Delivery and Recirculation Pump specifications to existing and new equipment involved in your Water and Heat Recovery System. Pumps feature Mechanical Seal for maintenance free operation and are properly selected to match Net Positive Suction Head (NPSH) "Required" by the pump to the NPSH "Available".

Ⓕ **INSTANTANEOUS HEATER** – Boosts stored hot water to required operating temperatures quickly to reduce fill time. No production slow down waiting for high capacity water draws even during peak load periods. Shell and U-Tube design heats water with steam from your boiler or from high temperature oil system and has built-in expansion feature to minimize stresses caused by pressure and temperature variation.

Ⓖ **CONDENSATE COOLER** – Shell and U-Tube Heat Exchanger is designed to cool condensate below the boiling temperature (to prevent flashing to steam) to save heat and loss of steam to atmosphere. Cooled condensate reduces wear and cavitation to boiler feed pump for best performance over a longer service life. Condensate Cooler returns fresh hot water to storage, condensate to boiler receiving tank.

○ **VENT CONDENSER** – Used in place of Condensate Cooler, the Ludell Vent Condenser prevents loss of condensate to atmosphere through Shell and U-Tube heat exchanger design. Vent Condenser returns condensate to boiler receiving tank with no drop in temperature.

Ⓗ **BOILER** – In plants where excessive load on existing boilers indicates new boiler installation, a Ludell Hot Water and Heat Recovery System is the real answer to lower capital investment as well as a reduction in fuel costs. Ludell equipment can reduce water heating fuel costs by over 50% and save up to one-third on boiler load.

Ⓘ **WASTE WATER PUMP** – This pump is specially selected to meet the requirements of handling waste water. Features include self priming, vertical lift, pump solids, cut off blades for long fibers, mechanical seal, internal check valve, and easy access opening for inspection.

Ⓙ **BLOWDOWN ECONOMIZER** – Used primarily in conjunction with a boiler having constant blowdown. This is a Shell and U-Tube Heat Exchanger designed to preheat boiler make-up water with the blowdown water.

Ⓚ **CONTINUOUS TUBE DESIGN** – Ludell's unique continuous tube design assures against plugging because there are no seams to "catch" on. Smooth, rounded corners eliminate fouling or accumulation. Continuous tube design together with automatic backflush operation guarantees you peak performance for the life of the reclaimer.

○ **A TOTALLY BALANCED SYS-TEM** – The Ludell "Open" Hot Wat System insures faster filling of vesse regardless of outside water pressur and provides a total balance betwe preheated water and waste water flo rates. No more will you have to wa for fills due to low pressure or temper ture variations. The Ludell Hot Wat and Heat Recovery System designe for your plant converts downtime t productive time. In the usual "Close system outside water pressures wi limit internal production, particular during peak draws when all processe are demanding water at the same tim The Ludell System balances incomin and outgoing pressures and replenish hot water supply through an economic combination of recovering heat fro waste water and boosting it to the r quired temperatures with minimum lo to your boiler. All at a pre-set ra based on the requirements of you plant.

Ludell's balanced system smoothe out the highs and lows in water deman and heating and as a result, your oper ation will require less in terms of: boile size and load; piping, valves and fitting softeners, filters and related equipment smaller and lighter holding tanks be cause they need not be pressurized Less means economy and efficiency.

○ **ANTI-POLLUTION AND CON-SERVATION REQUIREMENTS** – Lu dell provides the know-how and th equipment to cope with local and na tional requirements while saving you money at the same time. Application include:

**Thermal Pollution** resulting from high temperature water discharge Ludell Heat Reclaimers reduce hea from discharged water in raising fresh, incoming water temperature and lower fuel costs and boiler load at the same time.

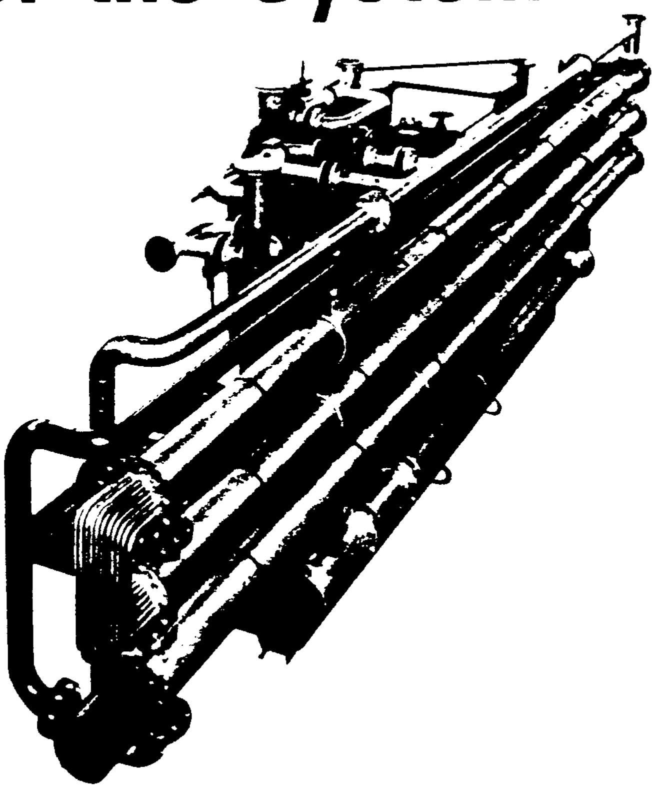
**Solids Removal Systems** mechan ically screen and sediment solids and dirt before discharging into the sewer Pumping of sludge from waste water pits is greatly reduced with Ludel Solids Removal System.

**Conservation.** Ludell uses less fuel less of everything in the balanced Hot Water and Heat Recovery Sys tem. And Ludell engineers are ex perts at incorporating ideas and equipment in your operation to at tain the highest efficiency and savings

# Ludell Heat Exchangers: The Heart of the System.

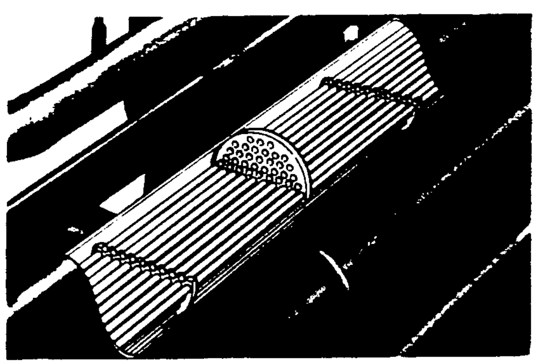
**LUDELL CONSTRUCTION MAKES THE DIFFERENCE.**

Ludell, originator of the continuous tube reclaimer, manufactures a wide range of Heat Reclaimers and Heat Exchangers in the styles and sizes to suit your needs. Fabrication includes all types of materials (stainless steel, carbon steel, cast iron, admiralty, muntz metal, brass, cupro nickel, aluminum or silicon bronze and also offers a broad line of baked or cold set phenolic or epoxy linings for added corrosion resistance). Ludell designs and manufactures to meet or exceed Commercial Standards, ASME Code for Unifired Pressure Vessels Standards and TEMA Standards (Tubular Exchangers Manufacturers Association).



**Baffle plates welded-in-place increase efficiency and mean longer life.**

- Baffles are welded to the shell to become one integral unit with no moving parts.
- All welded construction holds baffles and tubes firmly in place so baffles cannot cut into shell or tubes.
- Provides a tighter fit because baffles, welded-in-place, eliminate clearance otherwise required for sliding of bundles into shell; shifting and twisting; eliminates bypass of water between the baffles and shell. Bypassed water will not pick up heat.
- Ludell welded baffles, requiring perfect alignment in the manufacturing process, assures you of maximum heat transfer and better overall performance in heat reclaiming.



**Ludell**

**Ludell Manufacturing Company** 5200 West State Street, Milwaukee, WI 53208 (414) 476-99:

ECO # 17

DESCRIPTION: LOWER HOT WATER SUPPLY TEMPERATURE

SAVINGS POTENTIAL: HOT WATER IS CURRENTLY SUPPLIED AT A TEMPERATURE OF 160 DEGREES FAHRENHEIT. THIS TEMPERATURE WATER MAKES UP ONLY 15% OF TOTAL HOT WATER REQUIREMENTS. THE REMAINING HOT WATER CAN BE SUPPLIED AT A LOWER TEMP. REDUCING HOT WATER SUPPLY TEMPERATURE WILL REDUCE DISTRIBUTION LOSSES AND OVERALL HOT WATER HEATING LOAD.

A: ESTIMATED SAVINGS

SAVINGS ESTIMATES ARE BASED UPON THE FOLLOWING CONDITIONS:

EXISTING HOT WATER USE AT 160 DEG = 6625000 GALS
% OF HOT WATER AT DIFF TEMPERATURES AS FOLLOWS:

| | | | |
|---|---|---|---|
| 120 DEG | ----- | .05 | 5% |
| 130 DEG | ----- | .26 | 26% |
| 140 DEG | ----- | .13 | 13% |
| 150 DEG | ----- | .41 | 41% |
| 160 DEG | ----- | .15 | 15% |
| | | ------- | ------- |
| | | 1 | 100% |

EXISTING ENERGY USE FOR HOT WATER

$$\text{MBTU} = \frac{\text{GALLONS HOT WATER X 8.33 X DELTA T}}{1{,}000{,}000}$$

GALLONS HOT WATER = 6565600
DELTA T = 100
MBTU = 5469.145 NOT ACCOUNTING FOR PLANT EFFICIENCY
MBTU = 7292.193 USING 75% PLANT EFF.

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ENERGY USE TO HEAT TO 140 DEG
GALLONS HOT WATER = 6565600
DELTA T = 80
MBTU = 4375.316 NOT ACCOUNTING FOR PLANT EFFICIENCY
MBTU = 5833.754 USING 75% PLANT EFF.

ENERGY USE TO HEAT TO 150 DEG
GALLONS HOT WATER = 6565600 * .41 = 2691896
DELTA T = 10
MBTU = 224.2349
MBTU = 298.9799

ENERGY USE TO HEAT TO 160 DEG
GALLONS HOT WATER = 6565600 * .15 = 984840
DELTA T = 20
MBTU = 164.0743
MBTU = 218.7658

TOT. ENERGY USE WITH
140 DEG & REHEAT = 6351.500

TOTAL SAVINGS (MBTU) = 940.6929
TOTAL $ SAVINGS = 3079.23

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007 LOWER HW TEMPERATURE
FISCAL YEAR: 1989 ECO #,s 17
ANALYSIS DATE: ECON LIFE 25

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 132 | |
| B. | SIOH | 0 | |
| C. | DESIGN COST | 0 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 119 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 119 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | 0 | 0 | 11.16 | 0 | |
| B. | DIST | 4.34 | 0 | 0 | 17.17 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 17.12 | 0 | |
| D. | LPG | 3.27 | 941 | 3077 | 16.15 | 49695 | |
| E. | WOOD | 2.00 | 0 | 0 | 13.47 | 0 | |
| F. | TOTAL | | 941 | 3077 | | | 49695 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

A. ANNUAL RECURRING 0
(1) DISCOUNT FACTOR (TABLE A) * 11.65
(2) DISCOUNTED SAVINGS/COST (3A X 3A1) 0

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST 0

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33) 16399
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE)) 3077

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C) 49695

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F) 418.31

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

## COST ESTIMATE ANALYSIS

For use of this form, see TM 5 800-2; the proponent agency is USACE.

| | | | |
|---|---|---|---|
| PROJECT: LOWER HOT WATER TEMP. | INVITATION/CONTRACTOR | EFFECTIVE PRICING DATE | DATE PREPARED: 26 MAY 89 |
| LOCATION: FORT LEONARD WOOD | CODE (Check one) ☐ A ☐ B ☐ C ☐ OTHER | DRAWING NO. | SHEET 1 OF 1 SHEETS |
| | | ESTIMATOR | CHECKED BY |

| ECO #17 TASK DESCRIPTION | QUANTITY | | LABOR | | | | EQUIPMENT | | MATERIAL | | TOTAL | SHIPPING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NO. OF UNITS | UNIT MEAS | MH UNIT | TOTAL HRS | UNIT PRICE | COST | UNIT PRICE | COST | UNIT PRICE | COST | | UNIT WT | TOTAL WT |
| MODIFY CONTROLS | 4 | HRS | | 4 | 33- | 132- | | | | | 132- | | |
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| TOTAL THIS SHEET | | | | | | | | | | | | | |

DA FORM 5418-R, Apr 85

ECO # 19

DESCRIPTION: STEAM TRAP INSPECTION/REPLACEMENT

SAVINGS POTENTIAL: REPLACEMENT OF WORN STEAM TRAPS ELIMINATES LIVE STEAM RETURNING TO THE BOILER AND IMPROVES SYSTEM EFFICIENCY AND REDUCES FUEL CONSUMPTION.

A: ESTIMATED SAVINGS

POTENTIAL SAVINGS WERE BASED UPON REPLACING ONE FAULTY TRAP CONNECTED TO TO A 3/4 INCH PIPE SUPPLYING STEAM AT 15 PSI.

$$\text{MBTU SAVINGS} = \frac{\text{STEAM LOSS/HR X HR/YR X BTU/ LB STM}}{\text{EFF X BTU/MBTU}}$$

| | |
|---|---|
| STEAM LOSS/HR = | 13.7 |
| HR/YR = | 8760 |
| BTU/LB STEAM = | 1075 |
| EFFICIENCY = | .75 |
| BTU/MBTU = | 1000000 |

| | |
|---|---|
| MBTU SAVINGS = | 172.0172 |
| $ SAVINGS = | 562.84 |

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007 STEAM TRAP REPLACEMENT
FISCAL YEAR: 1989 ECO #,s 19
ANALYSIS DATE: ECON LIFE 8

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 117 | |
| B. | SIOH | 0 | |
| C. | DESIGN COST | 0 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 105 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 105 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 20.58 | 0 | 0 | 5.74 | 0 | |
| B. | DIST | 6.20 | 0 | 0 | 7.18 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 6.79 | 0 | |
| D. | LPG | 4.90 | 172 | 843 | 6.75 | 5689 | |
| E. | WOOD | 2.00 | 0 | 0 | 6.41 | 0 | |
| F. | TOTAL | | 172 | 843 | | | 5689 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

A. ANNUAL RECURRING 0
(1) DISCOUNT FACTOR (TABLE A) * 5.97
(2) DISCOUNTED SAVINGS/COST (3A X 3A1) 0

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST 0

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33) 1877
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE)) 843

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C) 5689

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F) 54.03

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

**COST ESTIMATE ANALYSIS**

For use of this form, see TM 5-800-2; the proponent agency is USACE.

INVITATION/CONTRACTOR

EFFECTIVE PRICING DATE

DATE PREPARED 24 MAY 89

PROJECT STEAM TRAP REPLACEMENT

CODE (*Check one*) ☐ A ☐ B ☐ C ☐ OTHER

DRAWING NO.

SHEET 1 OF 1 SHEETS

LOCATION FORT LEONARD WOOD

ESTIMATOR

CHECKED BY

ECO # 19

| TASK DESCRIPTION | QUANTITY | | LABOR | | | | EQUIPMENT | | MATERIAL | | TOTAL | SHIPPING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NO. OF UNITS | UNIT MEAS | MH UNIT | TOTAL HRS | UNIT PRICE | COST | UNIT PRICE | COST | UNIT PRICE | COST | | UNIT WT | TOTAL WT |
| TRAP INSPECTION & | 1 | EA | | 1 | 39- | 39- | | | 78- | 78- | 117- | | |
| REPLACEMENT | | | | | | | | | | | | | |
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| TOTAL THIS SHEET | | | | | | | | | | | | | |

DA FORM 5418-R, Apr 85

ECO # 20

DESCRIPTION: INSTALL A CONTINUOUS BATCH WASHER (1000 LB CAPACTIY).

SAVINGS POTENTIAL: A CONTINUOUS BATCH WASHER REDUCES WATER CONSUMPTION TO 1.0 TO 1.2 GALLONS PER POUND OF LAUNDRY. SAVINGS IS ACCOMPLISHED THROUGH WATER RE-CYCLING & IMPROVED DRUM DESIGN.

A: SAVINGS IF CBW IS USED FOR SHEETS ONLY.

| | |
|---|---|
| AVERAGE ANNUAL SHEET PRODUCTION (LBS): | 1084663 |
| EXISTING WATER USE PER LB: | 2.6 |
| WATER USE PER LB WITH CBW: | 1.2 |
| WATER SAVINGS PER LB: | 1.4 |
| TOTAL ANNUAL WATER SAVINGS (GALS): | 1518528. |
| TOTAL ANNUAL HOT WATER SAVINGS (GALS): (HOT WATER = .68 TOTAL WATER) | 1032599. |

$$\text{MBTU SAVINGS} = \frac{\text{GAL} * 8.33 * \text{DELTA TEMP}}{1{,}000{,}000 * \text{SYST. EFFIC.}}$$

DELTA T = 100
SYSTEM EFFIC. = .75

| | |
|---|---|
| MBTU SAVINGS = | 1146.873 |

B: SAVINGS IF CBW IS USED AT MAXIMUM CAPACITY:

| | |
|---|---|
| HOURLY CAPACITY (LBS/HR): | 1000 |
| WEEKLY CAPACITY (LBS/HR) @ 40 HR WEEK: | 40000 |
| ANNUAL CAPACITY (LBS/HR) @ 50 WEEKS/YR: | 2000000 |
| TOTAL ANNUAL WATER SAVINGS (GALS): | 2800000 |
| TOTAL ANNUAL HOT WATER SAVINGS (GALS): | 1904000 |
| MBTU SAVINGS = | 2114.709 |
| $ SAVINGS = | 6919.93 |

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007 INSTALL CONT. B WASHER
FISCAL YEAR: 1989 ECO #,s 20
ANALYSIS DATE: ECON LIFE 25

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 103485 | |
| B. | SIOH | 5692 | |
| C. | DESIGN COST | 6209 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 103847 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 103847 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | 0 | 0 | 11.16 | 0 | |
| B. | DIST | 4.34 | 0 | 0 | 17.19 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 17.12 | 0 | |
| D. | LPG | 3.27 | 2114.7 | 6915 | 16.15 | 111678 | |
| E. | WOOD | 2.00 | 0 | 0 | 13.47 | 0 | |
| F. | TOTAL | | 2114.7 | 6915 | | | 111678 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

A. ANNUAL RECURRING 0
(1) DISCOUNT FACTOR (TABLE A) * 11.65
(2) DISCOUNTED SAVINGS/COST (3A X 3A1) 0

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST 0

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33) 36854
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE)) 6915

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C) 111678

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F) 1.08

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

## COST ESTIMATE ANALYSIS

For use of this form, see TM 5-800-2; the proponent agency is USACE.

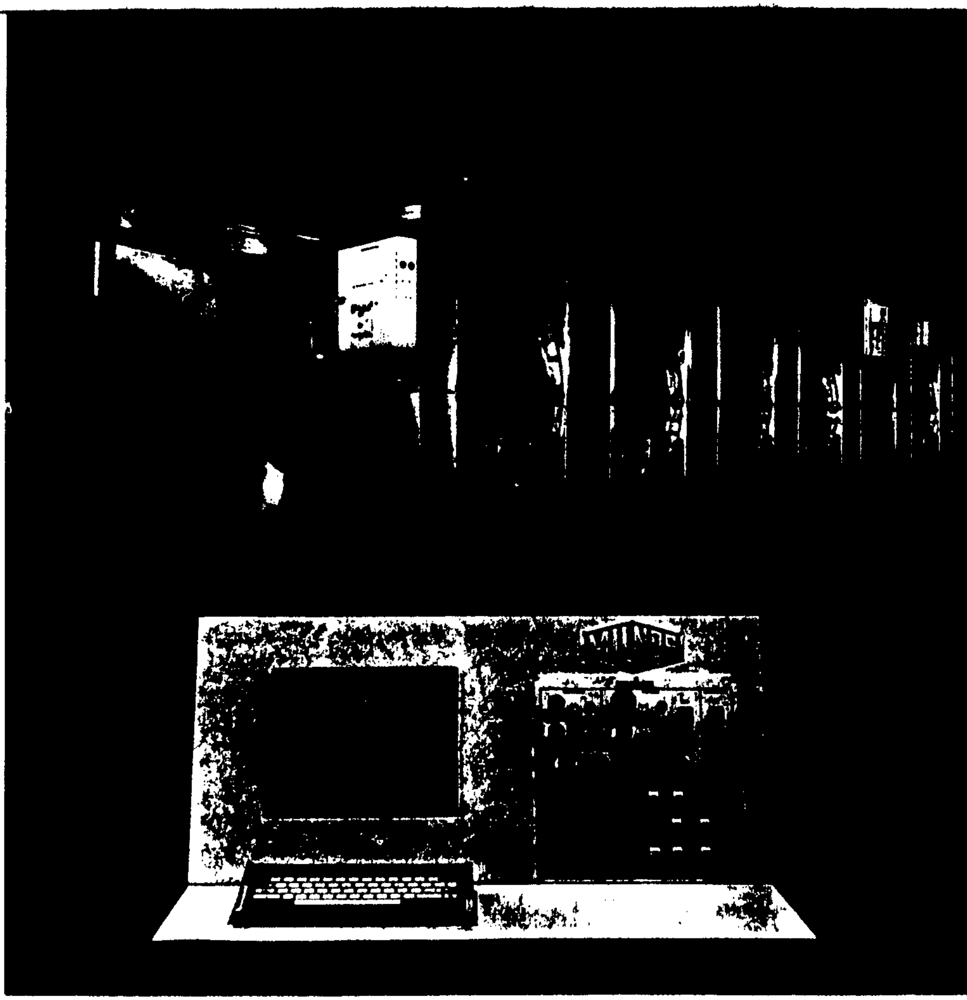
| | |
|---|---|
| PROJECT | INSTALL CONTINUOUS BATCH WASHER |
| LOCATION | FORT LEONARD WOOD |
| INVITATION/CONTRACTOR | |
| CODE (Check one) | ☐ A ☐ B ☐ C ☐ OTHER |
| EFFECTIVE PRICING DATE | |
| DRAWING NO. | |
| ESTIMATOR | |
| DATE PREPARED | 25 MAY 89 |
| SHEET | 1 OF 1 SHEETS |
| CHECKED BY | |

ECO #20

| TASK DESCRIPTION | QUANTITY | | LABOR | | | | EQUIPMENT | | MATERIAL | | TOTAL | SHIPPING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NO. OF UNITS | UNIT MEAS | MH UNIT | TOTAL HRS | UNIT PRICE | COST | UNIT PRICE | COST | UNIT PRICE | COST | | UNIT WT | TOTAL WT |
| CONTINUOUS BATCH WASH | | | | | | | | | | | | | |
| MODULE 1 | 1 | EA | | | | 5000– | | 49,995– | | | 54,995– | | |
| MODULE 2 | 1 | EA | | | | 2100– | | 19,995– | | | 22,095– | | |
| MODULE 3 | 1 | EA | | | | 2400– | | 23,995– | | | 26,395– | | |
| | | | | | | | | | | | $103,485 | | |
| TOTAL THIS SHEET | | | | | | | | | | | | | |

DA FORM 5418-R, Apr 85

# 76032 CBW* Batch Washing System



## Efficient, continuous production

The MILNOR continuous batch washer is the product of many years' experience in manufacturing the world's most innovative laundry machinery.

It is basically an automated washing/transport system. The system is modular. Output per hour depends on the number of modules and the cycle time. Batches of 110 lbs. (50 kgs.)* are fed into the machine's loading funnel by conveyor or other means. These batches travel throught the continuous batch washer (see drawing inside this flap), exit into an extraction system for moisture removal, and then move via conveyor to a self-loading/unloading dryer.

The entire CBW® washing system (including the extraction system, conveyors, and pass-through dryers) is manufactured by MILNOR. The result is a fully-integrated system.

*Capacity differs, depending on type of goods washed, liquor levels, etc. See back page.

## Big labor savings

After a batch is placed onto a loading conveyor (or other device) in the soil room, it is untouched until it is discharged by the dryer.

This means a smaller workforce. It also means easier work, because there is less handling of soiled linen and no heavy loads to move.

## Big hot water savings

The MILNOR CBW® batch washer employs the counterflow method—a built-in water reuse system. As the washload moves through the system from soiled to clean, water moves in the opposite direction. The water travels through a simple arrangement of piping and overflow weirs.

Depending on the washing program, water use can be as low as 1 to 1.4 gals./lb. (8 to 12 L./kg.). This exceptionally low consumption means big savings on water, sewer, supply and water heating bills.

## Fast turnover of goods

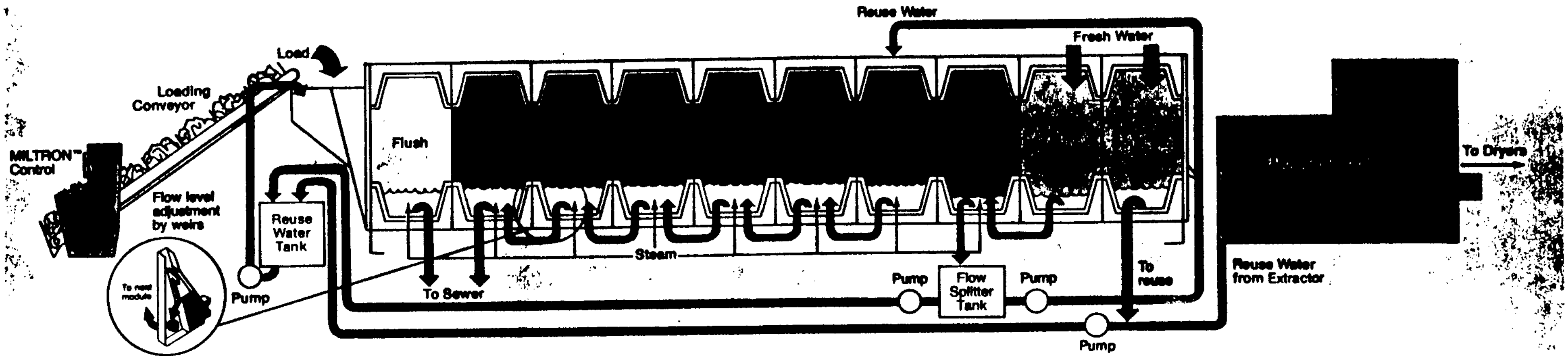
Work goes from soiled to clean more quickly, because the system continuously processes small, 110 lb. (50 kg.) batches.

Washing can begin soon after personnel start working in the morning, since the system is ready to go once a 110 lb. batch has been sorted.

And because small batches come from the washroom at regular intervals—on a steady basis—production planning is easier.

**To see how a typical system works, just turn this flap.**

# HOW A TYPICAL SYSTEM WORKS




## A variety of arrangements

The MILNOR CBW® batch washer can be tailored to meet individual requirements. It can vary in number of modules, automatic formulas, thermostatically controlled temperatures, supply, water and drain valves, and so on.

This drawing, an example of one system, illustrates the following features and operations

## MILTRON™ control

When the operator puts a batch in line for loading into the washer, he selects the wash formula on the MILTRON control (at left in drawing). The formula then follows that batch through each stage—until it's automatically unloaded from the dryer and delivered to its final finishing destination.

## Loading

The loading funnel (see drawing) may be fed by such devices as conveyors, chutes or slings. As goods enter the funnel, they are flushed into the machine by water.

A major advantage is that only one loading station is necessary . . . not several, as with individual washing machines. This simplifies materials handling procedures.

## Washing

Each module consists of a stationary shell—to hold the wash bath—and a perforated cylinder.

Separate modules are used for different baths. As the drawing shows, the goods proceed through the formula by traveling from module to module.

Washing is continuous. There are no stops and starts for draining and filling after each bath. This helps reduce wash cycle time, compared to conventional washing machinery

## Transfer

On signal from the MILTRON™ control, goods are transferred from one module to the next through a specially designed transfer scoop. This happens quickly and simultaneously.

All washing cylinders are keyed together, so they turn together. To wash, they turn through an arc of about 300°, for a complete reversal approximately every 11 seconds. To transfer, the cylinders turn an additional amount (about 210°) in one direction. As each cylinder dumps a load through its scoop into the next cylinder, it also receives a load from the cylinder behind it.

## Water flow

Fresh water is usually introduced at or near the unloading end. It travels toward the loading end through pipes connecting the modules. Flow levels are controlled by adjustable overflow level controls, (see inset above).

Optional drain valves—and/or fresh water inlets—may be included on various modules as desired, to meet special formula requirements where counterflow is not desirable. It is also possible to pump water from one module to a module other than the adjacent one.

Water from the extractor is reused, too. It is pumped to a holding tank, then flushed into the loading funnel and first module. The first module is normally ordered so that it overflows to the sewer, as is the last module receiving counterflow water (the second module in the drawing).

## Temperature controls

Any module can be equipped with a steam inlet and combination thermometer-thermostat. The thermometer-thermostat provides for two or four thermostatically controlled temperatures.

## Supplies

Supply valves can be placed in each module. The MILTRON control dictates the amount of supplies and when—or if—they are added to the specific goods in each module during the wash cycle

## Post-wash

Clean work is discharged from the last module into an extractor. From there, it moves by conveyor to a self-loading/unloading dryer.

The MILTRON control governs the pressure exerted by the extractor and whether or not the goods are to be dried. If the work is to be dried, the control determines the time in the dryer, selects tumbler drying temperatures, cooldown, reversing or non-reversing modes, and the destination of the goods after drying. If drying is not desired, the control dictates the proper destination after extraction.

The MILTRON control also tells the operator every time a new customer's work is discharged from the machine

# Production per Hour

*TOTAL WASHING TIME*

| | 20 Min. | 24 Min. | 30 Min. | 36 Min. |
|---|---|---|---|---|
| 8 modules—lbs./hr<br>(kg./hr.) | 2640<br>(1200) | 2200<br>(1000) | 1760<br>(800) | 1465<br>(665) |
| 12 modules—lbs./hr.<br>(kg./hr.) | 3960<br>(1800) | 3300<br>(1500) | 2640<br>(1200) | 2200<br>(1000) |

Batch size: 110 lbs. (50 kg.)

This table is for guidance only. Some applications may require longer formulas

# Specifications
**(Subject to change without notice)**

## Washing cylinder

| | |
|---|---|
| Diameter | 76 in. (1930 mm.) |
| Depth | 32 in. (810 mm.) |
| Volume | 88.7 cu. ft. (2512 L)* |
| Loading capacity and loading factor | 100 lbs. at 1.1 lbs./cu. ft. (45 kg. at 1:56) |
| Capacity depends on several factors, including type of goods washed, liquor levels, etc. | 110 lbs. at 1.2 lbs./cu. ft. (50 kg. at 1:50) |
| *Full interior cylinder volume, including conical portion and exit ring. | 120 lbs. at 1.3 lbs./cu. ft. (55 kg. at 1:46) |

## Each module

| | |
|---|---|
| Length | 43 in. (1092 mm.) |
| Add to first module | 59 in. (1283 mm.) |
| Add to last module | 8 in. (121 mm.) |
| Width (without side panels) | 92 in. (2489 mm.) |
| Approx. Height | 103 in. (2616 mm.) |
| Water valve* | 1 or 1¼ in. |
| Drain* | 5 in. |
| Quick drain valve* | 10 in. |
| Steam inlet* | 2 in. |
| Air connection | ½ in. |
| Approx. water consumption** | 1 - 1.4 gals./lb. (8-12 L/kg.) |
| Approx. net weight | 2480 lbs. (1125 kg.) |
| Add to first module | 615 lbs. (280 kg.) |

*If used
**Depending on washing program

Pellerin Milnor Corporation
P. O. Box 400, Kenner, LA 70063, U.S.A.
Telephone 504/467-9591





Class 5-9 Brochure B22SL81008
86091

ECO # 20A

DESCRIPTION: REPLACE EXISTING STEAM DRYERS WITH GAS DRYERS (220LB).

SAVINGS POTENTIAL: NEW GAS DRYERS (200LB CAP) USE APPROXIMATELY 3000 BTU TO REMOVE 1 POUND OF WATER. EXISTING STEAM DRYERS USE APPROXIMATELY 4050 BTU TO REMOVE 1 POUND OF WATER.

A: SAVINGS BASED ON EXISTING USE.

| | |
|---|---|
| AVERAGE ANNUAL PROD. FOR 1 STEAM DRYER (LBS): | 100000 |
| AVERAGE ANNUAL WATER REMOVAL (LBS OF H2O): | 65000 |
| EXISTING ENERGY USE (BTU PER LB H2O): | 4052 |
| EXISTING ANNUAL ENERGY USE PER DRYER (MBTU): | 263.38 |
| (PLANT EFFICIENCY NOT INCLUDED) | |
| EXISTING ANNUAL ENERGY USE PER DRYER (MBTU): | 351.1733 |
| (USING 75 % PLANT EFFICIENCY) | |

| | |
|---|---|
| NEW ENERGY USE (BTU PER LB H2O): | 3000 |
| NEW ANNUAL ENERGY USE PER DRYER (MBTU): | 195 |
| SAVINGS PER DRYER PER YEAR (MBTU) | 156.1733 |
| SAVINGS FOR 20 DRYERS | 3123.467 |
| SAVINGS AT $ 3.27 PER MBTU | 10219.39 |

B. NUMBER OF NEW DRYERS REQUIRED

| | |
|---|---|
| EXISTING ANNUAL PROD.OF STEAM DRYERS (LBS) | 2000000 |
| NEW PRODUCTION RATE PER CYCLE (LBS) | 220 |
| CYCLE TIME 15 MINUTES | |
| NEW PRODUCTION RATE PER HOUR (LBS) | 880 |
| HOURS REQUIRED PER YEAR | 2272.727 |
| (USE TWO SYSTEMS) | |

C. ELECTRICITY SAVINGS

EXISTING ELECT. USE (TAKEN FROM TABLE II-5)

| DRYER TYPE | # | ANNUAL KWH | TOTAL KWH |
|---|---|---|---|
| A | 2 | 895.2 | 1790.4 |
| B | 7 | 895.2 | 6266.4 |
| C | 2 | 2238 | 4476 |
| D | 2 | 1044.4 | 2088.8 |
| E | 6 | 1342.2 | 8053.2 |
| H | 1 | 1044.4 | 1044.4 |
| | | | --------- |
| | | | 23719.2 |

| NEW ELECTRICITY USE | | HRS | KWH |
|---|---|---|---|
| BLOWER MTR (KW) | 7.46 | 2273 | 16956.58 |
| BASKET MTR (KW) | 2.24 | 2273 | 5091.52 |
| BURNER MTR (KW) | .373 | 2273 | 847.829 |
| | | | --------- |
| | | | 22895.93 |

| | |
|---|---|
| KWH SAVINGS | 823.271 |
| MBTU SAVINGS | 2.809824 |
| $ SAVINGS @ 12.97 | 36.32 |

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007 REPLACE STM. DRYERS
FISCAL YEAR: 1989 ECO #,s 20A
ANALYSIS DATE: ECON LIFE 25

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 84250 | |
| B. | SIOH | 4634 | |
| C. | DESIGN COST | 5055 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 84545 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 84545 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | 2.8 | 36 | 11.16 | 405 | |
| B. | DIST | 4.34 | 0 | 0 | 17.79 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 17.12 | 0 | |
| D. | LPG | 3.27 | 3123 | 10212 | 16.15 | 164927 | |
| E. | WOOD | 2.00 | 0 | 0 | 13.47 | 0 | |
| F. | TOTAL | | 3125.8 | 10249 | | | 165332 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

| | | | |
|---|---|---|---|
| A. | ANNUAL RECURRING | 0 | |
| | (1) DISCOUNT FACTOR (TABLE A) * | 11.65 | |
| | (2) DISCOUNTED SAVINGS/COST (3A X 3A1) | 0 | |

| B. | NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|---|
| | a. | 0 | | 1.00 | 0 |
| | b. | 0 | | 1.00 | 0 |
| | c. | 0 | | 1.00 | 0 |
| | d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST 0

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33) 54560
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE)) 10249

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C) 165332

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F) 1.96

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

**COST ESTIMATE ANALYSIS**
For use of this form, see TM 5 800-2; the proponent agency is USACE.

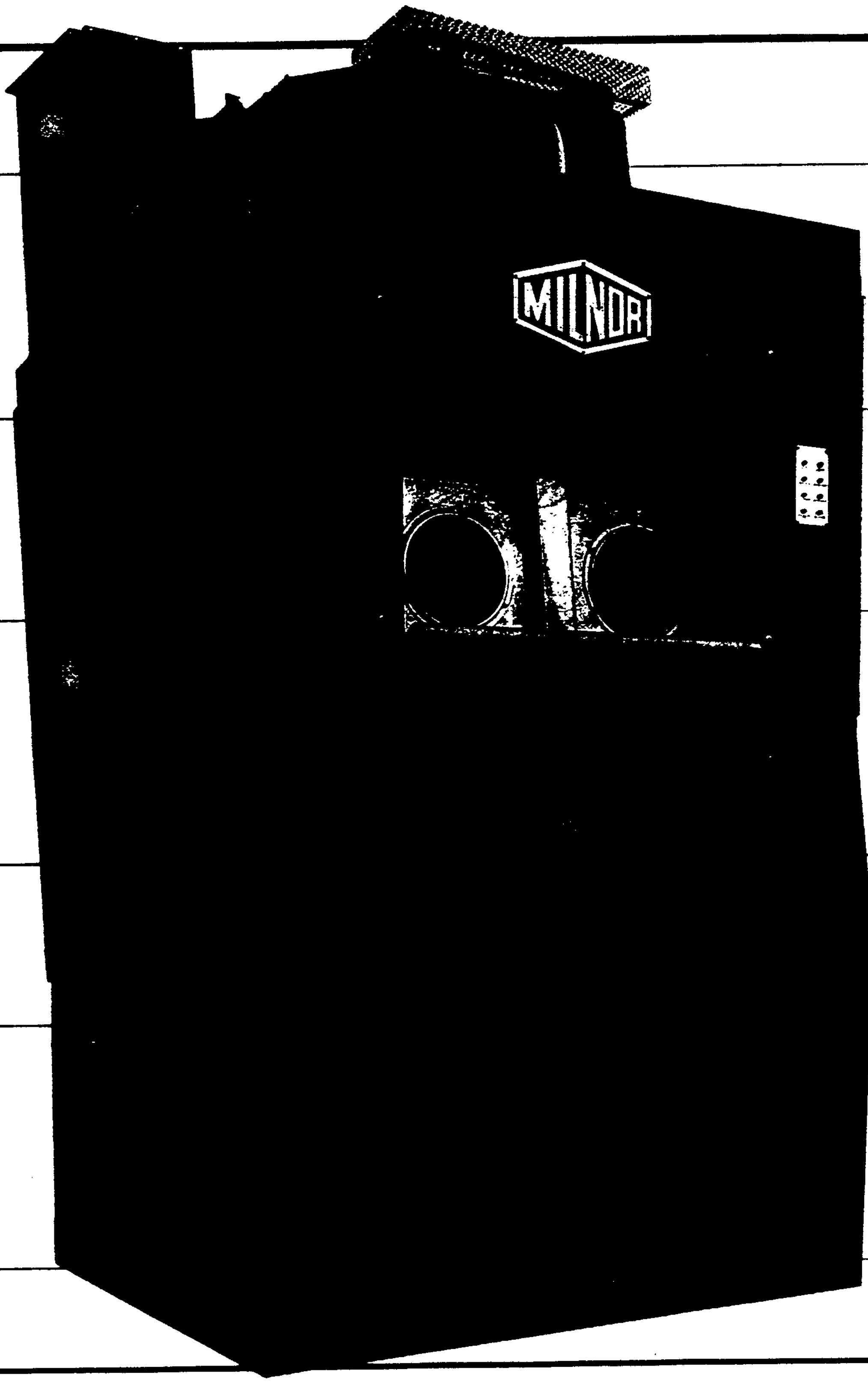
| | |
|---|---|
| PROJECT | INSTALL TWO 220 lb DRYERS (GAS) |
| LOCATION | FORT LEONARD WOOD |
| INVITATION/CONTRACTOR | |
| CODE (Check one) | ☐ A ☐ B ☐ C ☐ OTHER |
| EFFECTIVE PRICING DATE | |
| DRAWING NO. | |
| ESTIMATOR | |
| DATE PREPARED | 25 MAY 89 |
| SHEET | 1 OF 1 SHEETS |
| CHECKED BY | |

| TASK DESCRIPTION | QUANTITY | | LABOR | | | | EQUIPMENT | | MATERIAL | | TOTAL | SHIPPING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECO # 20A | NO. OF UNITS | UNIT MEAS | MH UNIT | TOTAL HRS | UNIT PRICE | COST | UNIT PRICE | COST | UNIT PRICE | COST | | UNIT WT | TOTAL WT |
| 220 lb GAS DRYER | 2 | EA | | | 4000- | 8000- | 38,000 | 76,000- | | | 84,000- | | |
| DUCTWORK | 40 | LF | | | 1.26 | 50.40 | | | 1.39 | 55.60 | 106- | | |
| PIPING | 30 | LF | | | 3.40 | 102- | | | 1.39 | 41.70 | 144- | | |
| | | | | | | | | | | | 84,250 | | |
| TOTAL THIS SHEET | | | | | | | | | | | | | |

DA FORM 5418-R, Apr 85

# DRYERS

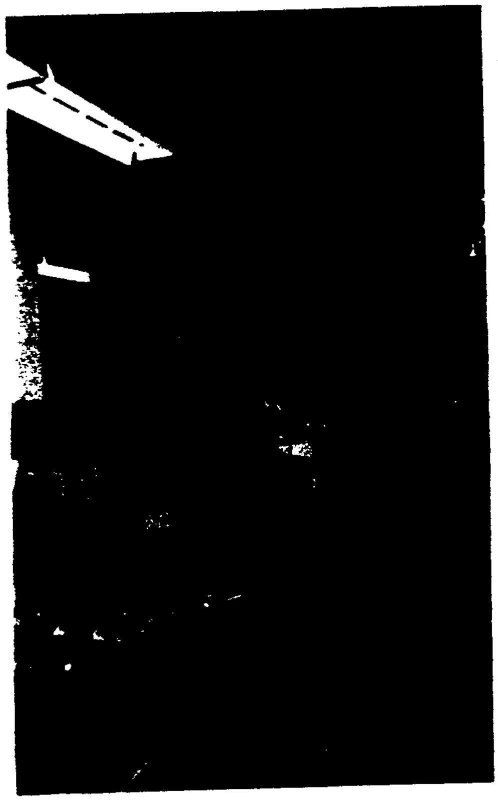
FOR • BATCH • WASHERS • AND • OTHER • WASHING • SYSTEMS

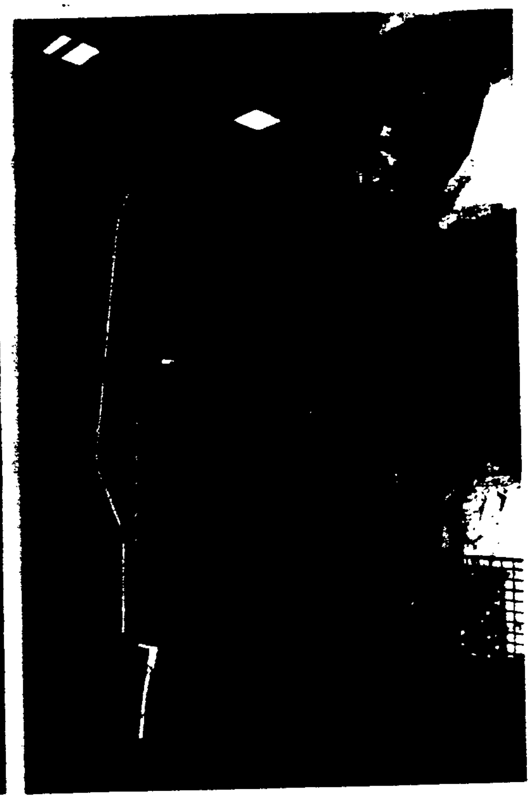


***Dries rapidly and evenly***

***Conserves energy***

***F[illegible]ilt means instant unloading***





(Left) A freestanding MILNOR dryer increases efficiency, improves workflow, and reduces labor in laundries with conventional washing systems. (Right) MILNOR's fixed tilt toward the unload end lets goods fall out by gravity in as little as 15 to 20 seconds. Besides being ready for a new load sooner, the dryer saves fuel by retaining more heat, since goods aren't blown out by hot air during unloading. ▶

MILNOR dryers are an integral, energy-saving part of an automated batch laundry processing system. Their fast, uniform drying ability results in four loads per hour of full-dry linen supply terry. ▶

## Various sizes and types

[illegible]cities are keyed to popular batch wash[illegible]ere is a choice of one-batch (110 lb./50 [illegible]nd two-batch (220 lb./100 kg.) sizes. Heating methods include gas, steam, or thermal oil. An unheated model is also available for loosening no-dry cakes of goods. Different pedestal heights are available as options.

## *These dryers help streamline laundry production.*

MILNOR dryers are pass-through machines that load at one end and discharge at the other. They form an integral part of an automated batch laundry processing system, along with a continuous batch washer, an extraction system, and transport conveyors.

These fully automatic dryers can also be used to streamline operations with washer-extractors and conventional washers. Pass-through design allows excellent workflow, while automatic loading/unloading and drying controls reduce operator attention.

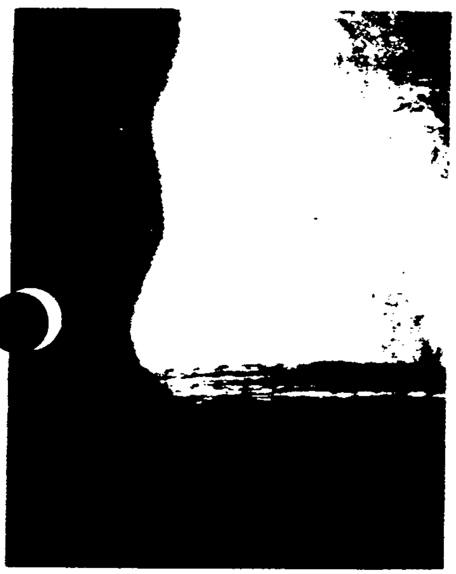
## They save energy

Superior airflow provides fast efficient drying and healthy fuel savings

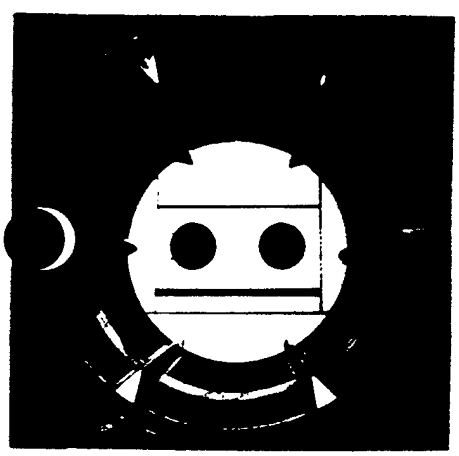
The blower motor is half the size of a major competitor's (thanks to MILNOR's exclusive airflow through the goods, instead of around the outside of the basket). This saves power.

The dryer's microprocessor also helps assure optimum fuel use. In gas models, for example, both inlet and outlet temperatures are monitored. In this way, the cycle can be ended once the goods are dry, without burning more fuel than needed. Incoming fuel and fresh air can be modulated too, to reduce gas use. (See the microprocessor description for more information.)

MILNOR dryers avoid wasting heated air. They're well insulated. Their basket seals are long-lived. And because they don't unload by blowing out the goods (and the hot air with them), these dryers retain much of the heat for the next load.



This drawing shows basic airflow. With recirculation, the desired amount of hot air returns to the heat source instead of exiting at the top. It then flows through the goods in the same path as illustrated. ▶



## Here's why these dryers reduce cycle time

Five important features contribute to fast, uniform drying that results in four loads *per hour* of full-dry, linen supply terry in actual field installations.

**1. Heat comes from the bottom.** MILNOR takes advantage of the fact that heat rises, by placing the heating element beneath the goods.

**2. Basket has huge open area.** About 65% of the basket's perforated side sheet is open. That's over one-third more open area than a major competitive dryer. So hot air can flow through the basket more freely.

**3. Hot air is forced through the goods.** A unique air path* prevents heated air from escaping **around** the load. And to maintain proper air direction, MILNOR has designed-in longer seal life. A self-lubricating seal system includes a low-friction radial seal riding on a smooth part of the basket. The seal is not continuously scraped by the reverse side of basket peforations as with competitive designs. Thus, unlike these competitive designs, it won't fail early and allow hot-air bypass.

* Application has been made for worldwide patents

**4. Goods circulate freely, for fast, uniform drying.** There's a constant turnover of goods. Because the basket is tilted, gravity forces the goods toward the low end, while airflow returns them to the opposite end. The goods open up and float freely thanks to the large basket diameter. Continuous rotary motion effectively exposes all fabric surfaces to hot air.

**5. Goods unload instantly.** MILNOR's fixed tilt – toward the unload end – lets goods fall out by gravity ... in as little as 15-20 seconds. Compare that to dryers which have to blow the goods out or dump them by tilting mechanisms. A MILNOR dryer is ready for another load sooner.

## They improve work environment, safety

ƆR uses fuel to dry the goods. not heat undry Working conditions benefit from ective insulation and the fact that hot air is not blown out of the dryer in the unloading process

MILNOR's belt drive is considerably quieter than a chain drive system too Of course. automated loading/unloading eliminates heavy labor. compared to conventional dryers An automatic lint filter is available as an optional extra.

For safety, an automatic sprinkler is standard on all MILNOR gas and thermal oil-fired dryers (optional on others). It may also be manually actuated Once actuated. the spray will not shut off if machine goes off. Fixed mechanical temperature sensors. external to the microprocessor control. shut off the heat source if temperature exceeds a preset level.

## AUTOLINT™ system simplifies lint collection

MILNOR's AUTOLINT system (optional at extra cost) elimintates the need to manually clean the dryer's lint filter.

Following each drying cycle this system automatically strips the dryer's internal lint filter clean Lint is conveyed into a quickly detachable bag (which can hold more than a full day's run) at a remote enclosed collection point

Unlike many lint filters which operate continuously. MILNOR's lint screen in stripped only after the dry cycle thus preventing heat loss Nor does it interfere with the operation of the dr...er since the entire process – which takes ...econds – occurs while the dryer is ...ding/loading

## Microprocessor control means simplicity and accuracy

The solid state control's alphanumeric display provides helpful operating information

Programming in the field is simple By keyboard. plant management can select every parameter that affects each step in a formula. such as reversing/non-reversing. airflow blower speed. incoming temperature. stack temperature. formula time. etc Cooldown temperature, which can also be selected. can be different for each formula if desired (Cooldown is standard on all models.)

Precise temperature is necessary when drying delicate fabrics In gas and steam models. fast-acting probes and microprocessor technology allow MILNOR to accurately control inlet and outlet temperatures to within about one percent! (Compare that to dryers which offer only a high fire/low fire scheme ) MILNOR's gas valve is infinitely adjustable. controlled by the microprocessor to yield the exact gas flow rate required for the commanded temperatures – regardless of the condition of the goods. Combustion air is also modulated to maintain the proper gas/air mixture for efficient combustion.

The microprocessor also optimizes the airflow, regardless of the type of load (to maintain free circulation of the goods for fast. efficient, uniform drying).

Once programmed. MILNOR's microprocessor can interface with press and batch washer controls to form a completely automated system.

With MILNOR systems. the dryer can be interfaced with the exclusive MILTRAC/MILNET™ serial control system. This system minimizes installation wiring and simplifies trouble-shooting.

### SPECIFICATIONS

| | Model 58040 1 Batch | Model 58058 2 Batches |
|---|---|---|
| Maximum capacity – lbs. (kg.)* | 110 (50) | 220 (100) |
| Basket diameter – ins. (mm.) | 58 (1473) | 58 (1473) |
| Basket depth – ins (mm.) | 40 (1016) | 58 (1473) |
| Blower motor size – HP | 7.5 | 10 |
| Basket motor size – HP | 2 | 3 |
| Combustion air motor – HP | ½ | ½ |
| Approx overall width – ins (mm ) | 81 (2057) | 81 (2057) |
| Approx overall depth – ins (mm ) | 78 (1981) | 96 (2438) |
| Approx overall height – ins (mm )** | 129 (3277) | 146 (3708) |
| Approx net weight – lbs (kg ) | 4225 (1920) | 4987 (2267) |

*Depending on density of goods

**Does not include pedestal height

Specifications subject to change without notice

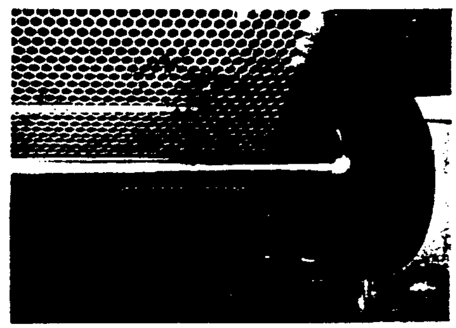
## These dryers are highly adaptable

MILNOR dryers can be positioned as close as one foot apart. They can be arranged in various ways with MILNOR conveyors to help fit the proper system to your laundry's size and shape.

These machines can be added to existing installations, too. They are sized for compatibility with several major batch washers They can also be used to modernize the drying section of plants that have large washer-extractors or conventional washers

## Typical MILNOR engineering adds up to dependability

Dryers manufactured by MILNOR feature the same high quality design. construction and materials found in other MILNOR laundry machinery and systems.



Steel parts that contact the wet load are of course stainless. The basket is made of heavier gauge stainless steel than is customary with many competitive machines (and this allows more open area). Steam coils are copper, so they won't rust. The timing belt drive doesn't need lubrication as competitive geared motor and chain drives do. and the belt doesn't slip as V-belts can The timing belt drive also helps insure precise basket rotation speed The cylinder runs on long-lasting. quiet rollers. As mentioned earlier. a special basket seal design prevents the need for frequent seal replacement. Easy access is provided for maintenance

## Ask about MILNOR's other automated laundry machinery

Please contact us for information about MILNOR CBW batch washers. extraction presses conveyors. and washer-extractors Our Laundry Engineering Department can design an integrated laundry system that will give you maximum productivity and energy efficiency

**Pellerin Milnor Corporation**
**P.O. Box 400**
**Kenner, Louisiana 70063**
**USA (suburban New Orleans)**

Printed in USA
Class 5.1
Brochure B22SL84023 8727?

ECO # 20B

DESCRIPTION: REPLACE EXISTING (400 LB) GAS DRYER.

SAVINGS POTENTIAL: NEW GAS DRYER (400LB CAP) USES APPROXIMATELY 1800 BTU TO REMOVE 1 POUND OF WATER. EXISTING DRYER USES APPROXIMATELY 2695 BTU TO REMOVE 1 POUND OF WATER.

A: SAVINGS BASED ON EXISTING USE.

| | |
|---|---|
| AVERAGE ANNUAL PROD. DRYER #14 (LBS): | 548000 |
| AVERAGE ANNUAL WATER REMOVAL #14 (LBS OF H20) | 356200 |
| EXISTING ENERGY USE (BTU PER LB H2O): | 2695 |
| EXISTING ANNUAL ENERGY USE PER DRYER (MBTU): | 959.959 |
| (PLANT EFFICIENCY NOT INCLUDED) | |
| NEW ENERGY USE (BTU PER LB H2O): | 1800 |
| NEW ANNUAL ENERGY USE PER DRYER (MBTU): | 641.16 |
| SAVINGS PER DRYER PER YEAR (MBTU) | 318.799 |
| SAVINGS AT $ 3.27 PER MBTU | 1042.47 |

B. NUMBER OF NEW DRYERS REQUIRED

| | |
|---|---|
| EXISTING ANNUAL PROD.OF GAS DRYER (LBS) | 548000 |
| NEW PRODUCTION RATE PER CYCLE (LBS) | 400 |
| CYCLE TIME 15 MINUTES | |
| NEW PRODUCTION RATE PER HOUR (LBS) | 1600 |
| HOURS REQUIRED PER YEAR | 342.5 |
| (USE ONE SYSTEM) | |

C. ELECTRICITY SAVINGS

EXISTING ELECT. USE (TAKEN FROM TABLE II-5)

| DRYER TYPE | # | ANNUAL KWH | TOTAL KWH |
|---|---|---|---|
| 14 | 1 | 16531.7 | 16531.7 |
| | | | 16531.7 |

| NEW ELECTRICITY USE | | HRS | KWH |
|---|---|---|---|
| BLOWER MTR (KW) | 3.73 | 342.5 | 1277.525 |
| BASKET MTR (KW) | 18.65 | 342.5 | 6387.625 |
| BURNER MTR (KW) | 1.49 | 342.5 | 510.325 |
| | | | 8175.475 |

| | |
|---|---|
| KWH SAVINGS | 8356.225 |
| MBTU SAVINGS | 28.51980 |
| $ SAVINGS @ 12.97 | 369.90 |

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO    REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007    REPLACE 400 LB GAS DRYER
FISCAL YEAR: 1989    ECO #,s 20B
ANALYSIS DATE:    ECON LIFE 25

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 51425 | |
| B. | SIOH | 2328 | |
| C. | DESIGN COST | 3086 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 51605 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 51605 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | 28.5 | 370 | 11.16 | 4125 | |
| B. | DIST | 4.34 | 0 | 0 | 17.19 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 17.12 | 0 | |
| D. | LPG | 3.27 | 318.8 | 1042 | 16.15 | 16828 | |
| E. | WOOD | 2.00 | 0 | 0 | 13.47 | 0 | |
| F. | TOTAL | | 347.3 | 1412 | | | 20953 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

| | | |
|---|---|---|
| A. | ANNUAL RECURRING | 0 |
| | (1) DISCOUNT FACTOR (TABLE A) * | 11.65 |
| | (2) DISCOUNTED SAVINGS/COST (3A X 3A1) | 0 |

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST    0

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33)    6914
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE))    1412

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C)    20953

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F)    .41

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

## COST ESTIMATE ANALYSIS

For use of this form, see TM 5 800-2; the proponent agency is USACE.

INVITATION/CONTRACTOR

EFFECTIVE PRICING DATE

DATE PREPARED 24 MAY 89

PROJECT INSTALL 400 lb GAS DRYER

CODE (Check one) ☐ A ☐ B ☐ C ☐ OTHER

DRAWING NO.

SHEET 1 OF 1 SHEETS

LOCATION FORT LEONARD WOOD

ESTIMATOR

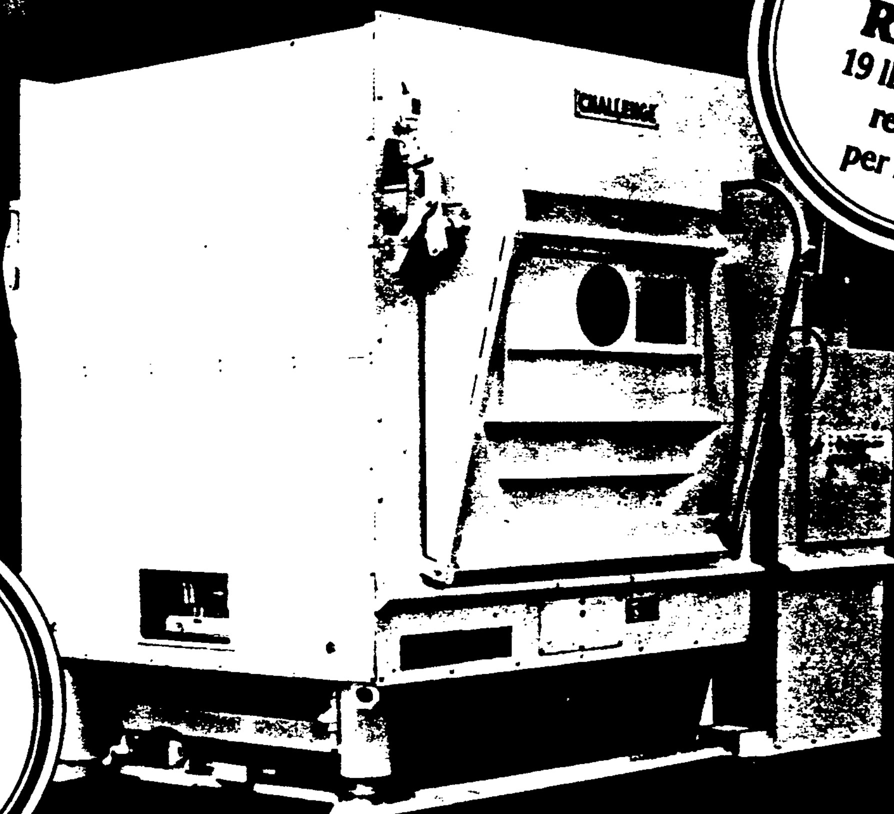
CHECKED BY

ECO # 20B

| TASK DESCRIPTION | QUANTITY | | LABOR | | | | EQUIPMENT | | MATERIAL | | TOTAL | SHIPPING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NO. OF UNITS | UNIT MEAS | MH UNIT | TOTAL HRS | UNIT PRICE | COST | UNIT PRICE | COST | UNIT PRICE | COST | | UNIT WT | TOTAL WT |
| 400 lb GAS DRYER | 1 | EA | | | | 4500- | | 46,800 | | | $51,300- | | |
| | | | | | | | | | | | | | |
| PIPING 1" STEEL | 15 | LF | | | 3.40 | 51- | | | 1.39 | 20.85 | 72- | | |
| | | | | | | | | | | | | | |
| DUCTWORK | 20 | LF | | | 1.26 | 25.20 | | | 1.39 | 27.80 | 53- | | |
| | | | | | | | | | | | $51,425- | | |
| TOTAL THIS SHEET | | | | | | | | | | | | | |

DA FORM 5418-R, Apr 85

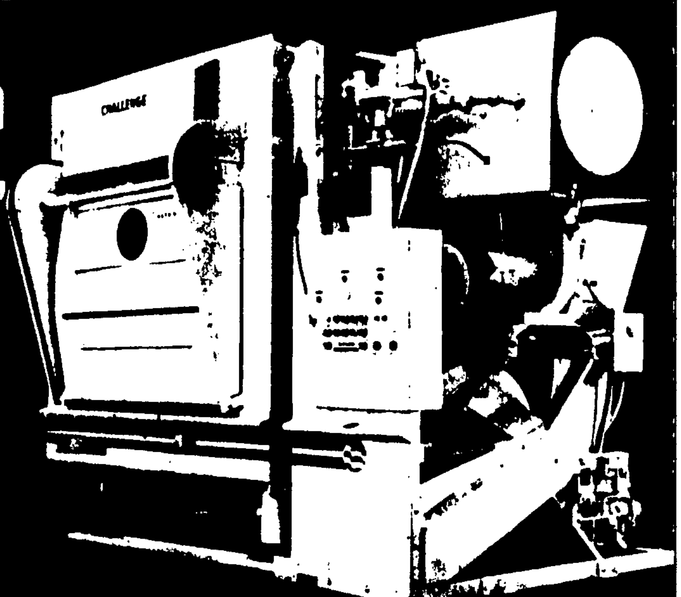
PRODUCTION RATING:
19 lbs. of water removed per minute



EFFICIENCY RATING:
1,800 BTUs per pound of water removed

# CHALLENGE PACESETTER™ TUMBLER-DRYERS

# How *PACESETTER*™ raises the standards in productivity, economy and reliability.



IV - 59

[illegible]

Here [illegible] overview of the adv[illegible] you'll enjoy with [illegible]:

- New [illegible] volume Axial Air Flow — for maximum efficiency
- New [illegible] Energy Saver heat recycler—standard equipment
- New [illegible] mode tilt action—improves work flow
- New [illegible] larger drying chamber — for optimum air flow
- New [illegible] diameter basket — improves efficiency
- [illegible] Geyseric burner — designed [illegible] for dryer [illegible]
- Low [illegible] height — for easy installation under low [illegible]
- New state of the art, plug-in type basket burner [illegible] system
- Teflon [illegible] seals standard — no basket wipers required
- Comb[illegible] highest production and highest efficiency

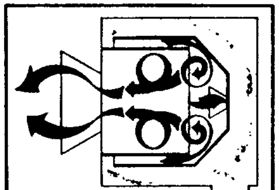
Reasonable purchase price, long and dependable life, and operating savings combine to reduce your total cost of ownership. Further, Pacesetter's high productivity can deliver very fast payback.

*Write [illegible] and we'll be glad to provide specifics.*

# Here's an energy saving story you won't read anywhere else.

Before Challenge turned its engineering talents to tumbler-dryer design, it took up to 4,000 BTUs to remove a pound of water. We quickly brought the figure to 2,000 BTUs, cutting fuel costs in half.

With Pacesetter, things get even better. Now, it can take less than 1,800 BTUs to remove that pound of water. The reasons? Our proven Geyseric burner, patented Axial Air Flow—now enhanced—plus an Energy-Saver that's built into every Pacesetter.



Geyseric Burner

## GEYSERIC BURNER

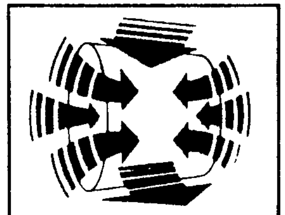
In this unique double-shell burner, air is precirculated in the outer shell before passing through louvers into the combustion chamber. Inside the chamber, turbulence is actually much greater than in any other type burner—assuring thorough fuel-air mixing for highest efficiency.

This technique also supplies more heat for the same amount of fuel and contributes to a more uniform distribution of heat.

## AXIAL AIR FLOW

Challenge's patented and exclusive Axial Air Flow system has been field proven worldwide for well over a decade. This was the first tumbler design to break the old 4,000 BTU fuel cost barrier. Well, it took a long time to improve on axial air flow, but our engineers have finally done it!

To dry faster and with less fuel, Axial Air



Axial Air Flow

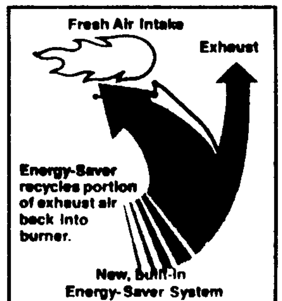
Flow directs heated air into the center of the load through the wide open ends of the Challenge basket. Generous and uniform air flow minimizes heat loss and does a far better drying job.

## BUILT-IN ENERGY-SAVER DELIVERS DUAL PERFORMANCE

Like a high performance vehicle, the Pacesetter can be controlled to deliver maximum speed or maximum fuel efficiency, by merely flicking a switch. It is up to the owner to set his/her production and efficiency priorities. The Pacesetter's built-in Energy-Saver will deliver maximum speed or maximum efficiency, whichever is called for.

### Here's How It Works

A simple toggle switch on the Pacesetter control panel activates a large damper between the blower and the exhaust outlet. In this heat recycling mode, the Energy-Saver damper separates the exhaust air flow, sending up to 70% of the hot air into the secondary combustion zone of the Geyseric burner, and the balance up the stack. The specially designed exhaust duct is incurvated to throw the lint to the exhaust side by centrifugal force so that it goes straight up the stack.




The damper and duct divide the exhaust air to maximize heat recycling without creating positive pressure inside the dryer. The effect of the recycled heat is that the tumbler maintains its set temperatures with less fuel consumption and dries or conditions each batch at the least possible cost. In the recycling mode, drying times are only slightly longer than in the open loop mode. In the open mode all the air is exhausted. No heat is recycled, but drying speed is maximized.

The Pacesetter gives its owner full control of the speed vs. efficiency equation. The owner may choose top production rates in the open loop mode, or he may choose minimum cost of operation with the recycling mode. Over the long service life of the Pacesetter the owner may have occasion for management decisions to respond to production requirements or to react to escalating fuel costs. With Challenge you have a choice. And there is no additional cost, and nothing to buy later. The Pacesetter Energy-Saver gives you everything you need for today and tomorrow.

## YOU CAN COUNT ON PACESETTER FOR PERFORMANCE AND EFFICIENCY

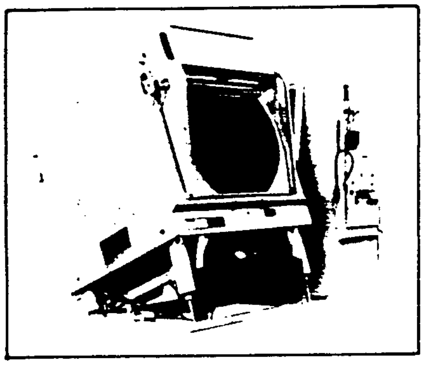
When high production is your priority, you will want to operate the Pacesetter in the open loop mode, and you can count on a water removal rate of at least 19 lbs. per minute. In the open loop mode fuel consumption will be only 2,050 BTUs per pound of water removed.

To maximize fuel efficiency, just activate the built-in Energy-Saver with the flick of a switch. Immediately your fuel efficiency factor improves to 1,800 BTUs per pound of water removed. Your production rate falls by less than 2% while your efficiency improves by more than 13%. You can achieve major fuel cost reductions with only negligible production rate decrease. With Pacesetter the choice is always yours.

## A WORD ABOUT RATINGS

The Pacesetter ratings are not theoretical. They are based on in-plant performance under actual job conditions. Under like conditions you will be able to achieve like performance and efficiency. Specifically, these ratings are based on 400-lb. (dry weight) loads of terry cloth extracted to 60-65% moisture retention, full dried, using natural gas with a heating value of 1,000 BTUs per cu. ft.

# Just a sampling of PACESETTER advantages...

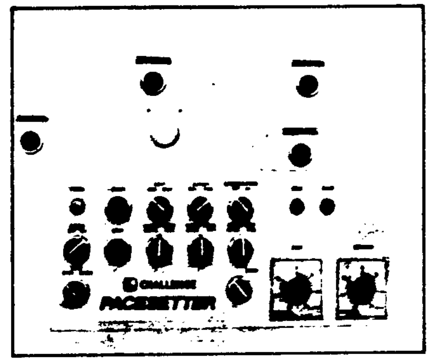


## Wide, Easy-Access Loading Doors

Pacesetter's large loading and unloading doors simplify handling and readily accommodate sling, conveyor and cake loading. Special wide design quickly accepts the largest loads. Two-hand controls assure maximum operator safety, and guide rails prevent doors from swinging when opening or closing.

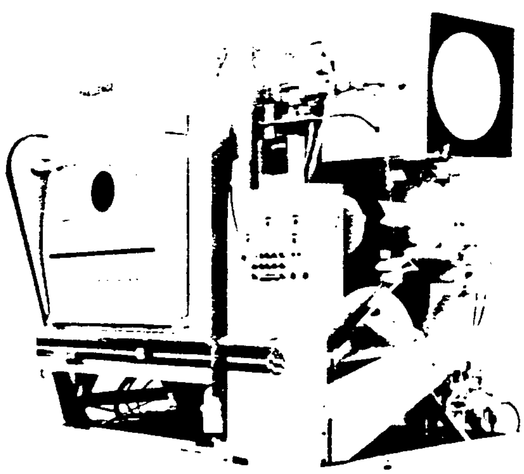
## Efficient Basket Design

For better load distribution and more heat penetration through the load, Pacesetter baskets are shorter in relationship to diameter than others. With this thoroughly engineered design, Challenge's exclusive Axial Air Flow becomes even more efficient. This uniform drying speeds handling and means more loads per hour.



## Straightforward Automatic Controls

Controls are positioned for easy use and can be set for manual, or optional semi-automatic or automatic discharge. Door and tilt controls are available either front or rear. Warning devices and safety interlocks are standard.



## Low Maintenance Throughout

Pacesetter is designed with fast, simple maintenance in mind. All components are easily accessible for inspection and servicing—nothing's hidden under sheet metal. Single frame construction leaves the space under the machine open, and there are no obstructive aprons. The side-mounted burner is particularly easy to access.


**CHALLENGE INDUSTRIES**
720 East Perry Street
P. O. Box 547
Bryan, Ohio 43506
Telephone (419) 636-3111
FAX (419) 636-5948

ECO # 21

DESCRIPTION: INSTALL AIR CURTAIN AT LOADING DOCK AREA.

SAVINGS POTENTIAL: AN AIR CURTAIN CONSISTING OF CLEAR VINYL STRIPS WILL REDUCE THE AMOUNT OF OUTSIDE AIR INFILTRATING INTO THE BUILDING. REDUCTION OF AIR INFILTRATION WILL REDUCE THE BUILDINGS HEATING LOAD.

A: ESTIMATED SAVINGS

THE FOLLOWING SPREAD SHEETS USE THE BIN METHOD TO ESTIMATE EXISTING AIR INFILTRATION AND HEAT LOAD DUE TO INFILTRATION AS WELL AS INFILTRATION AND HEAT LOAD WITH AN AIR CURTAINS INSTALLED.

| | | |
|---|---|---|
| EXISTING HEAT LOAD DUE TO INFILTRATION = | 416 | MBTU |
| HEAT LOAD WITH AIR CURTAIN = | 23 | MBTU |
| SAVINGS MBTU = | 393 | MBTU |
| $ SAVINGS AT 3.27 PER MBTU | 1286.01 | |

INFILTRATION LOSSES THRU OVERHEAD DOOR
(WITH AIR CURTAIN INSTALLED)

| -A- | -B- | -C- | -D- | -E- | -F- | -G- | -H- | -I- | -J- | -K- | -L- | -M- | -N- | -O- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 102 | 44 | .005 | .22 | 120 | 50 | 500 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 |
| 97 | 44 | .005 | .22 | 120 | 50 | 500 | 0 | 0 | 0 | 22 | 18 | 0 | 0 | 0 |
| 92 | 44 | .005 | .22 | 120 | 50 | 500 | 0 | 0 | 0 | 94 | 75 | 0 | 0 | 0 |
| 87 | 44 | .005 | .22 | 120 | 50 | 500 | 0 | 0 | 0 | 262 | 197 | 0 | 0 | 0 |
| 82 | 44 | .005 | .22 | 120 | 50 | 500 | 0 | 0 | 0 | 474 | 306 | 0 | 0 | 0 |
| 77 | 44 | .005 | .22 | 120 | 50 | 500 | 0 | 0 | 0 | 676 | 307 | 0 | 0 | 0 |
| 72 | 44 | .005 | .22 | 120 | 50 | 500 | 0 | 0 | 0 | 902 | 280 | 0 | 0 | 0 |
| 67 | 44 | .005 | .22 | 120 | 50 | 500 | 5 | 1.188 | 2700 | 900 | 247 | 1069.2 | 666900 | 667969.2 |
| 62 | 44 | .005 | .22 | 120 | 50 | 500 | 10 | 2.376 | 5400 | 794 | 212 | 1886.544 | 1144800 | 1146686.544 |
| 57 | 44 | .005 | .22 | 120 | 50 | 500 | 15 | 3.564 | 8100 | 706 | 195 | 2516.184 | 1579500 | 1582016.184 |
| 52 | 44 | .005 | .22 | 120 | 50 | 500 | 20 | 4.752 | 10800 | 642 | 186 | 3050.784 | 2008800 | 2011850.784 |
| 47 | 44 | .005 | .22 | 120 | 50 | 500 | 25 | 5.94 | 13500 | 557 | 165 | 3308.58 | 2227500 | 2230808.58 |
| 42 | 44 | .005 | .22 | 120 | 50 | 500 | 30 | 7.128 | 16200 | 593 | 172 | 4226.904 | 2786400 | 2790626.904 |
| 37 | 44 | .005 | .22 | 120 | 50 | 500 | 35 | 8.316 | 18900 | 565 | 156 | 4698.54 | 2948400 | 2953098.54 |
| 32 | 44 | .005 | .22 | 120 | 50 | 500 | 40 | 9.504 | 21600 | 583 | 161 | 5540.832 | 3477600 | 3483140.832 |
| 27 | 44 | .005 | .22 | 120 | 50 | 500 | 45 | 10.692 | 24300 | 396 | 105 | 4234.032 | 2551500 | 2555734.032 |
| 22 | 44 | .005 | .22 | 120 | 50 | 500 | 50 | 11.88 | 27000 | 286 | 72 | 3397.68 | 1944000 | 1947397.68 |
| 17 | 44 | .005 | .22 | 120 | 50 | 500 | 55 | 13.068 | 29700 | 156 | 33 | 2038.608 | 980100 | 982138.608 |
| 12 | 44 | .005 | .22 | 120 | 50 | 500 | 60 | 14.256 | 32400 | 78 | 16 | 1111.968 | 518400 | 519511.968 |
| 7 | 44 | .005 | .22 | 120 | 50 | 500 | 65 | 15.444 | 35100 | 40 | 7 | 617.76 | 245700 | 246317.76 |
| 2 | 44 | .005 | .22 | 120 | 50 | 500 | 70 | 16.632 | 37800 | 18 | 3 | 299.376 | 113400 | 113699.376 |
| -3 | 44 | .005 | .22 | 120 | 50 | 500 | 75 | 17.82 | 40500 | 7 | 1 | 124.74 | 40500 | 40624.74 |
| -8 | 44 | .005 | .22 | 120 | 50 | 500 | 80 | 19.008 | 43200 | 2 | 0 | 38.016 | 0 | 38.016 |
| | | | | | | | | | | | | 38159.748 | 23233500 | 23271659.75 |

ENERGY USE (MBTU) = 23.27165975

-A- OUTSIDE TEMP
-B- CRACK LENGTH (FT)
-C- INFILTRATION PER FT OF CRACK (CFM)
-D- TOTAL INFILTRATION THRU CRACK
-E- DOOR AREA (SF)
-F- VELOCTIY THRU OPEN DOOR (FPM)
-G- INFILTRATION THRU OPEN DOOR (CFM) BASED ON OPEN 5 MIN/HR
-H- TEMPERATURE DIFFERENCE BETWEEN OUTSIDE & INSIDE
-I- HEAT LOSS THRU CRACK INFILTRATION (BTUH)
-J- HEAT LOSS THRU OPEN DOOR (BTUH)
-K- HOURS AT OUTSIDE TEMP. -A- FOR LOSSES THRU CRACK
-L- HOURS AT OUTSIDE TEMP. -A- FOR LOSSES THRU OPEN DOOR
-M- TOTAL HEAT LOSS THRU CRACK (BTU)
-N- TOTAL HEAT LOSS THRU OPEN DOOR (BTU)
-O- TOTAL HEAT LOSS THRU OPEN DOOR & CRACK (BTU)

INFILTRATION LOSSES THRU OVERHEAD DOOR

| -A- | -B- | -C- | -D- | -E- | -F- | -G- | -H- | -I- | -J- | -K- | -L- | -M- | -N- | -O- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 102 | 44 | .02 | .88 | 120 | 895 | 8950 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 |
| 97 | 44 | .02 | .88 | 120 | 895 | 8950 | 0 | 0 | 0 | 22 | 18 | 0 | 0 | 0 |
| 92 | 44 | .02 | .88 | 120 | 895 | 8950 | 0 | 0 | 0 | 94 | 75 | 0 | 0 | 0 |
| 87 | 44 | .02 | .88 | 120 | 895 | 8950 | 0 | 0 | 0 | 262 | 197 | 0 | 0 | 0 |
| 82 | 44 | .02 | .88 | 120 | 895 | 8950 | 0 | 0 | 0 | 474 | 306 | 0 | 0 | 0 |
| 77 | 44 | .02 | .88 | 120 | 895 | 8950 | 0 | 0 | 0 | 676 | 307 | 0 | 0 | 0 |
| 72 | 44 | .02 | .88 | 120 | 895 | 8950 | 0 | 0 | 0 | 902 | 280 | 0 | 0 | 0 |
| 67 | 44 | .02 | .88 | 120 | 895 | 8950 | 5 | 4.752 | 48330 | 900 | 247 | 4276.8 | 11937510 | 11941786.8 |
| 62 | 44 | .02 | .88 | 120 | 895 | 8950 | 10 | 9.504 | 96660 | 794 | 212 | 7546.176 | 20491920 | 20499466.18 |
| 57 | 44 | .02 | .88 | 120 | 895 | 8950 | 15 | 14.256 | 144990 | 706 | 195 | 10064.736 | 28273050 | 28283114.74 |
| 52 | 44 | .02 | .88 | 120 | 895 | 8950 | 20 | 19.008 | 193320 | 642 | 186 | 12203.136 | 35957520 | 35969723.14 |
| 47 | 44 | .02 | .88 | 120 | 895 | 8950 | 25 | 23.76 | 241650 | 557 | 165 | 13234.32 | 39872250 | 39885484.32 |
| 42 | 44 | .02 | .88 | 120 | 895 | 8950 | 30 | 28.512 | 289980 | 593 | 172 | 16907.616 | 49876560 | 49893467.62 |
| 37 | 44 | .02 | .88 | 120 | 895 | 8950 | 35 | 33.264 | 338310 | 565 | 156 | 18794.16 | 52776360 | 52795154.16 |
| 32 | 44 | .02 | .88 | 120 | 895 | 8950 | 40 | 38.016 | 386640 | 583 | 161 | 22163.328 | 62249040 | 62271203.33 |
| 27 | 44 | .02 | .88 | 120 | 895 | 8950 | 45 | 42.768 | 434970 | 396 | 105 | 16936.128 | 45671850 | 45688786.13 |
| 22 | 44 | .02 | .88 | 120 | 895 | 8950 | 50 | 47.52 | 483300 | 286 | 72 | 13590.72 | 34797600 | 34811190.72 |
| 17 | 44 | .02 | .88 | 120 | 895 | 8950 | 55 | 52.272 | 531630 | 156 | 33 | 8154.432 | 17543790 | 17551944.43 |
| 12 | 44 | .02 | .88 | 120 | 895 | 8950 | 60 | 57.024 | 579960 | 78 | 16 | 4447.872 | 9279360 | 9283807.872 |
| 7 | 44 | .02 | .88 | 120 | 895 | 8950 | 65 | 61.776 | 628290 | 40 | 7 | 2471.04 | 4398030 | 4400501.04 |
| 2 | 44 | .02 | .88 | 120 | 895 | 8950 | 70 | 66.528 | 676620 | 18 | 3 | 1197.504 | 2029860 | 2031057.504 |
| -3 | 44 | .02 | .88 | 120 | 895 | 8950 | 75 | 71.28 | 724950 | 7 | 1 | 498.96 | 724950 | 725448.96 |
| -8 | 44 | .02 | .88 | 120 | 895 | 8950 | 80 | 76.032 | 773280 | 2 | 0 | 152.064 | 0 | 152.064 |
| | | | | | | | | | | | | 152638.992 | 415879650 | 416032289.0 |

ENERGY USE (MBTU) = 416.0322890

-A- OUTSIDE TEMP
-B- CRACK LENGTH (FT)
-C- INFILTRATION PER FT OF CRACK (CFM)
-D- TOTAL INFILTRATION THRU CRACK
-E- DOOR AREA (SF)
-F- VELOCTIY THRU OPEN DOOR (FPM)
-G- INFILTRATION THRU OPEN DOOR (CFM) BASED ON OPEN 5 MIN/HR
-H- TEMPERATURE DIFFERENCE BETWEEN OUTSIDE & INSIDE
-I- HEAT LOSS THRU CRACK INFILTRATION (BTUH)
-J- HEAT LOSS THRU OPEN DOOR (BTUH)
-K- HOURS AT OUTSIDE TEMP. -A- FOR LOSSES THRU CRACK
-L- HOURS AT OUTSIDE TEMP. -A- FOR LOSSES THRU OPEN DOOR
-M- TOTAL HEAT LOSS THRU CRACK (BTU)
-N- TOTAL HEAT LOSS THRU OPEN DOOR (BTU)
-O- TOTAL HEAT LOSS THRU OPEN DOOR & CRACK (BTU)

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007 INSTALL PVC CLOSURE STRIPS
FISCAL YEAR: 1989 ECO #,s 21
ANALYSIS DATE: ECON LIFE 8

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 795 | |
| B. | SIOH | 40 | |
| C. | DESIGN COST | 48 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 794 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 794 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | 0 | 0 | 5.74 | 0 | |
| B. | DIST | 4.34 | 0 | 0 | 7.18 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 6.79 | 0 | |
| D. | LPG | 3.27 | 393 | 1285 | 6.75 | 8674 | |
| E. | WOOD | 2.00 | 0 | 0 | 6.41 | 0 | |
| F. | TOTAL | | 393 | 1285 | | | 8674 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

| | | |
|---|---|---|
| A. | ANNUAL RECURRING | 0 |
| | (1) DISCOUNT FACTOR (TABLE A) * | 5.97 |
| | (2) DISCOUNTED SAVINGS/COST (3A X 3A1) | 0 |

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST 0

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33) 2863
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE)) 1285

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C) 8674

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F) 10.92

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

## COST ESTIMATE ANALYSIS

For use of this form, see TM 5-800-2; the proponent agency is USACE.

| | | | |
|---|---|---|---|
| PROJECT: INSTALL PVC STRIP CLOSURES | INVITATION/CONTRACTOR | EFFECTIVE PRICING DATE | DATE PREPARED: 24 MAY 89 |
| | CODE (Check one) ☐ A ☐ B ☐ C | DRAWING NO. | SHEET 1 OF 1 SHEETS |
| LOCATION: FORT LEONARD WOOD | ☐ OTHER | ESTIMATOR | CHECKED BY |

ECO # 21

| TASK DESCRIPTION | QUANTITY | | LABOR | | | | EQUIPMENT | | MATERIAL | | TOTAL | SHIPPING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NO. OF UNITS | UNIT MEAS | MH UNIT | TOTAL HRS | UNIT PRICE | COST | UNIT PRICE | COST | UNIT PRICE | COST | | UNIT WT | TOTAL WT |
| PVC STRIPS | 2 | EA | 8 | 16 | 40 | 640 – | 77 | 154 – | 77 | 155 – | $795 – | | |
| 12' WIDE x 12' LONG | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
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| TOTAL THIS SHEET | | | | | | | | | | | | | |

DA FORM 5418-R, Apr 85

ECO # 23

| | |
|---|---|
| DESCRIPTION: | RECYCLE RINSE WATER |
| SAVINGS POTENTIAL: | WATER DISCHARGED AFTER A RINSE CYCLE CAN BE RE-USED IN A FOLLOWING WASH CYCLE. RE-USE OF RINSE WATER REDUCES THE HOT WATER HEATING LOAD AND OVERALL WATER CONSUMPTION. |

A: ESTIMATED SAVINGS

SAVINGS ESTIMATES ARE BASED UPON THE FOLLOWING CONDITIONS:

| | | |
|---|---|---|
| AVERAGE TEMP. OF DISCHARGE RINSE WATER = | 145 | DEG F |
| AVERAGE TEMPERATURE OF SUPPLY HOT WATER = | 160 | DEG F |
| AVERAGE TEMPERATURE OF SUPPLY COLD WATER = | 60 | DEG F |
| RINSE WATER AS % OF TOTAL WATER USE = | .4 | 40% |

ENERGY SAVINGS THRU RINSE WATER RECYCLE

$$\text{MBTU} = \frac{\text{GAL OF RINSE WATER X 8.33 X DELTA T}}{1,000,000}$$

| | | | |
|---|---|---|---|
| GALLONS HOT WATER = | 6565600 | * .4 = | 2626240 |
| DELTA T = | 85 | | |
| MBTU = | 1859.509 | NOT ACCOUNTING FOR PLANT EFFICIENCY | |
| MBTU = | 2479.346 | USING 75% PLANT EFF. | |
| $ SAVINGS = | 8112.03 | | |

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007 RECYCLE RINSE WATER
FISCAL YEAR: 1989 ECO #,s 23
ANALYSIS DATE: ECON LIFE 25

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 32590 | |
| B. | SIOH | 1792 | |
| C. | DESIGN COST | 1955 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 32704 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 32704 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | 0 | 0 | 11.16 | 0 | |
| B. | DIST | 4.34 | 0 | 0 | 17.19 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 17.12 | 0 | |
| D. | LPG | 3.27 | 2479 | 8106 | 16.15 | 130917 | |
| E. | WOOD | 2.00 | 0 | 0 | 13.47 | 0 | |
| F. | TOTAL | | 2479 | 8106 | | | 130917 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

A. ANNUAL RECURRING -500
(1) DISCOUNT FACTOR (TABLE A) * 11.65
(2) DISCOUNTED SAVINGS/COST (3A X 3A1) -5825

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST -5825

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33) 43203
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE)) 7606

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C) 125092

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F) 3.82

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

## COST ESTIMATE ANALYSIS

For use of this form, see TM 5 800-2; the proponent agency is USACE.

INVITATION/CONTRACTOR

EFFECTIVE PRICING DATE

DATE PREPARED 24 MAY 89

PROJECT RECYCLE RINSE WATER

CODE (Check one) ☐ A ☐ B ☐ C ☐ OTHER

DRAWING NO.

SHEET 1 OF 1 SHEETS

LOCATION FORT LEONARD WOOD

ESTIMATOR

CHECKED BY

ECO #23

| TASK DESCRIPTION | QUANTITY: NO. OF UNITS | QUANTITY: UNIT MEAS | LABOR: MH UNIT | LABOR: TOTAL HRS | LABOR: UNIT PRICE | LABOR: COST | EQUIPMENT: UNIT PRICE | EQUIPMENT: COST | MATERIAL: UNIT PRICE | MATERIAL: COST | TOTAL | SHIPPING: UNIT WT | SHIPPING: TOTAL WT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SPLIT DISCHARGE VALVE | 8 | EA | | | 150- | 1200- | | | $1000 | $8000- | $9200- | | |
| | | | | | | | | | | | | | |
| PIPING 6" | 50 | LF | | | 16.30 | 815- | | | 24.04 | 1202- | 2017- | | |
| 2" | 200 | LF | | | 5.05 | 1010- | | | 2.76 | 552- | 1562- | | |
| PUMP | 2 | EA | | | 45- | 90- | | | 420- | 840- | 930- | | |
| | | | | | | | | | | | | | |
| SUMP | 1 | EA | | | | 2200- | | | | 3500- | 5700- | | |
| | | | | | | | | | | | | | |
| STORAGE TANK | 1 | EA | | | 81- | 81- | | | | 4100- | 4181- | | |
| | | | | | | | | | | | | | |
| CONTROLS | | | | | | 2500- | | | | 6500- | 9000- | | |
| | | | | | | | | | | | 32,590 | | |
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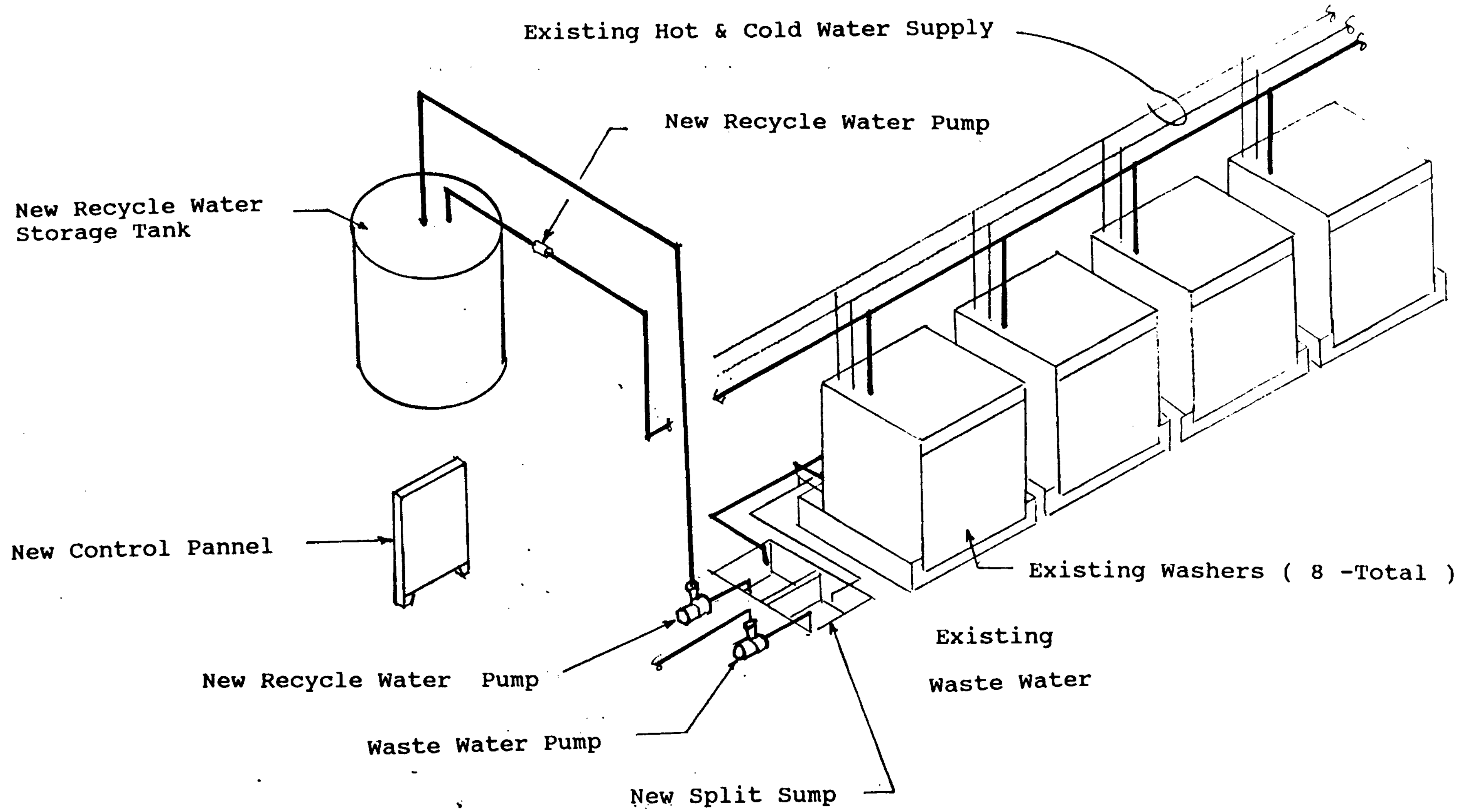
| TOTAL THIS SHEET | | | | | | | | | | | | | |

DA FORM 5418-R, Apr 85

RECYCLE RINSE WATER



ECO # 24

DESCRIPTION: INSTALL EXHAUST HEAT RECOVERY UNITS ON 100 LB DRYERS.

SAVINGS POTENTIAL: EXHAUST ON 100 LB DRYERS LEAVES THE EQUIPMENT AT 150 DEGREES FAHRENHEIT. THE DRYER EXHAUST IS DRAWN THROUGH LINT FILTERS BY CENTRAL FANS. WHEN EXHAUST AIR IS REJECTED TO THE OUTSIDE IT IS APPROXIMATELY 120 DEGREES FAHRENHEIT. TOTAL AMOUNT OF EXHAUST AIR IS 72,000 CFM. ENERGY CAN BE RECOVERED FROM THE DRYER EXHAUST TO PREHEAT MAKE-UP AIR.

A: ESTIMATED SAVINGS

THE FOLLOWING SPREAD SHEET USES THE BIN METHOD & PRODUCT LITERATURE TO ESTIMATE SAVINGS FROM AIR TO AIR HEAT EXCHANGERS.

TOTAL ANNUAL ENERGY SAVINGS (NOT ACCOUNTING FOR PLANT EFF) = 5757.96

TOTAL ANNUAL ENERGY SAVINGS WITH 75% PLANT EFFICIENCY = 7677.28

$ SAVINGS AT $ 3.27 PER MBTU = $ 25,105

ELECTRICITY COSTS

ADDITIONAL FANS WILL BE REQUIRED TO FORCE MAKE-UP AIR INTO BUILDING. APROXIMATELY THE SAME AMOUNT OF ENERGY WILL BE REQUIRED TO MAKE-UP AIR AS IS NOW USED FOR EXHAUSTING AIR AT THE LINT TRAP.

| | | |
|---|---|---|
| ADDITIONAL ELECTRICAL USE | = | 22380 KWH x 2 |
| | = | 44760 KWH |
| ADDITIONAL ENERGY USE (MBTU) | = | 152.7659 |
| ADDITIONAL $ COST AT 12.97 /MBTU | = | 1984.41 |

HEATING
EXHAUST HEAT RECOVERY
100 LB DRYERS

| EXHAUST ACFM | INTAKE ACFM | T1 | T3 | T4 | CF1 | CF2 | K | EXHAUST SCFM | INTAKE SCFM | T3-T1 | T3-T4 | BTUH SAVED | # HRS | MBTU SAVED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 72000 | 72000 | 102 | 120 | 107.53 | .89831 | .94 | 1.0498 | 64678 | 67900 | 18 | 12.47 | 871057 | 1 | 0.87 |
| 72000 | 72000 | 97 | 120 | 104.06 | .89831 | .95 | 1.0592 | 64678 | 68510 | 23 | 15.94 | 1113445 | 12 | 13.36 |
| 72000 | 72000 | 92 | 120 | 100.60 | .89831 | .96 | 1.0688 | 64678 | 69130 | 28 | 19.40 | 1355133 | 51 | 69.11 |
| 72000 | 72000 | 87 | 120 | 97.13 | .89831 | .97 | 1.0786 | 64678 | 69762 | 33 | 22.87 | 1597520 | 135 | 215.67 |
| 72000 | 72000 | 82 | 120 | 93.67 | .89831 | .98 | 1.0886 | 64678 | 70406 | 38 | 26.33 | 1839209 | 210 | 386.23 |
| 72000 | 72000 | 77 | 120 | 90.20 | .89831 | .99 | 1.0987 | 64678 | 71061 | 43 | 29.80 | 2081597 | 211 | 439.22 |
| 72000 | 72000 | 72 | 120 | 86.74 | .89831 | 1.00 | 1.1090 | 64678 | 71729 | 48 | 33.26 | 2323286 | 192 | 446.07 |
| 72000 | 72000 | 67 | 120 | 83.27 | .89831 | 1.01 | 1.1195 | 64678 | 72410 | 53 | 36.73 | 2565673 | 169 | 433.60 |
| 72000 | 72000 | 62 | 120 | 79.81 | .89831 | 1.02 | 1.1303 | 64678 | 73103 | 58 | 40.19 | 2807362 | 145 | 407.07 |
| 72000 | 72000 | 57 | 120 | 76.34 | .89831 | 1.03 | 1.1412 | 64678 | 73810 | 63 | 43.66 | 3049749 | 134 | 408.67 |
| 72000 | 72000 | 52 | 120 | 72.88 | .89831 | 1.04 | 1.1523 | 64678 | 74531 | 68 | 47.12 | 3291438 | 128 | 421.30 |
| 72000 | 72000 | 47 | 120 | 69.41 | .89831 | 1.05 | 1.1637 | 64678 | 75266 | 73 | 50.59 | 3533825 | 113 | 399.32 |
| 72000 | 72000 | 42 | 120 | 65.95 | .89831 | 1.06 | 1.1753 | 64678 | 76016 | 78 | 54.05 | 3775514 | 118 | 445.51 |
| 72000 | 72000 | 37 | 120 | 62.48 | .89831 | 1.07 | 1.1871 | 64678 | 76781 | 83 | 57.52 | 4017901 | 107 | 429.92 |
| 72000 | 72000 | 32 | 120 | 59.02 | .89831 | 1.08 | 1.1992 | 64678 | 77561 | 88 | 60.98 | 4259590 | 110 | 468.55 |
| 72000 | 72000 | 27 | 120 | 55.55 | .89831 | 1.09 | 1.2115 | 64678 | 78357 | 93 | 64.45 | 4501977 | 72 | 324.14 |
| 72000 | 72000 | 22 | 120 | 52.09 | .89831 | 1.10 | 1.2241 | 64678 | 79170 | 98 | 67.91 | 4743666 | 49 | 232.44 |
| 72000 | 72000 | 17 | 120 | 48.62 | .89831 | 1.11 | 1.2369 | 64678 | 80000 | 103 | 71.38 | 4986053 | 23 | 114.68 |
| 72000 | 72000 | 12 | 120 | 45.16 | .89831 | 1.12 | 1.25 | 64678 | 80847 | 108 | 74.84 | 5227742 | 11 | 57.51 |
| 72000 | 72000 | 7 | 120 | 41.69 | .89831 | 1.13 | 1.2634 | 64678 | 81713 | 113 | 78.31 | 5470129 | 5 | 27.35 |
| 72000 | 72000 | 2 | 120 | 38.23 | .89831 | 1.15 | 1.2771 | 64678 | 82597 | 118 | 81.77 | 5711818 | 2 | 11.42 |
| 72000 | 72000 | -3 | 120 | 34.76 | .89831 | 1.16 | 1.2910 | 64678 | 83501 | 123 | 85.24 | 5954205 | 1 | 5.95 |
| | | | | | | | | | | | | | | -------- |
| | | | | | | | SAVINGS NOT ACCOUNTING FOR PLANT EFFICIENCY = | | | | | | | 5757.96 |

EXHAUST ACFM = ACTUAL AMOUNT OF AIR BEING EXHAUSTED
INTAKE SCFM = ACTUAL AMOUNT OF MAKE-UP REQUIRED
EXHAUST SCFM = CORRECTED AMOUNT OF EXHAUST AIR = EXHAUST ACFM * CF1
INTAKE SCFM = CORRECTED AMOUNT OF INTAKE AIR = INTAKE ACFM * CF2
# HRS = TOTAL OPERATING HOURS AT GIVEN OUTSIDE TEMPERATURE T1
BTUH SAVED PER DRYER = (1.08)(SCFM EXHAUST)(T3-T4)
MBTU SAVED PER DRYER = (BTUH SAVED PER DRYER)(#HRS OPERATION)/1,000,000
T1 = OUTDOOR AIR (MAKEUP AIR) TEMPERATURE ENTERING HEAT RECOVER UNIT
T2 = MAKEUP AIR TEMPERATURE LEAVING HEAT RECOVERY UNIT
T3 = EXHAUST AIR TEMPERATURE ENTERING HEAT RECOVERY UNIT
T4 = EXHAUST AIR TEMPERATURE LEAVING HEAT RECOVERY UNIT
T4 EQUALS T3 (EFFICIENCY)(ECF)(T3-T1)
EFFICIENCY = 70%; ECF = 0.99
K = FLOW RATIO = (SCFM INTAKE/SCFM EXHAUST)
CF1= CORRECTION FACTOR TO CONVERT AIR FLOW AT EXHAUST TEMPERATURE TO STANDARD AIR TEMPERATURE (SCFM) = $\frac{(70^\circ + 460^\circ)}{(T3 + 460^\circ)}$
CF2= CORRECTION FACTOR TO CONVERT AIR FLOW AT INTAKE TEMPERATURE TO STANDARD AIR TEMPERATURE (SCFM) = $\frac{(70^\circ + 460^\circ)}{(T1 + 460^\circ)}$

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007 EXHAUST HR 100LB DRYERS
FISCAL YEAR: 1989 ECO #,s 24
ANALYSIS DATE: ECON LIFE 25

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 377800 | |
| B. | SIOH | 20779 | |
| C. | DESIGN COST | 22668 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 379122 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 379122 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | -153 | -1984 | 11.16 | -22146 | |
| B. | DIST | 4.34 | 0 | 0 | 17.19 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 17.12 | 0 | |
| D. | LPG | 3.27 | 7677 | 25104 | 16.15 | 405430 | |
| E. | WOOD | 2.00 | 0 | 0 | 13.47 | 0 | |
| F. | TOTAL | | 7524 | 23120 | | | 383284 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

| | | |
|---|---|---|
| A. | ANNUAL RECURRING | -500 |
| | (1) DISCOUNT FACTOR (TABLE A) * | 11.65 |
| | (2) DISCOUNTED SAVINGS/COST (3A X 3A1) | -5825 |

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST -5825

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33) 126484
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A=(BLD/YEARS LIFE)) 22620

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C) 377459

6. DISCOUNTED SAVINGS RATION (SIR = 5/1F) 1.00

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

## COST ESTIMATE ANALYSIS

For use of this form, see TM 5-800-2; the proponent agency is USACE.

INVITATION/CONTRACTOR

EFFECTIVE PRICING DATE

DATE PREPARED: 26 MAY 89

PROJECT: EXHAUST HEAT RECOVERY - 100 16 DRYERS

CODE (Check one): ☐ A ☐ B ☐ C ☐ OTHER

DRAWING NO.

SHEET 1 OF 1 SHEETS

LOCATION: FORT LEONARD WOOD

ESTIMATOR

CHECKED BY

ECO #24

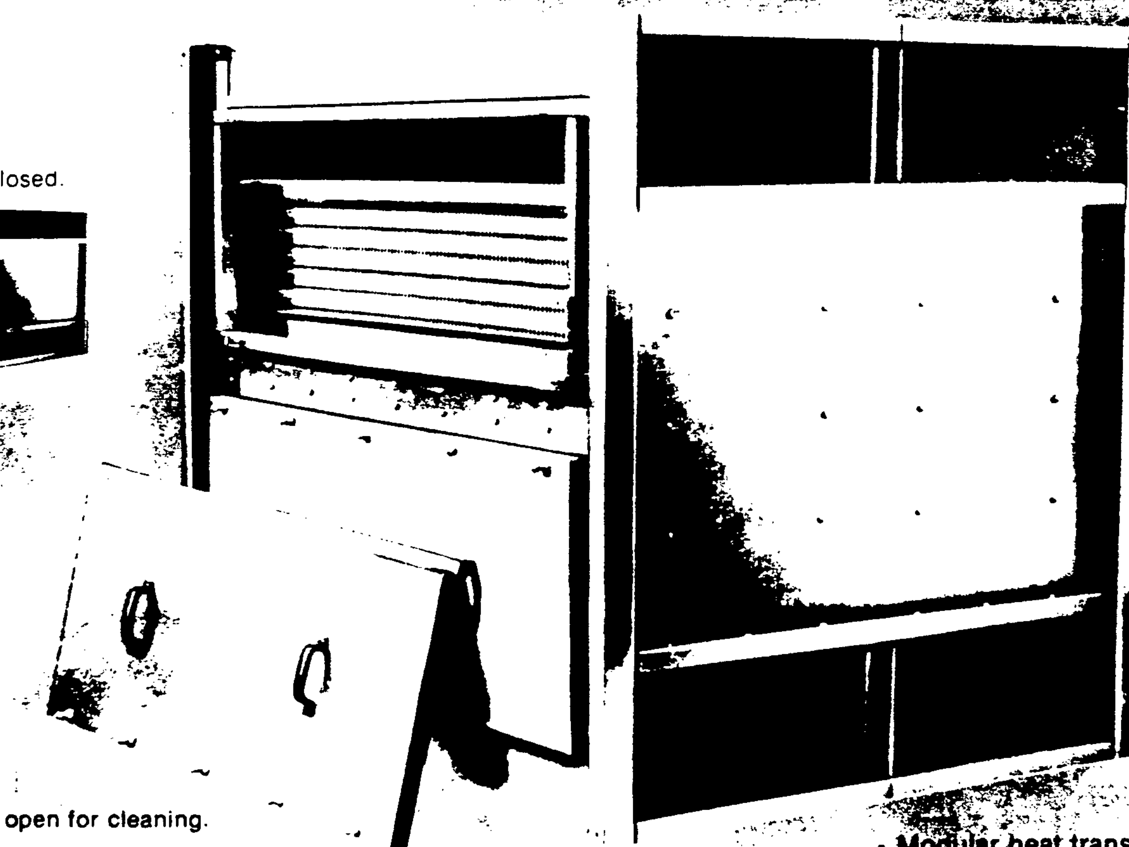
| TASK DESCRIPTION | QUANTITY | | LABOR | | | | EQUIPMENT | | MATERIAL | | TOTAL | SHIPPING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NO. OF UNITS | UNIT MEAS | MH UNIT | TOTAL HRS | UNIT PRICE | COST | UNIT PRICE | COST | UNIT PRICE | COST | | UNIT WT | TOTAL WT |
| AIR TO AIR HEAT | | | | | | | | | | | | | |
| EXCHANGER | 2 | EA | | | | | 185,000 | 370,000 | | | 370,000 | | |
| | | | | | | | | | | | | | |
| SUPPLY EXHAUST DUCT | 2 | EA | | | 1200 | 2400- | | | 1800- | 3600- | 6000 | | |
| | | | | | | | | | | | | | |
| ELECTRICAL SERVICE | | LS | | | | | | | | | 1800- | | |
| | | | | | | | | | | | 377,800 | | |
| TOTAL THIS SHEET | | | | | | | | | | | | | |

DA FORM 5418-R, Apr 85

Bulletin 79-4-75
Supercedes 11-77

# Z DUCT™ 75 ENERGY RECOVERY UNIT


Unit closed.


Unit open for cleaning.

- Modular heat transfer units for large commercial and industrial installations.
- Economical, compact, versatile. Easy to install and clean. Completely passive heat exchangers.

DLI DESCHAMPS LABORATORIES INCORPORATED

# Z DUCT SERIES 75 FROM DLI: UNIQUE MODULAR

Now, to complement our basic Z-Duct Series 74 (1,000 CFM), we've developed a new addition to the line. Z-Duct Series 75 modules of 4,000, 6,000, 8,000, and 10,000 CFM designed specifically for large installations. By combining modules in various arrangements, flow rates up to 100,000 CFM can be easily assembled. Installation and duct work are simplified.

Z-Duct Series 75 is designed to function economically in almost any situation where fresh air is being drawn into a building or industrial process to replace spent, stale or contaminated air of a different temperature. It transfers the thermal energy from the exhaust air stream to the in-take stream, greatly reducing the ..ount of fuel, as well as the equipment capacity required to condition the fresh air. (The same reductions apply to summer air conditioning as to winter heating.)

## Complete Separation Between Air Streams

Z-Duct is a unique and simple counterflow heat exchanger. It consists of a single folded energy transfer surface, fitted within a duct in such a way as to divide it into two separate yet intermeshed passages. Opposing air streams are brought into close proximity, while cross-contamination is virtually prevented.

## Economical, Efficient

Z-Duct is a compact, lightweight energy exchanger with no moving parts. The only exchanger with gas temperature applications up to 1200°F. The only one that provides high recovery efficiency over any ..ge of temperature with low ..rating costs and minimum maintenance. Higher transfer efficiencies are attained because no intermediate thermal transfer fluids are required as in heat pipes and run around systems.

## Easy to Clean

Removable panels are readily accessible for convenient visual inspection and cleaning of exhaust chambers and exhaust side heat transfer surfaces after installation. The only energy recovery device incorporating this important feature.

## No Humidity Problems

Condensation removal is provided for by a built-in drip pan and drain. Condensation from gases having high humidity improves Z-Duct performance and helps keep surfaces clean. Optional equipment is available for use where freezing temperatures might be a problem.

## Special Considerations

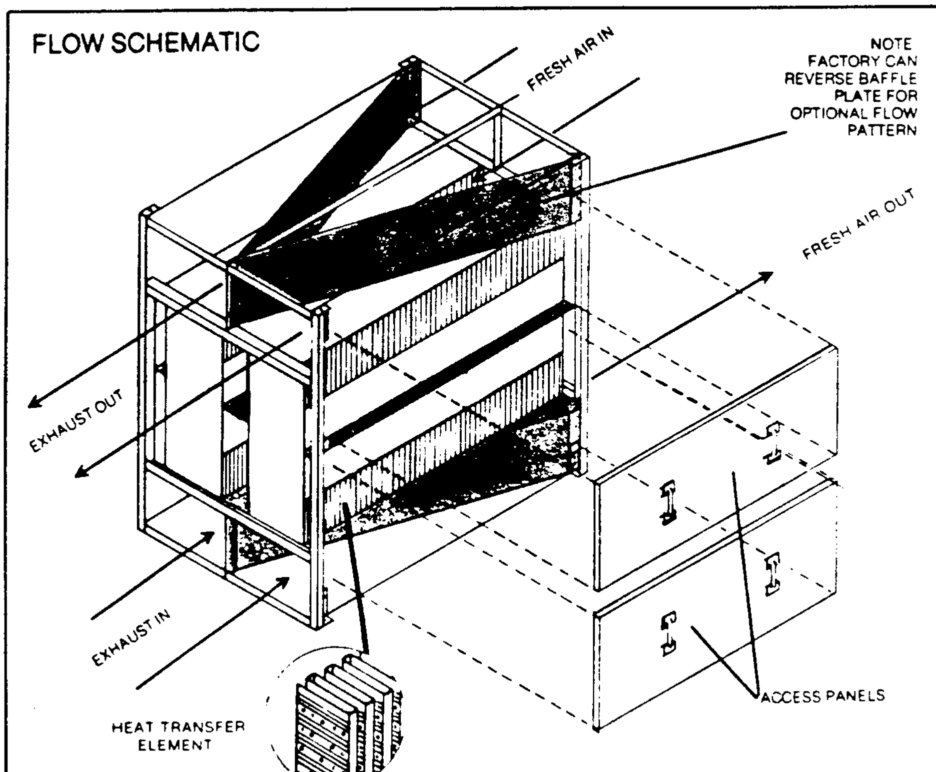
Proper precautions must be taken with the exterior inlet and exhaust to assure that no contaminated air will return to the building or process through the inlet air duct.

For high temperature and special environments, consult DLI for the appropriate materials and special design features that will assure the long life and efficiency of the system.

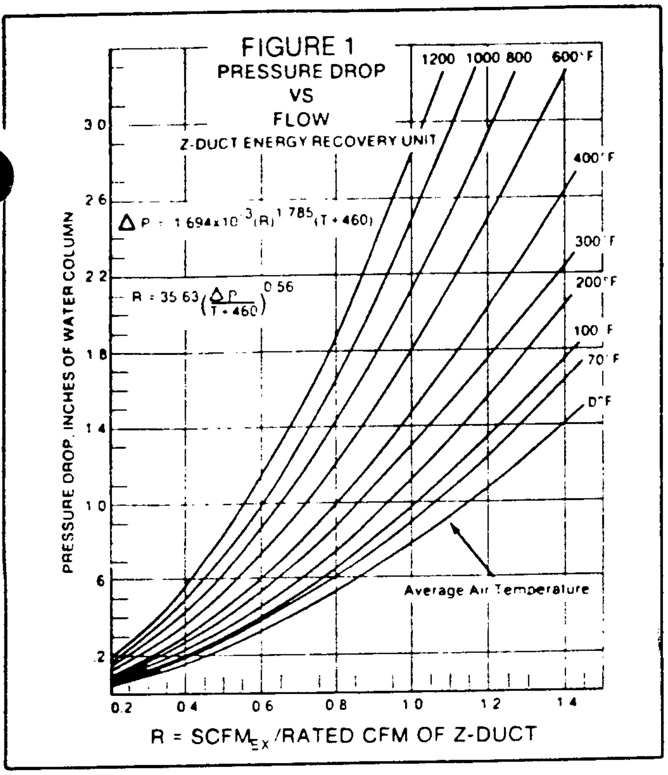
## STANDARD Z-DUCT SPECIFICATIONS

Z-Duct Series 75 modules are designed for 4,000, 6,000, 8,000, and 10,000 CFM with 0.93-inch W.C. pressure drop.

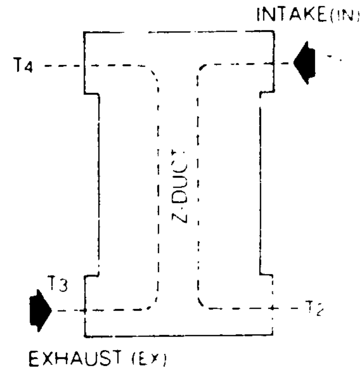
FLOW SCHEMATIC




U S and Foreign Patents




## Basic Equations




1. $SCFM_{EX} =$

$$ACFM_{EX} \left(\frac{70 + 460}{T_3 + 460}\right)$$

2. $SCFM_{IN} =$

$$ACFM_{IN} \left(\frac{70 + 460}{T_1 + 460}\right)$$

3. Flow Ratio = K = $SCFM_{IN}/SCFM_{EX}$

4. $T_4 = T_3$ - (Efficiency)(ECF)($T_3 - T_1$)

5. $T_2 = T_1$ + (Efficiency)(ECF)(1/K)($T_3 - T_1$)

6. Energy recovered from the exhaust air when condensing is not taking place is:

$$Q = (1.08)(SCFM_{EX})(T_3 - T_4) = \text{BTU/hr}$$

NOTE: Moisture in exhaust air yields higher value of Q, $T_4$ and $T_2$, assuming other conditions remain constant and the above equation is no longer valid. Consult manufacturer if condensing appears to be an important factor in your equation selection.

### Selection Procedure

A. Using equations 1 and 2, determine the values of SCFM.

B. Using equation 3, determine the flow ratio, K.

Refer to Figure 1, set pressure drop of side (intake or exhaust) having highest SCFM at desired value (use 1.0-inch pressure drop when sizing packaged units) estimate the average air temperature within the Z-Duct, and determine the value of SCFM/(rated CFM of Z-Duct). Size the unit:

Rated CFM of Z-Duct = (SCFM)/R

D. Select the standard Z-Duct product or multiples thereof that has a CFM rating nearest to the calculated value. Selecting a unit having a lower rating results in a higher pressure drop, slightly lower efficiency, and lower initial cost.

E. Determine the value of $SCFM_{EX}$/(rated CFM of Z-Duct) and value of K. Enter Figure 2 and determine efficiency. Look up ECF in Table 1.

F. With efficiency known, use equation 4 and 5 to determine $T_4$ and $T_2$.

G. Use equation 6 and calculate the energy recovered.

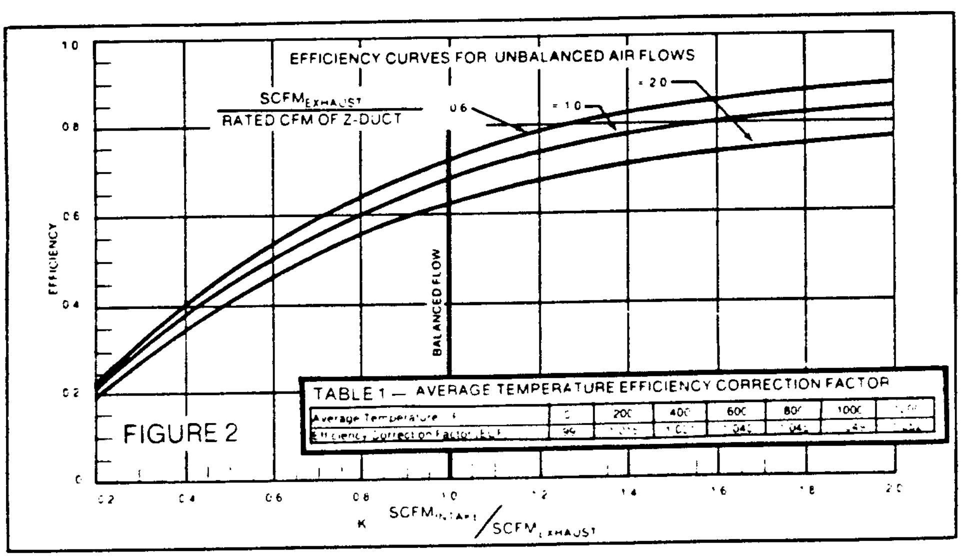



FIGURE 2

TABLE 1 — AVERAGE TEMPERATURE EFFICIENCY CORRECTION FACTOR

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Average Temperature °F | 0 | 200 | 400 | 600 | 800 | 1000 | [illegible] |
| Efficiency Correction Factor (ECF) | .99 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

NOTE: For more accurate calculations see Bulletin 78-8-1.

### DLI WARRANTY

DesChamps Laboratories equipment is guaranteed from defects in material and workmanship for one year from date of shipment.

DLI will repair or replace, at no charge, f.o.b. our plant, defective materials returned freight prepaid to the DLI factory within the guaranteed period. Any unauthorized repairs or replacement made to DLI equipment will void this guarantee.

DLI
**DES CHAMPS LABORATORIES INCORPORATED**
P.O. Box 348, East Hanover, N.J. 07936 • (201) 884-1460 Telex: 64-2030

ECO # 24A

DESCRIPTION: INSTALL EXHAUST HEAT RECOVERY UNITS ON 400 LB DRYERS.

SAVINGS POTENTIAL: EXHAUST ON 400 LB DRYERS LEAVES THE EQUIPMENT AT 150 DEGREES FAHRENHEIT. THE DRYER EXHAUST IS DRAWN ACROSS LINT FILTERS BY CENTRAL FANS. WHEN EXHAUST AIR IS REJECTED TO THE OUTSIDE IT REMAINS AT 150 DEGREES FAHRENHEIT. TOTAL AMOUNT OF EXHAUST AIR IS 8,000 CFM PER DRYER. ENERGY CAN BE RECOVERED FROM THE EXHAUST TO PREHEAT MAKE-UP AIR.THIS AFFECTS DRYERS NUMBERS 14, 39 AND 40.

A: ESTIMATED SAVINGS

THE FOLLOWING SPREAD SHEET USES THE BIN METHOD & PRODUCT LITERATURE TO ESTIMATE SAVINGS FROM AIR TO AIR HEAT EXCHANGERS.

| | |
|---|---|
| ANNUAL ENERGY SAVINGS FOR DRYER 14 = | 387 MBTU |
| ANNUAL ENERGY SAVINGS FOR DRYER 39 = | 285 MBTU |
| ANNUAL ENERGY SAVINGS FOR DRYER 40 = | 285 MBTU |
| TOTAL ANNUAL ENERGY SAVINGS FOR 400LB DRYERS = | 957 MBTU |
| TOTAL ANNUAL $ SAVINGS AT $3.27 PER MBTU = | $3129.00 |

ELECTRICITY COSTS

HEAT RECOVERY UNITS FOR 400 LB DRYERS DO NOT REQUIRE ADDITIONAL FANS.

HEATING
EXHAUST HEAT RECOVERY
400 LB GAS DRYERS (NO. 39 & NO. 40)

| EXHAUST ACFM | INTAKE ACFM | T1 | T3 | T4 | CF1 | CF2 | K | EXHAUST SCFM | INTAKE SCFM | T3-T1 | T3-T4 | BTUH SAVED/ DRYER | # HRS | MBTU SAVED/ DRYER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8000 | 8000 | 102 | 150 | 116.74 | .89831 | .94 | 1.0498 | 7186 | 7544 | 48 | 33.26 | 258127 | 0 | .00 |
| 8000 | 8000 | 97 | 150 | 113.27 | .89831 | .95 | 1.0592 | 7186 | 7612 | 53 | 36.73 | 285057 | 4 | 1.14 |
| 8000 | 8000 | 92 | 150 | 109.81 | .89831 | .96 | 1.0688 | 7186 | 7681 | 58 | 40.19 | 311910 | 15 | 4.68 |
| 8000 | 8000 | 87 | 150 | 106.34 | .89831 | .97 | 1.0786 | 7186 | 7751 | 63 | 43.66 | 338840 | 40 | 13.55 |
| 8000 | 8000 | 82 | 150 | 102.88 | .89831 | .98 | 1.0886 | 7186 | 7823 | 68 | 47.12 | 365693 | 62 | 22.67 |
| 8000 | 8000 | 77 | 150 | 99.41 | .89831 | .99 | 1.0987 | 7186 | 7896 | 73 | 50.59 | 392623 | 62 | 24.34 |
| 8000 | 8000 | 72 | 150 | 95.95 | .89831 | 1.00 | 1.1090 | 7186 | 7970 | 78 | 54.05 | 419476 | 57 | 23.91 |
| 8000 | 8000 | 67 | 150 | 92.48 | .89831 | 1.01 | 1.1195 | 7186 | 8046 | 83 | 57.52 | 446406 | 50 | 22.32 |
| 8000 | 8000 | 62 | 150 | 89.02 | .89831 | 1.02 | 1.1303 | 7186 | 8123 | 88 | 60.98 | 473258 | 43 | 20.35 |
| 8000 | 8000 | 57 | 150 | 85.55 | .89831 | 1.03 | 1.1412 | 7186 | 8201 | 93 | 64.45 | 500189 | 39 | 19.51 |
| 8000 | 8000 | 52 | 150 | 82.09 | .89831 | 1.04 | 1.1523 | 7186 | 8281 | 98 | 67.91 | 527041 | 38 | 20.03 |
| 8000 | 8000 | 47 | 150 | 78.62 | .89831 | 1.05 | 1.1637 | 7186 | 8363 | 103 | 71.38 | 553972 | 33 | 18.28 |
| 8000 | 8000 | 42 | 150 | 75.16 | .89831 | 1.06 | 1.1753 | 7186 | 8446 | 108 | 74.84 | 580824 | 35 | 20.33 |
| 8000 | 8000 | 37 | 150 | 71.69 | .89831 | 1.07 | 1.1871 | 7186 | 8531 | 113 | 78.31 | 607755 | 32 | 19.45 |
| 8000 | 8000 | 32 | 150 | 68.23 | .89831 | 1.08 | 1.1992 | 7186 | 8618 | 118 | 81.77 | 634607 | 33 | 20.94 |
| 8000 | 8000 | 27 | 150 | 64.76 | .89831 | 1.09 | 1.2115 | 7186 | 8706 | 123 | 85.24 | 661537 | 21 | 13.89 |
| 8000 | 8000 | 22 | 150 | 61.30 | .89831 | 1.10 | 1.2241 | 7186 | 8797 | 128 | 88.70 | 688390 | 15 | 10.33 |
| 8000 | 8000 | 17 | 150 | 57.83 | .89831 | 1.11 | 1.2369 | 7186 | 8889 | 133 | 92.17 | 715320 | 7 | 5.01 |
| 8000 | 8000 | 12 | 150 | 54.37 | .89831 | 1.12 | 1.25 | 7186 | 8983 | 138 | 95.63 | 742173 | 3 | 2.23 |
| 8000 | 8000 | 7 | 150 | 50.90 | .89831 | 1.13 | 1.2634 | 7186 | 9079 | 143 | 99.10 | 769103 | 1 | .77 |
| 8000 | 8000 | 2 | 150 | 47.44 | .89831 | 1.15 | 1.2771 | 7186 | 9177 | 148 | 102.56 | 795956 | 1 | .80 |
| 8000 | 8000 | -3 | 150 | 43.97 | .89831 | 1.16 | 1.2910 | 7186 | 9278 | 153 | 106.03 | 822886 | 0 | .00 |

SAVINGS PER DRYER NOT ACCOUNTING FOR PLANT EFFICIENCY = 284.53

EXHAUST ACFM = ACTUAL AMOUNT OF AIR BEING EXHAUSTED
INTAKE SCFM = ACTUAL AMOUNT OF MAKE-UP REQUIRED
EXHAUST SCFM = CORRECTED AMOUNT OF EXHAUST AIR = EXHAUST ACFM * CF1
INTAKE SCFM = CORRECTED AMOUNT OF INTAKE AIR = INTAKE ACFM * CF2
# HRS = TOTAL OPERATING HOURS AT GIVEN OUTSIDE TEMPERATURE T1
BTUH SAVED PER DRYER = (1.08)(SCFM EXHAUST)(T3-T4)
MBTU SAVED PER DRYER = (BTUH SAVED PER DRYER)(#HRS OPERATION)/1,000,000
T1 = OUTDOOR AIR (MAKEUP AIR) TEMPERATURE ENTERING HEAT RECOVER UNIT
T2 = MAKEUP AIR TEMPERATURE LEAVING HEAT RECOVERY UNIT
T3 = EXHAUST AIR TEMPERATURE ENTERING HEAT RECOVERY UNIT
T4 = EXHAUST AIR TEMPERATURE LEAVING HEAT RECOVERY UNIT
T4 EQUALS T3 (EFFICIENCY)(ECF)(T3-T1)
EFFICIENCY = 70%; ECF = 0.99
K = FLOW RATIO = (SCFM INTAKE/SCFM EXHAUST)
CF1= CORRECTION FACTOR TO CONVERT AIR FLOW AT EXHAUST TEMPERATURE TO STANDARD AIR TEMPERATURE (SCFM) = $\frac{(70^\circ + 460^\circ)}{(T3 + 460^\circ)}$
CF2= CORRECTION FACTOR TO CONVERT AIR FLOW AT INTAKE TEMPERATURE TO STANDARD AIR TEMPERATURE (SCFM) = $\frac{(70^\circ + 460^\circ)}{(T1 + 460^\circ)}$

HEATING
EXHAUST HEAT RECOVERY
400 LB GAS DRYERS (NO. 14)

| EXHAUST ACFM | INTAKE ACFM | T1 | T3 | T4 | CF1 | CF2 | K | EXHAUST SCFM | INTAKE SCFM | T3-T1 | T3-T4 | BTUH SAVED | # HRS | MBTU SAVED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8000 | 8000 | 102 | 150 | 116.74 | .89831 | .94 | 1.0498 | 7186 | 7544 | 48 | 33.26 | 258127 | 1 | .26 |
| 8000 | 8000 | 97 | 150 | 113.27 | .89831 | .95 | 1.0592 | 7186 | 7612 | 53 | 36.73 | 285057 | 5 | 1.43 |
| 8000 | 8000 | 92 | 150 | 109.81 | .89831 | .96 | 1.0688 | 7186 | 7681 | 58 | 40.19 | 311910 | 21 | 6.55 |
| 8000 | 8000 | 87 | 150 | 106.34 | .89831 | .97 | 1.0786 | 7186 | 7751 | 63 | 43.66 | 338840 | 54 | 18.30 |
| 8000 | 8000 | 82 | 150 | 102.88 | .89831 | .98 | 1.0886 | 7186 | 7823 | 68 | 47.12 | 365693 | 84 | 30.72 |
| 8000 | 8000 | 77 | 150 | 99.41 | .89831 | .99 | 1.0987 | 7186 | 7896 | 73 | 50.59 | 392623 | 85 | 33.37 |
| 8000 | 8000 | 72 | 150 | 95.95 | .89831 | 1.00 | 1.1090 | 7186 | 7970 | 78 | 54.05 | 419476 | 77 | 32.30 |
| 8000 | 8000 | 67 | 150 | 92.48 | .89831 | 1.01 | 1.1195 | 7186 | 8046 | 83 | 57.52 | 446406 | 68 | 30.36 |
| 8000 | 8000 | 62 | 150 | 89.02 | .89831 | 1.02 | 1.1303 | 7186 | 8123 | 88 | 60.98 | 473258 | 59 | 27.92 |
| 8000 | 8000 | 57 | 150 | 85.55 | .89831 | 1.03 | 1.1412 | 7186 | 8201 | 93 | 64.45 | 500189 | 54 | 27.01 |
| 8000 | 8000 | 52 | 150 | 82.09 | .89831 | 1.04 | 1.1523 | 7186 | 8281 | 98 | 67.91 | 527041 | 51 | 26.88 |
| 8000 | 8000 | 47 | 150 | 78.62 | .89831 | 1.05 | 1.1637 | 7186 | 8363 | 103 | 71.38 | 553972 | 46 | 25.48 |
| 8000 | 8000 | 42 | 150 | 75.16 | .89831 | 1.06 | 1.1753 | 7186 | 8446 | 108 | 74.84 | 580824 | 47 | 27.30 |
| 8000 | 8000 | 37 | 150 | 71.69 | .89831 | 1.07 | 1.1871 | 7186 | 8531 | 113 | 78.31 | 607755 | 43 | 26.13 |
| 8000 | 8000 | 32 | 150 | 68.23 | .89831 | 1.08 | 1.1992 | 7186 | 8618 | 118 | 81.77 | 634607 | 44 | 27.92 |
| 8000 | 8000 | 27 | 150 | 64.76 | .89831 | 1.09 | 1.2115 | 7186 | 8706 | 123 | 85.24 | 661537 | 29 | 19.18 |
| 8000 | 8000 | 22 | 150 | 61.30 | .89831 | 1.10 | 1.2241 | 7186 | 8797 | 128 | 88.70 | 688390 | 20 | 13.77 |
| 8000 | 8000 | 17 | 150 | 57.83 | .89831 | 1.11 | 1.2369 | 7186 | 8889 | 133 | 92.17 | 715320 | 9 | 6.44 |
| 8000 | 8000 | 12 | 150 | 54.37 | .89831 | 1.12 | 1.25 | 7186 | 8983 | 138 | 95.63 | 742173 | 4 | 2.97 |
| 8000 | 8000 | 7 | 150 | 50.90 | .89831 | 1.13 | 1.2634 | 7186 | 9079 | 143 | 99.10 | 769103 | 2 | 1.54 |
| 8000 | 8000 | 2 | 150 | 47.44 | .89831 | 1.15 | 1.2771 | 7186 | 9177 | 148 | 102.56 | 795956 | 1 | .80 |
| 8000 | 8000 | -3 | 150 | 43.97 | .89831 | 1.16 | 1.2910 | 7186 | 9278 | 153 | 106.03 | 822886 | 0 | .00 |

SAVINGS PER DRYER NOT ACCOUNTING FOR PLANT EFFICIENCY = 386.63

EXHAUST ACFM = ACTUAL AMOUNT OF AIR BEING EXHAUSTED
INTAKE SCFM = ACTUAL AMOUNT OF MAKE-UP REQUIRED
EXHAUST SCFM = CORRECTED AMOUNT OF EXHAUST AIR = EXHAUST ACFM * CF1
INTAKE SCFM = CORRECTED AMOUNT OF INTAKE AIR = INTAKE ACFM * CF2
# HRS = TOTAL OPERATING HOURS AT GIVEN OUTSIDE TEMPERATURE T1
BTUH SAVED PER DRYER = (1.08)(SCFM EXHAUST)(T3-T4)
MBTU SAVED PER DRYER = (BTUH SAVED PER DRYER)(#HRS OPERATION)/1,000,000
T1 = OUTDOOR AIR (MAKEUP AIR) TEMPERATURE ENTERING HEAT RECOVER UNIT
T2 = MAKEUP AIR TEMPERATURE LEAVING HEAT RECOVERY UNIT
T3 = EXHAUST AIR TEMPERATURE ENTERING HEAT RECOVERY UNIT
T4 = EXHAUST AIR TEMPERATURE LEAVING HEAT RECOVERY UNIT
T4 EQUALS T3 (EFFICIENCY)(ECF)(T3-T1)
EFFICIENCY = 70%; ECF = 0.99
K = FLOW RATIO = (SCFM INTAKE/SCFM EXHAUST)
CF1= CORRECTION FACTOR TO CONVERT AIR FLOW AT EXHAUST TEMPERATURE TO STANDARD AIR TEMPERATURE (SCFM) = $\frac{(70^\circ + 460^\circ)}{(T3 + 460^\circ)}$
CF2= CORRECTION FACTOR TO CONVERT AIR FLOW AT INTAKE TEMPERATURE TO STANDARD AIR TEMPERATURE (SCFM) = $\frac{(70^\circ + 460^\circ)}{(T1 + 460^\circ)}$

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO    REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007    EXHAUST HR 400LB DRYERS
FISCAL YEAR: 1989    ECO #,s 24A
ANALYSIS DATE:    ECON LIFE 25

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 57725 | |
| B. | SIOH | 3175 | |
| C. | DESIGN COST | 3464 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 57927 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 57927 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|
| A. ELEC | 12.97 | 0 | 0 | 11.16 | 0 | |
| B. DIST | 4.34 | 0 | 0 | 17.19 | 0 | |
| C. RESD | 3.49 | 0 | 0 | 17.12 | 0 | |
| D. LPG | 3.27 | 957 | 3129 | 16.15 | 50533 | |
| E. WOOD | 2.00 | 0 | 0 | 13.47 | 0 | |
| F. TOTAL | | 957 | 3129 | | | 50533 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

A. ANNUAL RECURRING 0
(1) DISCOUNT FACTOR (TABLE A) * 11.65
(2) DISCOUNTED SAVINGS/COST (3A X 3A1) 0

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST 0

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33) 16676
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE)) 3129

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C) 50533

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F) .87

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

## COST ESTIMATE ANALYSIS

For use of this form, see TM 5 800-2; the proponent agency is USACE.

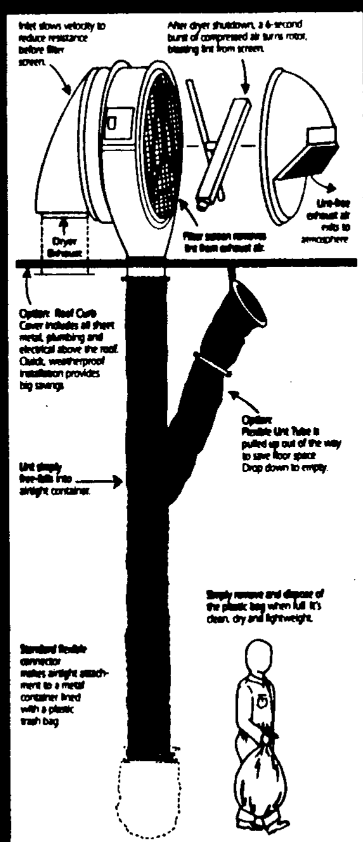
| | | | |
|---|---|---|---|
| PROJECT: 400 lb DRYER EXHAUST HEAT RECOVERY | INVITATION/CONTRACTOR | EFFECTIVE PRICING DATE | DATE PREPARED: 6-2-89 |
| LOCATION: FORT LEONARD WOOD | CODE (Check one) ☐ A ☐ B ☐ C ☐ OTHER | DRAWING NO. | SHEET 1 OF 1 SHEETS |
| | | ESTIMATOR | CHECKED BY |

ECO #24A

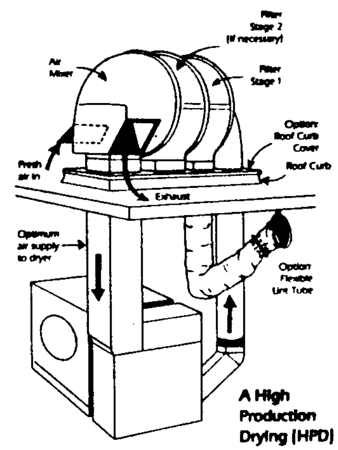
| TASK DESCRIPTION | QUANTITY: NO. OF UNITS | QUANTITY: UNIT MEAS | LABOR: MH UNIT | LABOR: TOTAL HRS | LABOR: UNIT PRICE | LABOR: COST | EQUIPMENT: UNIT PRICE | EQUIPMENT: COST | MATERIAL: UNIT PRICE | MATERIAL: COST | TOTAL | SHIPPING: UNIT WT | SHIPPING: TOTAL WT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HT. RECOVERY & FILTER UNIT | 3 | EA | | | 1600- | 4800- | 15,000 | 45,000- | 300- | 900- | 50,700 | | |
| SUPPLY/EXHAUST DUCT | 3 | EA | | | 600- | 1800- | | | 700- | 2100- | 3900- | | |
| WATER SUPPLY 3/4" | 3 | EA | | | 380 | 1140- | | | 90- | 270- | 1410- | | |
| VALVES (SUP & DRAIN) | 3 | EA | | | 60 | 180- | | | 45 | 135- | 315- | | |
| COMPRESSED AIR 3/4" | | LS | | | | | | | | | 900 | | |
| ELEC. SERVICE | | LS | | | | | | | | | 500 | | |
| | | | | | | | | | | | 57725 | | |
| TOTAL THIS SHEET | | | | | | | | | | | | | |

DA FORM 5418-R, Apr 85

# When you buy a Lint Filter, it should be guaranteed to last a lifetime and be clean and easy to live with.




# When you buy a Lint Filter, you should get a payback, not another expense.




A High Production Drying (HPD) System

**Energenics' High Production Drying (HPD) System:**

**HPD:** Fully dries 400 lb. loads in 11 to 14 minutes using 1/3 less fuel.*

**HPD:** Terminates dryer's heat and cool cycles automatically using true measurements of moisture and temperature.

**HPD:** Eliminates overdrying.

**HPD:** Means accurate conditioning.

**HPD:** Eliminates worker decisions.

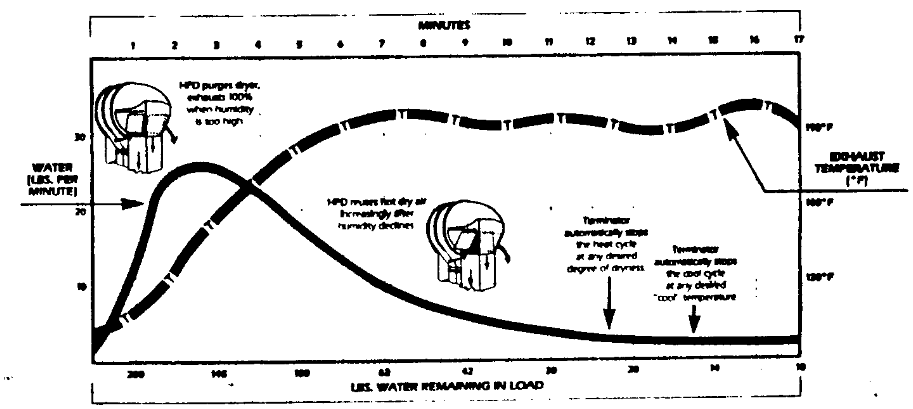
**HPD:** Supplies 100% of dryer make-up air.

**HPD:** Means exclusive factory start-up and training service.

**HPD:** Means High Production Drying!

**Important:** Any Energenics 130, 140 or 170 Filter easily and inexpensively can be retrofitted at any time to become a complete High Production Drying (HPD) System.

*For a complete engineering text describing how and why Energenics' HPD System enables any batch dryer to dry faster, request Technical Bulletin #10. Covered by US Patent Nos. 4,549,362 and 4,267,643.



ECO # 26

DESCRIPTION: INSTALL THERMAL FLUID PRESSES

SAVINGS POTENTIAL: THERMAL FLUID PRESSES ACCOMPLISH INCREASED PRODUCTION WITH A REDUCTION IN ENERGY CONSUMPTION OVER CONVENTIONAL STEAM PRESSES.

A: ESTIMATED SAVINGS

SAVINGS ESTIMATES ARE BASED UPON THE FOLLOWING CONDITIONS:

1. REPLACING THE FOUR EXISTING SHEET PRESSES WITH TWO THERMAL FLUID PRESSES. (ONE LARGE PRESSES & ONE SMALL PRESS).

2. TOTAL AMOUNT TO BE PRESSED AS FOLLOWS:

| | | |
|---|---|---|
| SMALL ITEMS --- | 330115 | LBS |
| LARGE ITEMS --- | 1331423 | LBS |
| TOTAL ITEMS --- | 1661538 | |

3. OPERATING HRS PER YEAR (NEW EQUIPMENT) = 1040

4. FUEL INPUT FOR NEW PRESSES:

| | | | |
|---|---|---|---|
| SMALL PRESS = | 350000 BTUH | * 1 PRESS = | 350000 |
| LARGE PRESS = | 1400000 BTUH | * 1 PRESS = | 1400000 |
| TOTAL FUEL INPUT | | | 1750000 |
| | HOURS PER YEAR = | | 1040 |
| | TOTAL ENERGY USE (MBTU) = | | 1820 |

---

EXISTING ENERGY CONSUMPTION

| | | |
|---|---|---|
| MBTU PER PRESS = | 645 | |
| # OF PRESSES = | 4 | |
| TOTAL USE = | 2580 | PLANT EFFICIENCY NOT ACCOUNTED FOR |
| TOTAL USE = | 3440 | PLANT EFFICIENCY @ 75% |

---

MBTU SAVINGS = 1620
$ SAVINGS = 5301.13

---

| EXISTING ELECTRICAL CONSUMPTION | | NEW ELECTRICAL CONSUMPTION | |
|---|---|---|---|
| KWH PER PRESS = | 3916.5 KWH | KW PER PRESS | 5.595 |
| # OF PRESSES = | 4 | # OF PRESSES = | 2 |
| TOTAL USE = | 15666 KWH | TOTAL KW | 11.19 |
| TOTAL USE = | 53.47 MBTU | HOURS OF USE | 1040 |
| | | TOTAL KWH | 11637.6 |
| | | TOTAL MBTU | 39.72 |

ELECTRICITY SAVINGS = 13.74893 MBTU
$ SAVINGS = 174.34

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007 INSTALL THERMAL FLUID PRESSES
FISCAL YEAR: 1989 ECO #,s 26
ANALYSIS DATE: ECON LIFE 25

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 244250 | |
| B. | SIOH | 96 | |
| C. | DESIGN COST | 105 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 220006 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 220006 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | 13.75 | 178 | 11.16 | 1990 | |
| B. | DIST | 4.34 | 0 | 0 | 17.19 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 17.12 | 0 | |
| D. | LPG | 3.27 | 1620 | 5297 | 16.15 | 85553 | |
| E. | WOOD | 2.00 | 0 | 0 | 13.47 | 0 | |
| F. | TOTAL | | 1633.75 | 5476 | | | 87543 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

| | | |
|---|---|---|
| A. | ANNUAL RECURRING | 500 |
| | (1) DISCOUNT FACTOR (TABLE A) * | 11.65 |
| | (2) DISCOUNTED SAVINGS/COST (3A X 3A1) | 5825 |

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST 5825

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33) 28889
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE)) 5976

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C) 93368

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F) .42

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

## COST ESTIMATE ANALYSIS

For use of this form, see TM 5 800-2; the proponent agency is USACE.

| | |
|---|---|
| INVITATION/CONTRACTOR | |
| EFFECTIVE PRICING DATE | |
| DATE PREPARED | 26 MAY 89 |
| PROJECT | INSTALL THERMAL FLUID SHEET PRESSES |
| CODE (Check one) | ☐ A ☐ B ☐ C ☐ OTHER |
| DRAWING NO. | |
| SHEET | 1 OF 1 SHEETS |
| LOCATION | FORT LEONARD WOOD |
| ESTIMATOR | |
| CHECKED BY | |

ECO # 26

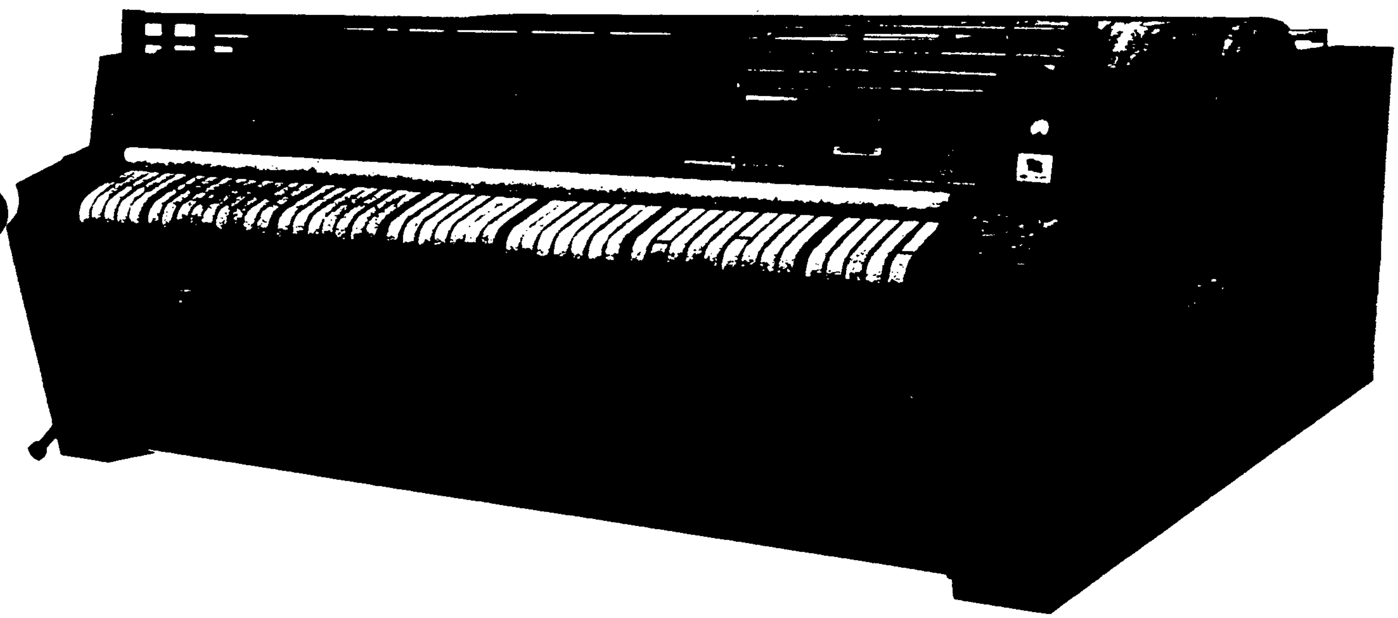
| TASK DESCRIPTION | QUANTITY | | LABOR | | | | EQUIPMENT | | MATERIAL | | TOTAL | SHIPPING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NO. OF UNITS | UNIT MEAS | MH UNIT | TOTAL HRS | UNIT PRICE | COST | UNIT PRICE | COST | UNIT PRICE | COST | | UNIT WT | TOTAL WT |
| THERMAL FLUID HEATER | 1 | EA | | | | 2500– | | 22,000– | | | 24,500– | | |
| ULTIMA 36 2 ROLL PRESS | 1 | EA | | | | 10,000– | | 121,000 | | | 131,000– | | |
| ULTIMA 36 1 ROLL PRESS | 1 | EA | | | | 8000– | | 79,000– | | | 87000– | | |
| GAS PIPING 3/4" | 80 | LF | | | 2.96 | 237– | | | .96 | 77– | 314– | | |
| THERMAL FLUID PIPING | 120 | LF | | | 5.05 | 606– | | | 2.76 | 331– | 937– | | |
| ELEC. SERVICE | | LS | | | | | | | | | 500 | | |
| | | | | | | | | | | | 244,250 | | |
| TOTAL THIS SHEET | | | | | | | | | | | | | |

DA FORM 5418-R, Apr 85

## Steam/Thermal Ironer Models

flatwork ironers

# SUPERSTAR™ 700•800



The benchmark in quality flatwork finishing.
SUPERSTARS, in use the world over, are designed and built in the U.S.A.
Each features the ready availability of all U.S.A. made components and JENDRIVE II—
a completely self-contained slide-out drive unit.

## Products of more than 60 years of developing, designing and building flatwork ironers to meet launderers' needs worldwide.

■ SUPERSTAR ironers feature JENDRIVE II, a hydrostatic-type hydraulic drive system and 5/10 WARRANTY PLUS, both Jensen exclusives.

■ High manufacturing and quality control standards lead to greater user production and finishing quality.

■ Only minimal floor space is required for high production output.

■ SUPERSTAR ironers are fully modular and easy to assemble. A three-roll model typically installs — ready for utilities connection — in less than one day.

■ Safety rails at feed end and along both sides of the ironer plus safety guard at feed end are standard.

■ SUPERSTAR's graduated size 27½" or 32" rolls and chests provide proper textile stretch for better finish. Design simplicity and same size padding on each roll reduces labor/down-time for easy repadding. No special fastening or sewing of padding required — ever.

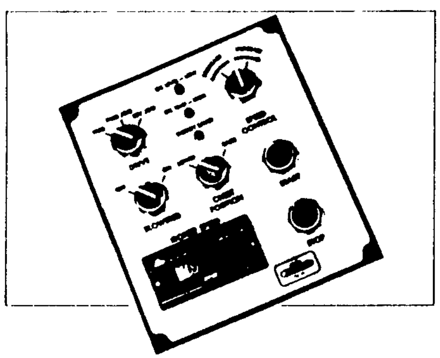
■ Patented "Energy-Saver" feature automatically engages when flatwork is not being fed making SUPERSTARS highly electrically efficient. This feature significantly extends padding life.

■ Needlefelt padding and internal pipework are supplied as standard (for thermal versions — Nomex padding is supplied).

■ Highly efficient vacuum system provides virtual heat-free laundry atmosphere, drier padding and higher production.

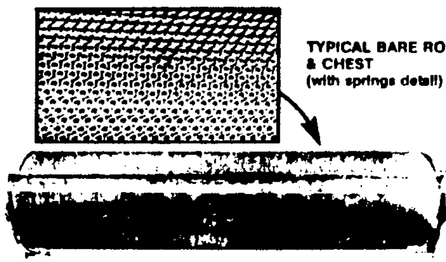
### 5/10 Warranty Plus

SUPERSTAR 700 and 800 ironers provide a unique FIVE YEAR FACTORY WARRANTY on the JENDRIVE II hydrostatic drive system. Additionally, rolls and chest (both steam and thermal) are covered by a TEN YEAR FACTORY WARRANTY. Jensen's 5/10 WARRANTY PLUS is the broadest warranty of any ironer in the world!



### Design Features

**IRONER CHESTS & ROLLS** — Computer designed deep chests are fabricated from boiler plate steel (rated for 250psi working steam pressure). Roll/chest contact of 170 degrees providing 40 inch contact under pressure on the SUPERSTAR 700 (47½ inch on SUPERSTAR 800) is achieved and chests are distortion-free under working conditions. Full 120 inch wide "Tulip-Style" chest design eliminates need for non-productive bridge or gap pieces. Large spring padded 27½ inch (700 mm) or 32 inch (800mm) rolls are mounted on large self-aligning ball bearings. Each SUPERSTAR roll contains approximately 19,000 holes with individually fitted zinc plated springs. Optimum chest/roll contact is provided, enabling the vacuum system to keep padding dry for maximum production. This combination of 19,000 holes, springs, and highly efficient vacuum eliminates the necessity for metal mesh and laminated spring padding and a canopy.



TYPICAL BARE ROLL & CHEST (with springs detail)

**Steam models** — specially designed steam chambers add velocity which encourages steam to give up its latent heat. Condensate is also quickly scoured from chest. Units can be supplied for 150psi actual production operation. Steam chests are burst tested above 2500psi. ASME certified and stamped (ASME IS STANDARD) and are rated for operation up to 250psi steam pressure. A condensate by-pass feature is included to facilitate cold starts and protect equipment from "thermal shock". Two steam traps are provided with each chest as well as all internal steam piping (steam separator and drip leg are optional).

**Thermal models** — specially designed chests have graduated oil channels and thermal fluid deflectors which automatically give required oil velocity and turbulence necessary for efficient heat transfer. Chests are connected in parallel from common inlet manifold for better heat distribution (no secondary pump needed). Each chest is designed to give a similar pressure drop from oil inlet to oil outlet providing balanced oil supply and uniform heat reduction gradient from inlet to outlet. Thermal chests are tested to ASME standards and capable of running at low oil pressure at temperatures to 450°F (normal max. operating temperature).

CONTROLS — Easily understood and carefully positioned for safe, simplifed operation. Emergency stop button, steam pressure indicator or thermal fluid temperature gauge and system interlock stop control are located on left feed frame. Right feed frame has stop/start buttons for drive motor, vacuum blowers and ironer roll direction (forward or reverse). Also an ammeter, speed control, digital speed indicator and "Energy-Saver" indicator are so located

| STEAM MODELS | Superstar 700 | Superstar 800 |
|---|---|---|
| **SPEEDS AND PRODUCTIVITY*** | | |
| 1 Roll Std. Speed | 15 - 100 ft./min. (5 - 30 m./min.) | 15 - 100 ft./min. (5 - 30 m./min.) |
| Cottons (@ 50% moisture) | 350 - 500 lbs./hr. (159 - 227 kg./hr.) | 450 - 580 lbs./hr. (204 - 263 kg./hr.) |
| 50/50 Blends (@ 30 - 35% moisture) | 475 - 750 lbs./hr. (216 - 341 kg./hr.) | 575 - 800 lbs./hr. (261 - 363 kg./hr.) |
| 2 Roll Std. Speed | 20 - 150 ft./min. (6 - 46 m./min.) | 20 - 150 ft./min. (6 - 46 m./min.) |
| Cottons (@ 50% moisture) | 650 - 900 lbs./hr. (295 - 409 kg./hr.) | 825 - 1050 lbs./hr. (374 - 476 kg./hr.) |
| 50/50 Blends (@ 30 - 35% moisture) | 975 - 1350 lbs./hr. (443 - 614 kg./hr.) | 1225 - 1650 lbs./hr. (556-750 kg./hr.) |
| 3 Roll Std. Speed | 25 - 175 ft./min. (8 - 53 m./min.) | 25 - 175 ft./min. (8 - 53 m./min.) |
| Cottons (@ 50% moisture) | 1125 - 1375 lbs./hr. (511 - 618 kg./hr.) | 1325 - 1700 lbs./hr. (703 - 748 kg./hr.) |
| 50/50 Blends (@ 30 - 35% moisture) | 1685 - 2080 lbs./hr. (766 - 938 kg./hr.) | 1925 - 2300 lbs./hr. (873 - 1043 kg./hr.) |
| 4 Roll Std. Speed | 25 - 175 ft./min. (8 - 53 m./min.) | 25 - 175 ft./min. (8 - 53 m./min.) |
| Cottons (@ 50% moisture) | 1560 - 1760 lbs./hr. (709 - 800 kg./hr.) | 1790 - 2100 lbs./hr. (812 - 955 kg./hr.) |
| 50/50 Blends (@ 30 - 35% moisture) | 2340 - 2640 lbs./hr. (1064 - 1200 kg./hr.) | 2600 - 3080 lbs./hr. (1179 - 1397 kg./hr.) |

* Approximate output dry weight (sheets) 125 psi (9 bars) steam at the ironer. Productivity may be affected by quality of steam and piping.

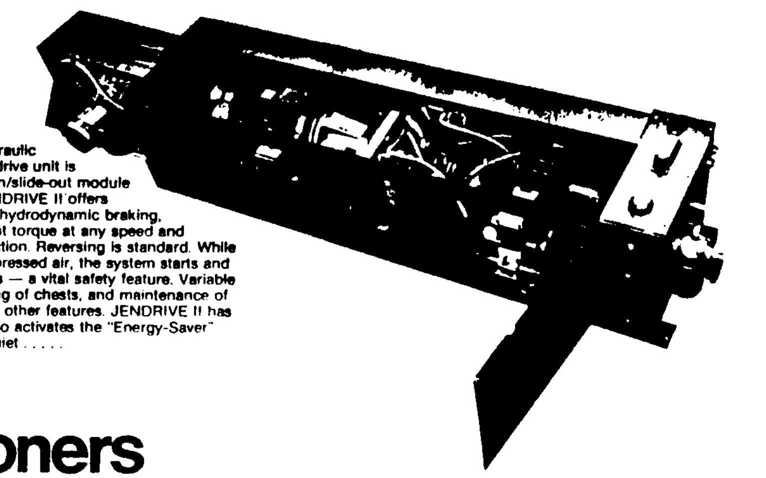
| THERMAL MODELS | Superstar 700 | Superstar 800 |
|---|---|---|
| **SPEEDS AND PRODUCTIVITY**** | | |
| 1 Roll Std. Speed | 15 - 100 ft./min. (5 - 30 m./min.) | 15 - 100 ft./min. (5 - 30 m./min.) |
| Cottons (@ 50% moisture) @ 450°F | 600 - 750 lbs./hr. (273 - 341 kg./hr.) | 680 - 850 lbs./hr. (308 - 386 kg./hr.) |
| 50/50 Blends (@ 30 - 35% moisture) @ 430°F | 930 - 1160 lbs./hr. (423 - 527 kg./hr.) | 1040 - 1290 lbs./hr. (472 - 585 kg./hr.) |
| 2 Roll Std. Speed | 20 - 150 ft./min. (6 - 46 m./min.) | 20 - 150 ft./min. (6 - 46 m./min.) |
| Cottons (@ 50% moisture) @ 450°F | 1250 - 1500 lbs./hr. (568 - 682 kg./hr.) | 1375 - 1700 lbs./hr. (625 - 773 kg./hr.) |
| 50/50 Blends (@ 30 - 35% moisture) @ 430°F | 1935 - 2325 lbs./hr. (880 - 1057 kg./hr.) | 2100 - 2600 lbs./hr. (955 - 1182 kg./hr.) |
| 3 Roll Std. Speed | 25 - 175 ft./min. (8 - 53 m./min.) | 25 - 175 ft. min. (8 - 53 m./min.) |
| Cottons (@ 50% moisture) @ 450°F | 1850 - 2300 lbs./hr. (841 - 1045 kg./hr.) | 2000 - 2500 lbs./hr. (907 - 1134 kg./hr.) |
| 50/50 Blends (@ 30 - 35% moisture) @ 430°F | 2865 - 3565 lbs./hr. (1302 - 1602 kg./hr.) | 3100 - 3800 lbs./hr. (1406 - 1724 kg./hr.) |

** Approximate output dry weight (sheets)

**CHEST PRESSURE** — Hydraulically applied for constant pressure across the entire roll. Total control of chest and unique roll-to-chest pressure provide great finish, high output, and low padding costs. NO COMPRESSED AIR IS REQUIRED, thus eliminating an additional service line need and another potential maintenance factor.

**AUTOMATIC CHEST LOWERING** — SUPERSTAR ironers feature automatic chest pressure reduction (Jensen's "Energy-Saver") activated by the JENDRIVE II hydraulic drive system. Additionally, on thermal version, chests fully drop away from rolls when machine is stopped.

**DRIVE SYSTEM** — SUPERSTAR ironers feature JENDRIVE II, a state-of-the-art closed loop hydrostatic-type hydraulic drive system. The entire drive unit is self-contained as a slide-in/slide-out module for ease of servicing. JENDRIVE II offers infinitely variable speeds, hydrodynamic braking, cushioned power, constant torque at any speed and automatic overload protection. Reversing is standard. While eliminating need for compressed air, the system starts and instantaneously stops rolls — a vital safety feature. Variable speed, raising and lowering of chests, and maintenance of pre-set chest pressure are other features. JENDRIVE II has "fail-safe" circuitry and also activates the "Energy-Saver". And JENDRIVE II is so quiet . . . . .



# SUPERSTAR steam/thermal flatwork ironers

## TECHNICAL DETAILS

### STEAM MODELS

| SERVICE REQUIREMENTS | Description | Connection | Position |
|---|---|---|---|
| Steam* | 125 psi (8.75 kg. sq. cm.) | 2" (50.8 mm) | LH delivery end |
| Boiler horsepower (max. BHP required) | 700 10 BHP, 800 11 BHP per roll. Average BHP consumption is 70 - 80% of maximum requirement. | | |
| Air | No air supply required | | |
| Condensate | | 1½" (38.1 mm) | RH delivery end |
| Drain | | 1" (25.4 mm) | RH delivery end |
| Vacuum outlet | | 7" (177 mm) dia. | LH delivery end |
| Electric supply | 208 or 230V/3 phase/60 Hz standard (special to order) | Disconnect box included | LH feed end |

* Steam usage is 0.7 lb. (0.33 kg.) per lb. dry weight of 100% cotton flatwork processed and 0.42 lb. (0.2 kg.) per lb. dry weight of blended flatwork processed.

**DRIVE SYSTEM** - JENDRIVE II engineered according to number of rolls

**FANS** - High volume vacuum system engineered according to number of rolls

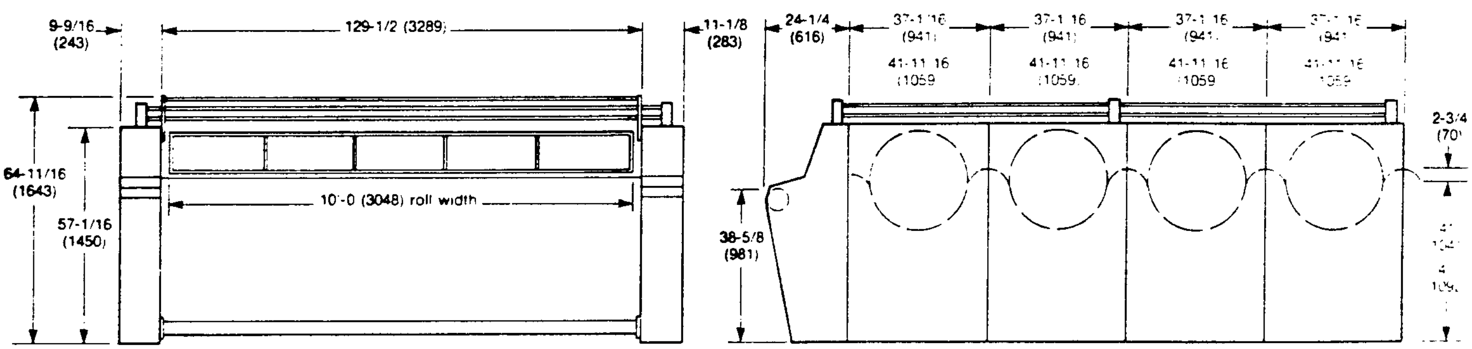
| SHIPPING SPECS - (L x W x H and weight) | Superstar 700 | Superstar 800 |
|---|---|---|
| Drive section and 1st roll (skidded) | 13'-4" x 6' x 6' (4.06 m. x 1.83 m. x 1.83 m.) 8500 lbs. (3856 kg.) | 13'-4"x6'-6"x6' (4.06m.x1.98m.x1.83m.) 9200 lbs. (4173 kg.) |
| Each additional roll (skidded) | 13'-4" x 6' x 6' (4.06 m. x 1.83 m. x 1.83 m.) 6500 lbs. (2948 kg.) | 13'-4"x6'-6"x6' (4.06m.x1.98m.x1.83m.) 7100 lbs. (3220 kg.) |

[redacted]

**C.S.A. and F.M. approved**

Specifications subject to change without notice.

**LEGEND** **—SUPERSTAR 700**
**—SUPERSTAR 800**
Dimensions shown in inches (millimeters in parentheses)




FRONT SIDE

For additional information contact your local Jensen Distributor.

**JENSEN CORPORATION** • 2775 Northwest 63rd Court, Fort Lauderdale, Florida 33309
Telephone (305) 974-6300 • TELEX 51-4561 JENSENMACH FTL • FAX (305) 972-6306



Printed in U.S.A. 4/87/5M

ECO # 27

DESCRIPTION: COLD WATER LAUNDERING

SAVINGS POTENTIAL: IF LAUNDRY CAN BE WASHED WITH COLD WATER THEN THE ENERGY USED TO HEAT WATER MAY BE ELIMINATED.

A: ESTIMATED SAVINGS

POTENTIAL SAVINGS WERE BASED UPON THE FOLLOWING CONDITIONS:

THIRTY PERCENT OF TOTAL LAUNDRY PRODUCTION IS SUITABLE FOR COLD WATER WASHING.

WASH CYCLES TIMES WILL INCREASE APPROXIMATELY 25%.

| | |
|---|---|
| EXISTING PRODUCTION RATE (LBS/YEAR) = | 3724954 |
| COLD WASH PRODUCTION (LBS/YEAR) = | 1117486. |
| WATER USE (GALLONS/LB) = | 2.6 |
| TOTAL WATER USE FOR COLD WATER WASH = | 2905464. |
| HOT WATER SAVED = 65% TOTAL USE = | 1888552. |

$$\text{MBTU SAVED} = \frac{\text{GAL} * 8.33 * \text{DELTA T}}{1{,}000{,}000 * \text{EFFICIENCY}}$$

DELTA T = 100
EFFICIENCY = .75

MBTU SAVED = 2097.55140
$ SAVINGS = 6865.29

---

ELECTRICITY COSTS

| | |
|---|---|
| COLD WASH PRODUCTION (LBS/YEAR) = | 1117486. |
| LBS/DAY = | 4469.945 @ 250 DAYS/YEAR |
| LBS/HOUR = | 558.7431 @ 8 HRS/DAY |

USE EXISTING 600 LB DRYER FOR 2000 HOURS

| MTR # | MTR KW | % OF TOT HRS | HRS OPER. | KWH USE |
|---|---|---|---|---|
| 1 | 5.60 | 75 | 1500 | 8400 |
| 2 | 9.33 | 20 | 400 | 3732 |
| 3 | 18.70 | 20 | 400 | 7480 |
| | | | | 19612 |

| | |
|---|---|
| TOTAL ELECTRICITY USE BEFORE COLD WASH = | 19612 |
| ADDITIONAL ELEC. USE AFTER COLD WASH = 19612 X .3 = | 5883.6 |
| ADDITIONAL ENERGY USE AFTER COLD WASH (MBTU) = | 20.08073 |
| ADDITIONAL $ COST= | 259.40 |

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007 COLD WATER LAUNDERING
FISCAL YEAR: 1989 ECO #,s 27
ANALYSIS DATE: ECON LIFE 25

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 132 | |
| B. | SIOH | 0 | |
| C. | DESIGN COST | 0 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 119 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 119 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | -20 | -259 | 11.16 | -2895 | |
| B. | DIST | 4.34 | 0 | 0 | 17.19 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 17.12 | 0 | |
| D. | LPG | 3.27 | 2098 | 6860 | 16.15 | 110796 | |
| E. | WOOD | 2.00 | 0 | 0 | 13.47 | 0 | |
| F. | TOTAL | | 2078 | 6601 | | | 107902 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

| | | |
|---|---|---|
| A. | ANNUAL RECURRING | 0 |
| | (1) DISCOUNT FACTOR (TABLE A) * | 11.65 |
| | (2) DISCOUNTED SAVINGS/COST (3A X 3A1) | 0 |

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST 0

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33) 35608
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE)) 6601

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C) 107902

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F) 908.26

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

## COST ESTIMATE ANALYSIS

For use of this form, see TM 5 800-2; the proponent agency is USACE.

| | | | |
|---|---|---|---|
| PROJECT COLD WATER LAUNDERING | INVITATION/CONTRACTOR | EFFECTIVE PRICING DATE | DATE PREPARED 26 MAY 89 |
| LOCATION FORT LEONARD WOOD | CODE (Check one) ☐ A ☐ B ☐ C ☐ OTHER ______ | DRAWING NO. | SHEET 1 OF 1 SHEETS |
| | | ESTIMATOR | CHECKED BY |

| ECO # 27 | QUANTITY | | LABOR | | | | EQUIPMENT | | MATERIAL | | | SHIPPING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TASK DESCRIPTION | NO. OF UNITS | UNIT MEAS | MH UNIT | TOTAL HRS | UNIT PRICE | COST | UNIT PRICE | COST | UNIT PRICE | COST | TOTAL | UNIT WT | TOTAL WT |
| MODIFY CONTROLS ON | 4 | MHRS | | 4 | 33- | 132- | | | | | 132- | | |
| ONE 600 lb WASHER | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
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| TOTAL THIS SHEET | | | | | | | | | | | | | |

DA FORM 5418-R, Apr 85

ECO # 31

DESCRIPTION: TURN OFF STEAM WHEN NOT REQUIRED

SAVINGS POTENTIAL: DURING CERTAIN HOURS OF THE YEAR STEAM BOILERS OPERATE JUST TO MAINTAIN SYSTEM PRESSURE WHEN THERE IS NO ACTUAL DEMAND FOR STEAM. BOILERS CAN BE TURNED OFF DURING THOSE HOURS AND FUEL CONSUMPTION WILL BE REDUCED.

A: ESTIMATED SAVINGS

POTENTIAL SAVINGS WERE BASED UPON THE FOLLOWING CONDITIONS:

BOILERS ARE ASSUMED TO CYCLE ON FOR 5% OF THE TIME WHEN THERE IS NO ACTUAL DEMAND FOR STEAM.

NO SPACE HEATING IS REQUIRED WHEN OUTSIDE TEMPERATURES ARE ABOVE 62 DEGREES FAHRENHEIT.

THERE ARE 100 DAYS EACH YEAR WHEN THE BOILERS WILL OPERATE AN ADDITIONAL 30 MINUTES PER DAY TO REGAIN OPERATING PRESSURE.

HOURS OF REQUIRED BOILER OPERATION ARE ESTIMATED FROM THE FOLLOWING BIN FILE

| | |
|---|---|
| TOTAL # OF HOURS HEATING IS NOT REQUIRED = | 3332 |
| HOURS HEATING NOT REQUIRED BUT PROCESS HEAT IS = | 1432 |
| HOURS STEAM IS NOT REQUIRED = | 1900 |
| HOURS BOILERS CYCLE TO MAINTAIN PRESSURE = 1900 X .05 | 95 |
| FUEL INPUT (MBTU) = 17.2/.75 = | 23 |
| FUEL CONSUMED TO MAINTAIN PRESSURE = | 2179 MBTU |
| FUEL CONSUMED TO REBUILD PRESSURE = 100 X .5 X 21.5 | 1147 |
| TOTAL MBTU SAVINGS = | 1032 |
| TOTAL $ SAVINGS = | 3753.33 |

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007 SHUT OFF STEAM
FISCAL YEAR: 1989 ECO #,s 31
ANALYSIS DATE: ECON LIFE 25

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 9900 | |
| B. | SIOH | 0 | |
| C. | DESIGN COST | 0 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 8910 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 8910 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | 0 | 0 | 11.16 | 0 | |
| B. | DIST | 4.34 | 0 | 0 | 17.19 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 17.12 | 0 | |
| D. | LPG | 3.27 | 1147 | 3751 | 16.15 | 60574 | |
| E. | WOOD | 2.00 | 0 | 0 | 13.47 | 0 | |
| F. | TOTAL | | 1147 | 3751 | | | 60574 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

| | | |
|---|---|---|
| A. | ANNUAL RECURRING | 0 |
| | (1) DISCOUNT FACTOR (TABLE A) * | 11.65 |
| | (2) DISCOUNTED SAVINGS/COST (3A X 3A1) | 0 |

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST 0

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33) 19989
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE)) 3751

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C) 60574

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F) 6.80

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

## COST ESTIMATE ANALYSIS

For use of this form, see TM 5 800 2; the proponent agency is USACE.

| | |
|---|---|
| PROJECT | SHUT OFF STEAM DURING NON-USE |
| LOCATION | FORT LEONARD WOOD |
| INVITATION/CONTRACTOR | |
| CODE *(Check one)* | ☐ A ☐ B ☐ C ☐ OTHER ____ |
| EFFECTIVE PRICING DATE | |
| DRAWING NO. | |
| ESTIMATOR | |
| DATE PREPARED | 26 MAY 89 |
| SHEET | 1 OF 1 SHEETS |
| CHECKED BY | |

ECO # 31

| TASK DESCRIPTION | QUANTITY | | LABOR | | | | EQUIPMENT | | MATERIAL | | TOTAL | SHIPPING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NO. OF UNITS | UNIT MEAS | MH UNIT | TOTAL HRS | UNIT PRICE | COST | UNIT PRICE | COST | UNIT PRICE | COST | | UNIT WT | TOTAL WT |
| SHUT OFF STEAM | 300 | MHRS | | 300 | 33- | 9900- | | | | | 9900- | | |
| TOTAL THIS SHEET | | | | | | | | | | | | | |

DA FORM 5418-R, Apr 85

| 1. COMPONENT<br>ARMY | FY 19 91 MILITARY CONSTRUCTION PROJECT DATA | 2. DATE<br>MARCH, 1991 |
|---|---|---|

| 3. INSTALLATION AND LOCATION | 4. PROJECT TITLE |
|---|---|
| FORT LEONARD WOOD, MISSOURI | WINDOW, DOOR & HOT WATER MODIFICATIONS (QRIP) |

| 5. PROGRAM ELEMENT | 6. CATEGORY CODE | 7. PROJECT NUMBER | 8. PROJECT COST ($000) |
|---|---|---|---|
| | | | 6.5 |

9. COST ESTIMATES

| ITEM | U/M | QUANTITY | UNIT COST | COST ($000) |
|---|---|---|---|---|
| CAULK WINDOWS | LF | 5514 | .87 | 4.797 |
| MODIFY HOT WATER CONTROLS | HRS | 4 | 35 | .132 |
| AIR CURTAIN (PVC CLOSURE STRIPS) | EA | 2 | 474 | .948 |
| SUBTOTAL | | | | 5.877 |
| SIOH (5%) | | | | .294 |
| DESIGN (6%) | | | | .353 |
| TOTAL REQUEST (FY 91) | | | | 6.524 |

10. DESCRIPTION OF PROPOSED CONSTRUCTION

THIS PROJECT CONSIST OF THREE SEPARATE ENERGY CONSERVATION OPPORTUNITIES FOR THE LAUNDRY FACILITY (BUILDING 2352).

THE WORK CONSIST OF:

CAULKING AROUND CRACKS IN 581 EXISTING WINDOWS.

REDUCING HOT WATER TEMPERTAURES FOR WASH CYCLES.

INSTALLING PVC STRIP CLOSURES ON TWO LOADING DOCK DOORS.



**FOR OFFICIAL USE ONLY**

*(WHEN DATA IS ENTERED)*

11. QUANTITATIVE DATA, JUSTIFICATION AND ADDITIONAL DATA

11.A - 0 -

11.B thru 11.K NOT APPLICABLE

11.L PROJECT

CAULK AROUND CRACKS ON 581 WINDOWS, LOWERING HOT WATER TEMPERATURES AND INSTALLING PVC STIP ENCLOSURES ON TWO LOADING DOCK DOORS.

11.M REQUIREMENTS

INSTALLATION OF PVC CLOSURES AND WINDOW CAULKING WILL REDUCE INFILTRATION OF OUTSIDE AIR INTO THE LAUNDRY FACILITY. LOWERING HOT WATER TEMPERATURE REQUIREMENTS WILL REDUCE ENERGY NEEDED FOR PROCESS HOT WATER.

11.N CURRENT SITUATION

THE INFILTRATION OF OUTSIDE AIR CAUSES SPACE HEATERS TO OPERATE LONGER THAN NECESSARY DURING WINTER MONTHS. HOT WATER IS CURRENTLY SUPPLIED AT 160 DEGREES FAHRENHEIT TO ALL WASHERS WHEN ONLY 15% OF WASH CYCLES ACTUALLY REQUIRE THIS TEMPERATURE.

11.O IMPACT IF NOT PROVIDED

IF THIS PROJECT IS NOT APPROVED, FUEL REQUIREMENT REDUCTIONS AFFORDED BY THIS PROJECT WILL NOT BE REALIZED. THIS PROJECT WILL CONTRIBUTE ITS SMALL SHARE TO A REDUCED NATIONAL REQUIREMENT FOR FOREIGN OIL.

11.P ADDITIONAL

A FORMAL ECONOMIC ANALYSIS HAS BEEN PREPARED. SEE SRP-1 FOR DETAILED INFORMATION.

PER ECIP CRITERIA, ANNUAL SAVINGS ARE AS FOLLOWS:

| | | |
|---|---|---|
| LP GAS | | 1632 MBTU/YR |
| ELECTRICITY | | 0 MBTU/YR |
| ANNUAL ENERGY SAVINGS | $5,337 | |
| SAVING INVESTMENT RATION (SIR) | 15 | |
| SIMPLE AMORTIZATION | 1.10 YEARS | |

CONSTRUCTION COSTS HAVE BEEN PROJECTED USING THE TRI-SERVICE MILITARY CONSTRUCTION PROGRAM INDICES OF 4.0% FOR FY-89 AND 3.7% FOR FY-90.

THIS PROJECT IS A RESULT OF EEAP/ESOS STUDY DACA41-89-D0007.

DETAILED JUSTIFICATION

D-1 GENERAL

THIS PROJECT IS NECESSARY TO SUPPORT THE ARMY'S EFFORT TO REDUCE ENERGY CONSUMPTION. THE PROJECT COMPRISES OF CAULKING WINDOWS, LOWERING HOT WATER TEMPERATURES AND INSTALLING PVC STRIP CLOSURES AT OVERHEAD DOORS.

WINDOW CRACKS AND OVERHEAD DOORS ALLOW AIR TO INFILTRATE INTO THE LAUNDRY FACILITY. ALL HOT WATER IS SUPPLIED AT 160 DEGREES WHEN ONLY 15% NEEDS TO BE AT THAT TEMPERATURE.

D-3 ANALYSIS OF DEFICIENCY

INFILTRATION OF UNTEMPERED OUTSIDE AIR CAUSES SPACE HEATERS TO OPERATE LONGER THAN NECESSARY. DOOR OPENINGS AND WINDOW CRACKS CONTRIBUTE TO THIS PROBLEM. ELEVATED HOT WATER TEMPERATURES REDUCE OVERALL SYSTEM EFFICIENCY.

D-4 CONSIDERATION OF ALTERNATIVES

AIR INFILTRATION

FORCED AIR TYPE CURTAINS AND REDUCTION IN WINDOW AREAS WERE CONSIDERED BUT PROVED TO INVOLVE TO HIGH OF CONSTRUCTION COSTS.

HOT WATER TEMPERATURES

COLD WATER LAUNDERING WAS CONSIDERED BUT UNCERTAINLY OF WASH QUALITY REMOVED THIS OPTION FROM CONSIDERATION.

D-5 CRITERIA FOR PROPOSED CONSTRUCTION

THIS PROJECT IS PROPOSED TO FACILITATE ENERGY CONSERVATION AT FORT LEONARD WOOD.

ALL EQUIPMENT SELECTED FOR INSTALLATION WILL MEET OR EXCEED THOSE EFFICIENCIES INDICATED IN THE CALCULATIONS.

D-6 PROGRAM FOR RELATED FURNISHINGS AND EQUIPMENT

NO RELATED FURNISHINGS AND EQUIPMENT ARE INVOLVED IN THIS PROJECT. BUILDING INTERIOR FUNCTION IS NOT CHANGED BY THIS PROJECT.

D-7 DISPOSAL OF PRESENT ASSETS

NO EQUIPMENT WILL BE REMOVED UNDER THIS PROJECT WILL BE TURNED OVER TO THE POST PROPERTY DISPOSAL OFFICER.

D-8 SURVIVAL MEASURES

THIS PROJECT IS NOT SUITABLE FOR INCLUSION OF PROTECTIVE SHELTER.

D-9 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

THIS PROJECT SHOULD HAVE NO IMPACT ON AIR OR WATER POLLUTION AT FORT LEONARD WOOD. THESE SHOULD BE NO NEGATIVE IMPACT ON THE QUALITY OF HUMAN ENVIRONMENT.

D-10 EVALUATION OF FLOOD HAZARDS

THESE FACILITIES ARE NOT SITED WITHIN AREAS KNOWN TO BE SUBJECT TO FLOODING.

D-11 ECONOMIC JUSTIFICATION

THIS PROJECT IS PART OF THE ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP). AN ECONOMIC ANALYSIS HAS BEEN PREPARED TO SHOW THAT THIS PROJECT MEETS ALL ECIP CRITERIA. AN ECONOMIC ANALYSIS CONFORMING TO ECIP GUIDELINES MAY BE FOUND IN SPR-1.

D-12 UTILITY AND COMMUNICATION SUPPORT

NO RELATED UTILITY SUPPORT PROJECTS ARE NEEDED. EXISTING UTILITY SUPPORT IS ADEQUATE.

D-13 PROTECTION OF HISTORIC PLACES AND ARCHAEOLOGICAL SITES

NO BUILDINGS AT FORT LEONARD WOOD ARE ON THE NATIONAL REGISTER OF HISTORIC PLACES. THE ENTIRE FORT IS ON AN ARCHAEOLOGICAL SITE.

THIS PROJECT WILL HAVE NO EFFECT UPON THE ARCHAEOLOGICAL SITE.

D-14 PROJECT DEVELOPMENT BROCHURE (PDB)

A PROJECT DEVELOPMENT BROCHURE HAS BEEN PREPARED FOR THIS PROJECT AND HAS BEEN PROVIDED AS AN ATTACHMENT.

D-15 ENERGY REQUIREMENTS

THE PROPOSED PROJECT WILL REDUCE THE ENERGY REQUIRED BY AFFECTED FACILITIES BY 1632 MBTU/YR OF LP GAS.

SEE ENERGY REQUIREMENT APPRAISAL IN SRP-3.

ARMY FY 1991 MILITARY CONSTRUCTION PROJECT DATA MAR 1991
FORT LEONARD WOOD, MISSOURI
WINDOW, DOOR & HOT WATER MODIFICATIONS (QRIP)

SPECIAL REQUIREMENTS PARAGRAPHS (SRP)

SRP-1 ECONOMIC ANALYSIS

I. NONRECURRING INITIAL CAPITAL COSTS

| | |
|---|---|
| CAULK WINDOWS | 4,797 |
| MODIFY HOT WATER CONTROLS | 132 |
| INSTALL PVC STRIP CLOSURES | 948 |
| TOTAL CONSTRUCTION COST | 5,877 |
| SIOH (5.5%) | 294 |
| DESIGN (6%) | 353 |
| TOTAL REQUEST (FY89) | $6,524 |

II. RECURRING ENERGY SAVINGS

INSTALLATION COSTS FROM MEANS HANDBOOK.

ENERGY COST DATA IS FROM ECIP GUIDANCE FOR LIFE CYCLE COST ANALYSIS. REGIONAL COSTS ARE SPECIFIED RATHER THAN ACTUAL INSTALLATION COSTS.

A. LIQUID PETROLEUM (LP) GAS

MBTU SAVED = 1632 MBTU/YR

$$\text{GALLONS SAVED} = \frac{7261.5\ \text{MBTU/YR}}{95{,}000\ \text{BTU/GAL}} = 17{,}179\ \text{GAL/YR}$$

\$ SAVED = 17,179 GAL/YR X 0.3106 \$/GAL
= 5,337

SRP-2 COMMERCIAL ACTIVITIES ANALYSIS, NOT APPLICABLE

## SRP-3 ENERGY REQUIREMENTS APPRAISAL (ERA)

### I. PROJECT DESCRIPTION

THIS PROJECT IS TO INSTALL A PACKAGED HEAT RECOVERY UNIT, A GAS FIRED HOT WATER HEATER WITH STORAGE TANK, TWO GAS FIRED (220 LB) DRYERS, AND ACCOMPLISH LIGHTING MODIFICATIONS.

### II. ESTIMATED ENERGY CONSUMPTION

THIS PROJECT WILL DECREASE (-) CONSUMPTION OF RESOURCES BY THE FOLLOWING AMOUNTS:

| | | |
|---|---|---|
| 1. | ELECTRICITY | 0 KWH/YR |
| 2. | LP GAS | 1,632 MBTU/YR |
| 3. | ELECTRICAL DEMAND | MINIMAL |
| 4. | WATER SUPPLY | - 0 - |
| 5. | SEWERAGE | - 0 - |
| 6. | OTHER | - 0 - |

THIS PROJECT WILL HAVE NO AFFECT ON THE CAPACITY OF THE FOLLOWING DELIVERY SYSTEMS.

1. HEATING
2. AIR CONDITIONING
3. ELECTRICAL POWER
4. WATER SUPPLY

THE NEW IMPACT OF THIS PROJECT WILL BE THE REDUCTION OF REQUIRED HEATING AND ELECTRICAL ENERGY. THIS SAVINGS IS COMPATIBLE WITH THE ARMY DIRECTIVE TO REDUCE THE TOTAL ENERGY USE.

### III. ENERGY SAVINGS CALCULATIONS

ENERGY SAVINGS WERE CALCULATED FOR EACH BUILDING AND ECO COMBINATION COMPRISING THIS PROJECT. A SUMMARY OF THE SAVINGS FOR INDIVIDUAL ECO'S ARE INCLUDED WITHIN THIS SECTION.

THE ATTACHED SAMPLE CALCULATION SHEETS WERE USED TO CALCULATE THE INDIVIDUAL SAVINGS. EACH SAMPLE CALCULATION PAGE INCLUDES SOURCE DOCUMENTATION.

ECO # 3

DESCRIPTION: CAULK & SEAL WINDOWS

SAVINGS POTENTIAL: CAULKING AND SEALING OF WINDOWS WILL REDUCE THE AMOUNT OF OUTSIDE AIR INFILTRATING INTO THE BUILDING. REDUCTION OF INFILTRATION WILL ALSO REDUCE BUILDING HEAT LOADS AND TOTAL FUEL CONSUMPTION.

A: ESTIMATED SAVINGS

POTENTIAL SAVINGS WERE BASED UPON THE FOLLOWING CONDITIONS:

| # OF WINDOWS | CRACK LENGTH |
|---|---|
| 486 | 9 |
| 95 | 12 |

AVERAGE CRACK LENGTH = 9.5 FEET

INFILTRATION (CFM) = Q/P X P

Q/P = INFILTRATION PER FOOT OF CRACK
P = PERIMETER OF CRACK

FROM ASHRAE TABLE 5.6 LOAD MANUAL

Q/P = .25 TIGHT FITTING WINDOW
Q/P = .5 AVERAGE FITTING WINDOW

CFM PER WINDOW = .5 X 9.5 = 5
CFM PER WINDOW = .25 X 9.5 = 2

HEAT LOSS PER DEGREE

Q = 1.08 CFM DELTA T

Q = 5.13 DELTA T AVERAGE FITTING WINDOW
Q = 2.57 DELTA T TIGHT FITTING WINDOW

THE HEAT LOSS PER DEGREE WAS USED IN THE FOLLOWING BIN CALCULATIONS TO DETERMINE THE ANNUAL HEAT LOSS PER WINDOW FOR TIGHT AND AVERAGE FITS.

| | |
|---|---|
| ENERGY LOSS AVERAGE FIT = | 1027368 |
| ENERGY LOSS TIGHT FIT = | 514685 |
| SAVINGS PER WINDOW = | 512683 |
| # OF WINDOWS = | 581 |
| TOTAL ENERGY SAVINGS (MBTU) | 298 |
| TOTAL $ SAVINGS = | 975.13 |

ECO # 17

DESCRIPTION: LOWER HOT WATER SUPPLY TEMPERATURE

SAVINGS POTENTIAL: HOT WATER IS CURRENTLY SUPPLIED AT A TEMPERATURE OF 160 DEGREES FAHRENHEIT. THIS TEMPERATURE WATER MAKES UP ONLY 15% OF TOTAL HOT WATER REQUIREMENTS. THE REMAINING HOT WATER CAN BE SUPPLIED AT A LOWER TEMP. REDUCING HOT WATER SUPPLY TEMPERATURE WILL REDUCE DISTRIBUTION LOSSES AND OVERALL HOT WATER HEATING LOAD.

A: ESTIMATED SAVINGS

SAVINGS ESTIMATES ARE BASED UPON THE FOLLOWING CONDITIONS:

EXISTING HOT WATER USE AT 160 DEG = 6625000 GALS

% OF HOT WATER AT DIFF TEMPERATURES AS FOLLOWS:

| | | | |
|---|---|---|---|
| 120 DEG | ----- | .05 | 5% |
| 130 DEG | ----- | .26 | 26% |
| 140 DEG | ----- | .13 | 13% |
| 150 DEG | ----- | .41 | 41% |
| 160 DEG | ----- | .15 | 15% |
| | | 1 | 100% |

EXISTING ENERGY USE FOR HOT WATER

$$\text{MBTU} = \frac{\text{GALLONS HOT WATER} \times 8.33 \times \text{DELTA T}}{1{,}000{,}000}$$

GALLONS HOT WATER = 6565600
DELTA T = 100
MBTU = 5469.145 NOT ACCOUNTING FOR PLANT EFFICIENCY
MBTU = 7292.193 USING 75% PLANT EFF.

---

ENERGY USE TO HEAT TO 140 DEG
GALLONS HOT WATER = 6565600
DELTA T = 80
MBTU = 4375.316 NOT ACCOUNTING FOR PLANT EFFICIENCY
MBTU = 5833.754 USING 75% PLANT EFF.

ENERGY USE TO HEAT TO 150 DEG
GALLONS HOT WATER = 6565600 * .41 = 2691896
DELTA T = 10
MBTU = 224.2349
MBTU = 298.9799

ENERGY USE TO HEAT TO 160 DEG
GALLONS HOT WATER = 6565600 * .15 = 984840
DELTA T = 20
MBTU = 164.0743
MBTU = 218.7658

TOT. ENERGY USE WITH
140 DEG & REHEAT = 6351.500

TOTAL SAVINGS (MBTU) = 940.6929
TOTAL $ SAVINGS = 3079.23

ECO # 21

DESCRIPTION: INSTALL AIR CURTAIN AT LOADING DOCK AREA.

SAVINGS POTENTIAL: AN AIR CURTAIN CONSISTING OF CLEAR VINYL STRIPS WILL REDUCE THE AMOUNT OF OUTSIDE AIR INFILTRATING INTO THE BUILDING. REDUCTION OF AIR INFILTRATION WILL REDUCE THE BUILDINGS HEATING LOAD.

A: ESTIMATED SAVINGS

THE FOLLOWING SPREAD SHEETS USE THE BIN METHOD TO ESTIMATE EXISTING AIR INFILTRATION AND HEAT LOAD DUE TO INFILTRATION AS WELL AS INFILTRATION AND HEAT LOAD WITH AN AIR CURTAINS INSTALLED.

| | | |
|---|---|---|
| EXISTING HEAT LOAD DUE TO INFILTRATION = | 416 | MBTU |
| HEAT LOAD WITH AIR CURTAIN = | 23 | MBTU |
| SAVINGS MBTU = | 393 | MBTU |
| $ SAVINGS AT 3.27 PER MBTU | 1286.01 | |

INFILTRATION LOSSES THRU OVERHEAD DOOR
(WITH AIR CURTAIN INSTALLED)

| -A- | -B- | -C- | -D- | -E- | -F- | -G- | -H- | -I- | -J- | -K- | -L- | -M- | -N- | -O- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 102 | 44 | .005 | .22 | 120 | 50 | 500 | 0 | . | 0 | 2 | 2 | 0 | 0 | 0 |
| 97 | 44 | .005 | .22 | 120 | 50 | 500 | 0 | 0 | 0 | 22 | 18 | 0 | 0 | 0 |
| 92 | 44 | .005 | .22 | 120 | 50 | 500 | 0 | 0 | 0 | 94 | 75 | 0 | 0 | 0 |
| 87 | 44 | .005 | .22 | 120 | 50 | 500 | 0 | 0 | 0 | 262 | 157 | 0 | 0 | 0 |
| 82 | 44 | .005 | .22 | 120 | 50 | 500 | 0 | 0 | 0 | 474 | 306 | 0 | 0 | 0 |
| 77 | 44 | .005 | .22 | 120 | 50 | 500 | 0 | 0 | 0 | 675 | 307 | 0 | 0 | 0 |
| 72 | 44 | .005 | .22 | 120 | 50 | 500 | 0 | 0 | 0 | 902 | 280 | 0 | 0 | 0 |
| 67 | 44 | .005 | .22 | 120 | 50 | 500 | 5 | 1.188 | 2700 | 900 | 247 | 1069.2 | 666900 | 667969.2 |
| 62 | 44 | .005 | .22 | 120 | 50 | 500 | 10 | 2.376 | 5400 | 794 | 212 | 1886.544 | 1144800 | 1146686.544 |
| 57 | 44 | .005 | .22 | 120 | 50 | 500 | 15 | 3.564 | 8100 | 706 | 195 | 2516.184 | 1579500 | 1582016.184 |
| 52 | 44 | .005 | .22 | 120 | 50 | 500 | 20 | 4.752 | 10800 | 642 | 186 | 3050.784 | 2008800 | 2011850.784 |
| 47 | 44 | .005 | .22 | 120 | 50 | 500 | 25 | 5.94 | 13500 | 557 | 165 | 3308.58 | 2227500 | 2230808.58 |
| 42 | 44 | .005 | .22 | 120 | 50 | 500 | 30 | 7.128 | 16200 | 593 | 172 | 4226.904 | 2786400 | 2790626.904 |
| 37 | 44 | .005 | .22 | 120 | 50 | 500 | 35 | 8.316 | 18900 | 565 | 156 | 4698.54 | 2948400 | 2953098.54 |
| 32 | 44 | .005 | .22 | 120 | 50 | 500 | 40 | 9.504 | 21600 | 583 | 161 | 5540.832 | 3477600 | 3483140.832 |
| 27 | 44 | .005 | .22 | 120 | 50 | 500 | 45 | 10.692 | 24300 | 396 | 105 | 4234.032 | 2551500 | 2555734.032 |
| 22 | 44 | .005 | .22 | 120 | 50 | 500 | 50 | 11.88 | 27000 | 286 | 72 | 3397.68 | 1944000 | 1947397.68 |
| 17 | 44 | .005 | .22 | 120 | 50 | 500 | 55 | 13.068 | 29700 | 156 | 33 | 2038.608 | 980100 | 982138.608 |
| 12 | 44 | .005 | .22 | 120 | 50 | 500 | 60 | 14.256 | 32400 | 78 | 16 | 1111.968 | 518400 | 519511.968 |
| 7 | 44 | .005 | .22 | 120 | 50 | 500 | 65 | 15.444 | 35100 | 40 | 7 | 617.76 | 245700 | 246317.76 |
| 2 | 44 | .005 | .22 | 120 | 50 | 500 | 70 | 16.632 | 37800 | 18 | 3 | 299.376 | 113400 | 113699.376 |
| -3 | 44 | .005 | .22 | 120 | 50 | 500 | 75 | 17.82 | 40500 | 7 | 1 | 124.74 | 40500 | 40624.74 |
| -8 | 44 | .005 | .22 | 120 | 50 | 500 | 80 | 19.008 | 43200 | 2 | 0 | 38.016 | 0 | 38.016 |
| | | | | | | | | | | | | 38159.748 | 23233500 | 23271659.75 |

ENERGY USE (MBTU) = 23.27165975

-A- OUTSIDE TEMP
-B- CRACK LENGTH (FT)
-C- INFILTRATION PER FT OF CRACK (CFM)
-D- TOTAL INFILTRATION THRU CRACK
-E- DOOR AREA (SF)
-F- VELOCTIY THRU OPEN DOOR (FPM)
-G- INFILTRATION THRU OPEN DOOR (CFM) BASED ON OPEN 5 MIN/HR
-H- TEMPERATURE DIFFERENCE BETWEEN OUTSIDE & INSIDE
-I- HEAT LOSS THRU CRACK INFILTRATION (BTUH)
-J- HEAT LOSS THRU OPEN DOOR (BTUH)
HOURS AT OUTSIDE TEMP. -A- FOR LOSSES THRU CRACK
HOURS AT OUTSIDE TEMP. -A- FOR LOSSES THRU OPEN DOOR
-M- TOTAL HEAT LOSS THRU CRACK (MBTU)
-N- TOTAL HEAT LOSS THRU OPEN DOOR (MBTU)
-O- TOTAL HEAT LOSS THRU OPEN DOOR & CRACK (MBTU)

INFILTRATION LOSSES THRU OVERHEAD DOOR

| -A- | -B- | -C- | -D- | -E- | -F- | -G- | -H- | -I- | -J- | -K- | -L- | -M- | -N- | -O- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 102 | 44 | .02 | .88 | 120 | 895 | 8950 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 |
| 97 | 44 | .02 | .88 | 120 | 895 | 8950 | 0 | 0 | 0 | 22 | 18 | 0 | 0 | 0 |
| 92 | 44 | .02 | .88 | 120 | 895 | 8950 | 0 | 0 | 0 | 94 | 75 | 0 | 0 | 0 |
| 87 | 44 | .02 | .88 | 120 | 895 | 8950 | 0 | 0 | 0 | 262 | 197 | 0 | 0 | 0 |
| 82 | 44 | .02 | .88 | 120 | 895 | 8950 | 0 | 0 | 0 | 474 | 306 | 0 | 0 | 0 |
| 77 | 44 | .02 | .88 | 120 | 895 | 8950 | 0 | 0 | 0 | 676 | 307 | 0 | 0 | 0 |
| 72 | 44 | .02 | .88 | 120 | 895 | 8950 | 0 | 0 | 0 | 902 | 260 | 0 | 0 | 0 |
| 67 | 44 | .02 | .88 | 120 | 895 | 8950 | 5 | 4.752 | 48330 | 900 | 247 | 4276.8 | 11937510 | 11941786.8 |
| 62 | 44 | .02 | .88 | 120 | 895 | 8950 | 10 | 9.504 | 96660 | 794 | 212 | 7545.176 | 20491920 | 20499466.18 |
| 57 | 44 | .02 | .88 | 120 | 895 | 8950 | 15 | 14.256 | 144990 | 706 | 195 | 10064.736 | 28273050 | 28283114.74 |
| 52 | 44 | .02 | .88 | 120 | 895 | 8950 | 20 | 19.008 | 193320 | 642 | 186 | 12203.136 | 35957520 | 35969723.14 |
| 47 | 44 | .02 | .88 | 120 | 895 | 8950 | 25 | 23.76 | 241650 | 557 | 165 | 13234.32 | 39872250 | 39885484.32 |
| 42 | 44 | .02 | .88 | 120 | 895 | 8950 | 30 | 28.512 | 289980 | 593 | 172 | 16907.616 | 49876560 | 49893467.62 |
| 37 | 44 | .02 | .88 | 120 | 895 | 8950 | 35 | 33.264 | 338310 | 565 | 156 | 18794.16 | 52776360 | 52795154.16 |
| 32 | 44 | .02 | .88 | 120 | 895 | 8950 | 40 | 38.016 | 386640 | 583 | 161 | 22163.328 | 62249040 | 62271203.33 |
| 27 | 44 | .02 | .88 | 120 | 895 | 8950 | 45 | 42.768 | 434970 | 396 | 105 | 16936.128 | 45671850 | 45688786.13 |
| 22 | 44 | .02 | .88 | 120 | 895 | 8950 | 50 | 47.52 | 483300 | 286 | 72 | 13590.72 | 34797600 | 34811190.72 |
| 17 | 44 | .02 | .88 | 120 | 895 | 8950 | 55 | 52.272 | 531630 | 156 | 33 | 8154.432 | 17543790 | 17551944.43 |
| 12 | 44 | .02 | .88 | 120 | 895 | 8950 | 60 | 57.024 | 579960 | 78 | 16 | 4447.872 | 9279360 | 9283807.872 |
| 7 | 44 | .02 | .88 | 120 | 895 | 8950 | 65 | 61.776 | 628290 | 40 | 7 | 2471.04 | 4398030 | 4400501.04 |
| 2 | 44 | .02 | .88 | 120 | 895 | 8950 | 70 | 66.528 | 676620 | 18 | 3 | 1197.504 | 2029860 | 2031057.504 |
| -3 | 44 | .02 | .88 | 120 | 895 | 8950 | 75 | 71.28 | 724950 | 7 | 1 | 498.96 | 724950 | 725448.96 |
| -8 | 44 | .02 | .88 | 120 | 895 | 8950 | 80 | 76.032 | 773280 | 2 | 0 | 152.064 | 0 | 152.064 |
| | | | | | | | | | | | | 152638.992 | 415879650 | 416032289.0 |

ENERGY USE (MBTU) = 416.0322890

-A- OUTSIDE TEMP
-B- CRACK LENGTH (FT)
-C- INFILTRATION PER FT OF CRACK (CFM)
-D- TOTAL INFILTRATION THRU CRACK
-E- DOOR AREA (SF)
-F- VELOCTIY THRU OPEN DOOR (FPM)
-G- INFILTRATION THRU OPEN DOOR (CFM) BASED ON OPEN 5 MIN/HR
-H- TEMPERATURE DIFFERENCE BETWEEN OUTSIDE & INSIDE
-I- HEAT LOSS THRU CRACK INFILTRATION (BTUH)
-J- HEAT LOSS THRU OPEN DOOR (BTUH)
-K- HOURS AT OUTSIDE TEMP. -A- FOR LOSSES THRU CRACK
-L- HOURS AT OUTSIDE TEMP. -A- FOR LOSSES THRU OPEN DOOR
TOTAL HEAT LOSS THRU CRACK (MBTU)
TOTAL HEAT LOSS THRU OPEN DOOR (MBTU)
-O- TOTAL HEAT LOSS THRU OPEN DOOR & CRACK (MBTU)

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO    REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007    CAULKING & SEALING
FISCAL YEAR: 1989    ECO #,s 3
ANALYSIS DATE:    ECON LIFE 8

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 4797 | |
| B. | SIOH | 264 | |
| C. | DESIGN COST | 288 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 4814 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 4814 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | 0 | 0 | 5.74 | 0 | |
| B. | DIST | 4.34 | 0 | 0 | 7.18 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 6.79 | 0 | |
| D. | LPG | 3.27 | 298 | 974 | 6.75 | 6578 | |
| E. | WOOD | 2.00 | 0 | 0 | 6.41 | 0 | |
| F. | TOTAL | | 298 | 974 | | | 6578 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

| | | |
|---|---|---|
| A. | ANNUAL RECURRING | 0 |
| | (1) DISCOUNT FACTOR (TABLE A) * | 5.97 |
| | (2) DISCOUNTED SAVINGS/COST (3A X 3A1) | 0 |

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST    0

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33)    2171
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE))    974

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C)    6578

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F)    1.37

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO    REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007    LOWER HW TEMPERATURE
FISCAL YEAR: 1989    ECO #,s 17
ANALYSIS DATE:    ECON LIFE 25

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 132 | |
| B. | SIOH | 0 | |
| C. | DESIGN COST | 0 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 119 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 119 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|
| A. ELEC | 12.97 | 0 | 0 | 11.16 | 0 | |
| B. DIST | 4.34 | 0 | 0 | 17.17 | 0 | |
| C. RESD | 3.49 | 0 | 0 | 17.12 | 0 | |
| D. LPG | 3.27 | 941 | 3077 | 16.15 | 49695 | |
| E. WOOD | 2.00 | 0 | 0 | 13.47 | 0 | |
| F. TOTAL | | 941 | 3077 | | | 49695 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

| | | |
|---|---|---|
| A. ANNUAL RECURRING | 0 | |
| (1) DISCOUNT FACTOR (TABLE A) * | 11.65 | |
| (2) DISCOUNTED SAVINGS/COST (3A X 3A1) | 0 | |

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST    0

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33)    16399
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE))    3077

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C)    49695

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F)    418.31

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007 INSTALL PVC CLOSURE STRIPS
FISCAL YEAR: 1989 ECO #,s 21
ANALYSIS DATE: ECON LIFE 8

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 795 | |
| B. | SIOH | 40 | |
| C. | DESIGN COST | 48 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 794 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 794 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | 0 | 0 | 5.74 | 0 | |
| B. | DIST | 4.34 | 0 | 0 | 7.18 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 6.79 | 0 | |
| D. | LPG | 3.27 | 393 | 1285 | 6.75 | 8674 | |
| E. | WOOD | 2.00 | 0 | 0 | 6.41 | 0 | |
| F. | TOTAL | | 393 | 1285 | | | 8674 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

A. ANNUAL RECURRING 0
(1) DISCOUNT FACTOR (TABLE A) * 5.97
(2) DISCOUNTED SAVINGS/COST (3A X 3A1) 0

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST 0

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33) 2863
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE)) 1285

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C) 8674

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F) 10.92

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007 WINDOW, DOOR & HW MOD.
FISCAL YEAR: 1989 ECO #,s 3, 17, &21
ANALYSIS DATE: ECON LIFE 25

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 5724 | |
| B. | SIOH | 315 | |
| C. | DESIGN COST | 343 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 5744 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 5744 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | 0 | 0 | 11.16 | 0 | |
| B. | DIST | 4.34 | 0 | 0 | 17.79 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 17.12 | 0 | |
| D. | LPG | 3.27 | 1632 | 5337 | 16.15 | 86187 | |
| E. | WOOD | 2.00 | 0 | 0 | 13.47 | 0 | |
| F. | TOTAL | | 1632 | 5337 | | | 86187 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

| | | |
|---|---|---|
| A. | ANNUAL RECURRING | 0 |
| | (1) DISCOUNT FACTOR (TABLE A) * | 11.65 |
| | (2) DISCOUNTED SAVINGS/COST (3A X 3A1) | 0 |

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST 0

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33) 28442
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE)) 5337

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C) 86187

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F) 15.00

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

## COST ESTIMATE ANALYSIS

For use of this form, see TM 5 800-2; the proponent agency is USACE.

| | | | |
|---|---|---|---|
| PROJECT: WINDOW CAULKING | INVITATION/CONTRACTOR | EFFECTIVE PRICING DATE | DATE PREPARED: 6·1·89 |
| | CODE *(Check one)* ☐ A ☐ B ☐ C | DRAWING NO. | SHEET 1 OF 1 SHEETS |
| LOCATION: FORT LEONARD WOOD | ☐ OTHER | ESTIMATOR | CHECKED BY |

ECO #3

| TASK DESCRIPTION | QUANTITY: NO. OF UNITS | QUANTITY: UNIT MEAS | LABOR: MH UNIT | LABOR: TOTAL HRS | LABOR: UNIT PRICE | LABOR: COST | EQUIPMENT: UNIT PRICE | EQUIPMENT: COST | MATERIAL: UNIT PRICE | MATERIAL: COST | TOTAL | SHIPPING: UNIT WT | SHIPPING: TOTAL WT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAULKING | 5514 | LF | | | .74 | 4080 | | | .13 | 717 | 4797 | | |
| TOTAL THIS SHEET | | | | | | | | | | | $4797 | | |

DA FORM 5418-R, Apr 85

## COST ESTIMATE ANALYSIS

For use of this form, see TM 5 800-2; the proponent agency is USACE.

| PROJECT | INVITATION/CONTRACTOR | EFFECTIVE PRICING DATE | DATE PREPARED |
|---|---|---|---|
| LOWER HOT WATER TEMP | CODE *(Check one)* ☐ A ☐ B ☐ C ☐ OTHER | DRAWING NO. | 26 MAY 89 |
| LOCATION: FORT LEONARD WOOD | | ESTIMATOR | SHEET 1 OF 1 SHEETS; CHECKED BY |

| TASK DESCRIPTION | QUANTITY | | LABOR | | | | EQUIPMENT | | MATERIAL | | TOTAL | SHIPPING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECO #17 | NO. OF UNITS | UNIT MEAS | MH UNIT | TOTAL HRS | UNIT PRICE | COST | UNIT PRICE | COST | UNIT PRICE | COST | | UNIT WT | TOTAL WT |
| MODIFY CONTROLS | 4 | HRS | | 4 | 33- | 132- | | | | | 132- | | |
| | | | | | | | | | | | | | |
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| TOTAL THIS SHEET | | | | | | | | | | | | | |

DA FORM 5418-R, Apr 85

## COST ESTIMATE ANALYSIS

For use of this form, see TM 5 800-2; the proponent agency is USACE.

PROJECT: INSTALL PVC STRIP CLOSURES

LOCATION: FORT LEONARD WOOD

INVITATION/CONTRACTOR:

CODE (Check one) ☐ A ☐ B ☐ C ☐ OTHER

EFFECTIVE PRICING DATE:

DRAWING NO.:

ESTIMATOR:

DATE PREPARED: 24 MAY 89

SHEET 1 OF 1 SHEETS

CHECKED BY:

ECO # 21

| TASK DESCRIPTION | QUANTITY | | LABOR | | | | EQUIPMENT | | MATERIAL | | TOTAL | SHIPPING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NO. OF UNITS | UNIT MEAS | MH UNIT | TOTAL HRS | UNIT PRICE | COST | UNIT PRICE | COST | UNIT PRICE | COST | | UNIT WT | TOTAL WT |
| PVC STRIPS | 2 | EA | 8 | 16 | 40 | 640- | 77 | 154- | 77 | 155- | $795- | | |
| 12' WIDE x 12' LONG | | | | | | | | | | | | | |
| TOTAL THIS SHEET | | | | | | | | | | | | | |

DA FORM 5418-R, Apr 85

**installation:** FORT LEONARD WOOD

**project:** ______

project number
temporary: ______ program year FY 91

permanent: ______ category code ______

**point of contact:**

user
name ______ date ______

title ______ phone ______

autovon ______

dfae
name ______ date ______

title ______ phone ______

autovon ______

engineer district
name ______ date ______

title ______ phone ______

autovon ______

other (A-E)
name ______ date ______

title ______ phone ______

autovon ______

**reviewed by:**

installation facility engineer
name ______ date ______

title ______ phone ______

autovon ______

**approved by:**

macom engineer
name ______ date ______

title ______ phone ______

autovon ______

## project development brochure, PDB-1

# facility

FORT LEONARD WOOD, MISSOURI

# project coordinator for using service

**functional requirements summary, PDB-1**

DA FORM 5020-1-R, Feb 82

OBJECTIVE:

THE PURPOSE OF THIS PROJECT IS TO REDUCE HEATING AND COOLING ENERGY CONSUMPTION AT FORT LEONARD WOOD. THIS MAY BE ACCOMPLISHED BY CAULKING WINDOWS, INSTALLING AN AIR CURTAIN AND LOWERING TEMPERATURES OF WAS WATER AT THE LAUNDRY FACILITY LOCATED IN BUILDING 2352.

LP GAS CONSUMPTION WILL BE REDUCED BY AN ESTIMATED 1632 MILLION BTU PER YEAR.

THE FIRST YEAR FUEL COST SAVINGS WILL BE ABOUT $5,337. THE SAVINGS INVESTMENT RATION FOR THIS PROJECT IS 15.0. THE SIMPLE PAYBACK IS 1.10 YEARS.

REQUIREMENTS:

THIS PROJECT IS REQUIRED TO REDUCE ENERGY CONSUMPTION AT FORT LEONARD WOOD, MISSOURI.

IMPACT SUMMARY:

IF THIS PROJECT IS APPROVED, AN ESTIMATED 1632 MBTU/YR WILL BE CONSERVED EACH YEAR. THIS WILL AMOUNT TO A COST SAVINGS OF $5,337.

IF THIS PROJECT IS NOT APPROVED, FORT LEONARD WOOD WILL NOT BE ABLE TO ACHIEVE THE POTENTIAL ENERGY SAVINGS THAT THIS PROJECT CAN PROVIDE.

**functional requirements summary, PDB-1**

DA FORM 5020-2-R, Feb 82

# facility

FORT LEONARD WOOD, MISSOURI

# project coordinator for using service

detailed functional requirements, PDB-2

DA FORM 5021-1-R, Feb 82

facilities requirements sketch, PDB- ½

DA FORM 5022-R, Feb 82

## A. SPECIAL CONSIDERATIONS

| | ITEM | Required or Not Required | * To Be Determined | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| A-1 | Cost estimates for each primary and supporting facility | R | | X | |
| A-2 | Telecommunications system coordination with USACC and authorization for exceptions | NR | | | |
| A-3 | Coordination with state and local governmental requirements (blind vendors, medical facilities, construction and operating permits, clearinghouse ccoordination, etc.) | NR | | | |
| A-4 | Assignment of airspace | NR | | | |
| A-5 | Economic analysis of alternatives | R | | X | |
| A-6 | Approval for new starts | NR | | | |
| A-7 | International balance of payments (IBOP) coordination with U.S. European command and NATO—overseas cost estimates and comparables (include rate of exchange used in estimates) | NR | | | |
| A-8 | Impact on historic places—on site survey by authorized archeologist and coordination with state historic preservation officer and advisory council on historic preservation | NR | | | |
| A-9 | Exceptions to established criteria | NR | | | |
| A-10 | Coordination with various staff agencies (Provost Marshall-physical security, etc.) | NR | | | |
| A-11 | Identification of related or support projects (so projects can be coordinated) | R | A | | |
| A-12 | Required completion date | R | A | | |
| | Other Special Considerations (List and number items) | | | | |
| A-13 | ENERGY CONSERVATION INVESTMENT PROGRAM | R | | X | |
| A-14 | ENERGY ENGINEERING - ANALYSIS PROGRAM | R | | X | |
| A-15 | INSTALLATION SCHEDULE | R | C | | |

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED – Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED – Significant information summarized or explained and attached.

DOCUMENT ATTACHED – Significant information is in an existing document which is attached.

* BY WHOM (Check and insert appropriate letter)

A – DFAE
B – Using Service
C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

# documentation checklist

DA FORM 5023-A-R, Feb 82

## B. SITE DEVELOPMENT

| | ITEM | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| B-1 | Consultation with the District Office to determine and evaluate flood plain hazards | NR | | | |
| B-2 | Preparation, submission, and/or approval of new | | | | |
| (A) | General Site Plan | NR | | | |
| (B) | Annotated General Site Plan | NR | | | |
| (C) | Sketch Site Plan | NR | | | |
| (D) | Facilities Requirements Sketch | NR | | | |
| B-3 | Preparation of | | | | |
| (A) | Site Survey | NR | | | |
| (B) | Subsoil information | NR | | | |
| B-4 | Approval by Department of Defense Explosive Safety Board (DDESB) for Safety Site Plan | NR | | | |
| | Other Site Development Considerations (List and number items) | | | | |

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED – Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED – Significant information summarized or explained and attached.

DOCUMENT ATTACHED – Significant information is in an existing document which is attached.

*BY WHOM (Check and insert appropriate letter)

A – DFAE
B – Using Service
C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

# documentation checklist

DA FORM 5023-B-R, Feb 82

## C. ARCHITECTURAL & STRUCTURAL

| | ITEM | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| C-1 | Reconciliation with troop housing programs and requirements | NR | | | |
| C-2 | Evaluation of existing facilities (including degree of utilization) | NR | | | |
| C-3 | Approval for removal and relocation of existing useable facilities | NR | | | |
| C-4 | Evaluation of off-post community facilities | NR | | | |
| C-5 | Storage and maintenance facilities (including nuclear weapons) | NR | | | |
| C-6 | Coordination hospitals, medical and dental facilities with Surgeon General | NR | | | |
| C-7 | Coordination of aviation facilities with FAA | NR | | | |
| C-8 | Coordination air traffic control and navigational aids with USACC | NR | | | |
| C-9 | Tabulation of types and numbers of aircraft | NR | | | |
| C-10 | Evaluation of laboratory, research and development, and technical maintenance facilities | NR | | | |
| C-11 | Coordination chapels with Chief of Chaplains | NR | | | |
| C-12 | Review food service facilities by USATSA | NR | | | |
| C-13 | Automated data processing system or equipment approvals—cost analysis when ADP and/or communication centers not co-located with related facilities | NR | | | |
| C-14 | Coordination postal facilities with U.S. Postal Service Regional Director | NR | | | |
| C-15 | Laundry and dry cleaning facilities coordination with ASD(I&L) | NR | | | |
| C-16 | Tenant facilities coordination with installation where sited | NR | | | |
| C-17 | Facilities for or exposed to explosions, toxic chemicals, or ammunition—review by DDESB (See also Item B-4) | NR | | | |
| C-18 | Analysis of deficiencies | R | | X | |
| C-19 | Consideration of alternatives | R | | X | |
| C-20 | Determination whether occupants will include physically handicapped or disabled persons | NR | | | |
| C-21 | As-build drawings for alterations or additions | NR | | | |
| C-22 | Availability of Standard Design or site adaptable designs | NR | | | |
| | Other Architectural & Structural (List and number items) | | | | |

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED – Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED – Significant information summarized or explained and attached.

DOCUMENT ATTACHED – Significant information is in an existing document which is attached.

*BY WHOM (Check and insert appropriate letter)

A – DFAE

B – Using Service

C – Construction Service

D – Designer

E – Other (Check Comments Attached and explain)

# documentation checklist

DA FORM 5023-C-R, Feb 82

# E. ENVIRONMENTAL CONSIDERATIONS

| | ITEM | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| E-1 | Environmental impact assessment | R | A | | |
| E-2 | EIA conclusions require Environmental Impact Statement | NR | | | |
| E-3 | Determination of health, environmental or related hazards. Assistance to determine existence of any health, environmental or related hazard may be requested from Aberdeen Proving Ground, MD 21010, the Office of the Surgeon General, Attn: DASG-HCH (Army Environmental Hygiene Agency) | NR | | | |
| E-4 | Air/water pollution permit, coordination with agencies and compliance with standards at Federal, state and local level | NR | | | |
| E-5 | Corrective measures associated with Environmental Impact Statements or assessment—list separately and evaluate. | NR | | | |
| | Other environmental considerations (list and number items) | | | | |

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED – Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED – Significant information summarized or explained and attached.

DOCUMENT ATTACHED – Significant information is in an existing document which is attached.

*BY WHOM (Check and insert appropriate letter)

A – DFAE
B – Using Service
C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

# documentation checklist

DA FORM 5023-E-R, Feb 82

COMMENTS

DOCUMENTATION CHECK LIST

| ITEM | COMMENT |
|---|---|
| A-1 | COST ESTIMATE: THE COST OF WINDOW CAULKING, AIR CURTAIN AND LOWERING WATER TEMPERATURES IS $6,524. |

| | |
|---|---|
| CAULK WINDOWS | 4,797 |
| MODIFY HOT WATER CONTROLS | 132 |
| INSTALL PVC STRIP CLOSURES | 948 |
| TOTAL CONSTRUCTION COST | 5,877 |
| SIOH (5.5%) | 294 |
| DESIGN (6%) | 353 |
| TOTAL REQUEST (FY91) | $6,524 |

A DETAILED BREAKDOWN OF THE COST ESTIMATE IS SUPPLIED IN THE DD 1391 DOCUMENTATION.

| | |
|---|---|
| A-5 | ECONOMIC ANALYSIS OF ALTERNATIVES: SEE ATTACHED DD 1391, DETAILED JUSTIFICATION, SECTION 4. |
| A-13 | THIS PROJECT MEETS ALL ECIP REQUIREMENTS FOR FUNDING. |
| A-14 | THIS PROJECT IS PART OF THE EEAP CONDUCTED AT FORT LEONARD WOOD DURING FY 89. |
| C-18 | ANALYSIS OF DEFICIENCIES: SEE ATTACHED DD 1391. |
| C-19 | CONSIDERATION OF ALTERNATIVES: SEE ATTACHED DD 1391, DETAILED JUSTIFICATION, SECTION 4. |

## A. SPECIAL CONSIDERATIONS

| | ITEM | Required or Not Required | * To Be Determined | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| A-1 | Factors of risk, restriction or unusual circumstance expected to increase costs beyond applicable area averages | NR | | | |
| A-2 | Construction phasing requirements | NR | | | |
| A-3 | Functional support equipment (mechanical, electrical, structural, and security) to be built in | NR | | | |
| A-4 | Equipment in place and justification | NR | | | |
| A-5 | Other equipment and furniture (O&MA, OPA) and costs | NR | | | |
| A-6 | Special studies and tests (hazards analyses, compatibility testing, new technology testing, etc.) | NR | | | |
| A-7 | Type of construction (permanent, temporary, semi-permanent) | NR | | | |
| A-8 | Government furnished equipment (quantities, procurement time, availability and special handling and storage requirements). Funds used for procurement. | NR | | | |
| | Other special considerations (list and number items) | | | | |

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED – Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED – Significant information summarized or explained and attached.

DOCUMENT ATTACHED – Significant information is in an existing document which is attached.

*BY WHOM (Check and insert appropriate letter)

A – DFAE
B – Using Service
C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

# technical data checklist

DA FORM 5024-A-R, Feb 82

## B. SITE DEVELOPMENT

| | ITEM | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| B-1 (A) | Construction restrictions or guidelines pertaining to site access and preferred construction routes | NR | | | |
| (B) | Airfield clearance, explosive storage, working hours, safety, etc. | NR | | | |
| (C) | Facilities and/or functions or adjoining areas (structures, materials, impact) | NR | | | |
| B-2 | Real estate actions (acquisition, disposal, lease, right-of-way) | NR | | | |
| B-3 (A) | Demolition/relocation required (data) Special considerations due to explosives/radioactivity/ chemical contamination/asbestos emissions/toxic gases | NR | | | |
| (B) | Restrictions on disposal of demolished/relocated material including hazardous waste | NR | | | |
| B-4 | Pavement types and requirements (including traffic surveys and MTMC coordination) | NR | | | |
| B-5 (A) | Landscape considerations Protection of existing vegetation | NR | | | |
| (B) | Stockpile topsoil | NR | | | |
| | Other Site Development (List and number items) | | | | |

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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# technical data checklist

DA FORM 5024-B-R, Feb 82

## C. ARCHITECTURAL & STRUCTURAL

| | ITEM | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| C-1 | Vibration-producing equipment requiring isolation | NR | | | |
| C-2 | Seismic zone and other design load criteria (typhoon, hurricane, earthquake loads, high or low loss potential) | NR | | | |
| C-3 | Protective shelter evaluation and resistant design criteria (conventional/nuclear blast and radiation, chemical/biological) | NR | | | |
| C-4 | Unusual foundation requirements (pier, pile, caisson, deep foundations, mat, special treatment, permafrost areas, soil bearing) | NR | | | |
| C-5 | Designation and strength of units to be accommodated | NR | | | |
| C-6 | Requirements and data for special design projects | NR | | | |
| C-7 | Unusual floor and roof loads (safes, equipment) | NR | | | |
| C-8 | Security features (arms rooms, vaults, interior secure areas) | NR | | | |
| | Other Architectural & Structural (List and number items) | | | | |

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**technical data checklist**

DA FORM 5024-C-R, Feb 82

## D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS

| | ITEM | Required or Not Required | * To Be Determined | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| D-1 | Special mechanical requirements or considerations (elevator, crane, hoist, etc.) | R | D | | |
| D-2 | Special peak usage periods and peak leveling techniques | NR | | | |
| D-3 | Maintenance considerations (accessibility of equipment, compatibility with existing equipment) | R | D | | |
| D-4 | Plumbing—availability, general system type and characteristics (proposed and/or existing, incl. compressed air and gas) | R | D | | |
| D-5 | Heating—availability, general system type and characteristics (proposed and/or existing) | R | D | | |
| D-6 | Ventilating, air condition/refrigeration—availability, general system type and characteristics (proposed and/or existing) | R | D | | |
| D-7 | Electrical—availability, general system type and characteristics incl. airfield lighting, communication, etc. (proposed and/or existing) | R | D | | |
| D-8 | Water supply/waste treatment—availability, general system type and characteristics (proposed and/or existing) | R | D | | |
| D-9 | Energy requirements/fuel conversion (sources, availability, loads, types of fuel, etc.) | R | D | | |
| D-10 | Solar energy evaluation | NR | | | |
| | Other Mechanical & Utility Systems (List and number items) | | | | |

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# technical data checklist

DA FORM 5024-D-R, Feb 82

## E. ENVIRONMENTAL CONSIDERATIONS

| | ITEM | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| E-1 | Waste water treatment, air quality, and solid waste disposal criteria | NR | | | |
| | Other Environmental Considerations (List and number items) | | | | |

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**technical data checklist**

DA FORM 5024-E-R, Feb 82

## F. FIRE PROTECTION

| | ITEM | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| F-1 | Special fire protection systems or features (detection and suppression equipment, hazards, etc.) | NR | | | |
| | Other Fire Protection Considerations (List and number items) | | | | |

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**technical data checklist**

DA FORM 5024-F-R, Feb 82

# A. SPECIAL CONSIDERATIONS

| See Tech. Data Checklist Item | | ITEM | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| A-1 | A-1 | Factors of risk, restriction, or unusual circumstance expected to increase costs beyond applicable area averages. | NR | | | |
| | (A) | Special applicable construction codes/criteria (NATO, SOFA, base regulations, use of government furnished documents, etc.) | NR | | | |
| | (B) | Skilled labor and/or structural material availability impact. | NR | | | |
| A-2 | A-2 | Construction phasing requirements | NR | | | |
| | A-3 | Unique contractor requirements (24 hr/day work capability; safety requirements—AR 385-10, DODI 1000.18, DODD 1000.3, DODI 6055.1; etc.) | NR | | | |
| | A-4 | Utilities available to contractor (types, metering, costs, billing, etc.) | NR | | | |
| | A-5 | Secure area availability for contractor equipment and materials storage | NR | | | |
| | A-6 | Clearances required of contractor | NR | | | |
| | A-7 | Contractor work area (location, limits) | R | A | | |
| A-3 | A-8 | Function support equipment (mechanical, electrical, structural support requirements) | R | D | | |
| D-1 | (A) | Cranes and hoists (loads, controls, uses, etc.) | R | D | | |
| | A-9 | Trash handling system (availability, storage area for recyclable material to coincide with installation resource recovery plan) | NR | | | |
| A-3, A-4, A-5 | A-10 | Real property installed equipment and furniture | NR | | | |
| | (A) | Functional support equipment | NR | | | |
| | (B) | Equipment in place | NR | | | |
| | (C) | Other equipment and furniture (O&MA, OPA) | NR | | | |
| | A-11 | Disposition of scrap and salvage | R | A | | |
| | A-12 | Training of using service operating personnel (Operating Manual, etc.) | R | D | | |
| | A-13 | Contingency plan for incidental discovery of archeological artifacts | R | | | |
| | A-14 | Maintenance and maintainability (i.e. avoiding features which have high maintenance requirements or new maintenance skills, etc.) | R | D | | |
| | A-15 | Economic Considerations | NR | | | |
| | (A) | Projected economic life associated with specified functional requirements. | NR | | | |
| | (B) | Special economic ranking considerations—design features for which factors other than economics (i.e., other than lowest LCC) should govern the decision as to which of the feasible alternatives should be selected, including statement of locally unacceptable alternatives and reasons therefor. | NR | | | |
| | (C) | Projected facility utilization/operation schedule. | NR | | | |
| | (D) | Planned changes in facility usage during economic life and alterations to be required. | NR | | | |
| | (E) | Projected preventive-maintenance (p-m) strategy (e.g., full p-m as recommended by manufacturer; minimum p-m—replace failures as they occur, and little else; full p-m on critical items only; etc.). | NR | | | |
| | (F) | Projected strategy for custodial care and maintenance for most commonly used types of exterior and interior finishes (e.g., frequencies for sweeping, vacuuming, washing, painting, etc.). | NR | | | |
| | (G) | Design features that experience has shown require excessive M&R. | NR | | | |

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# design data checklist

DA FORM 5025-A-R, Feb 82

| See Tech. Data Checklist Item | B. SITE DEVELOPMENT<br>ITEM | | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| B-1 | B-1 | Required site plans (incl. design and construction factors) | | | | |
| | (A) | Site access and preferred construction routes | NR | | | |
| | (B) | Site restrictions (airfield clearance, explosive storage, etc.) | NR | | | |
| | (C) | Existing facilities/functions on adjoining areas (structures, materials, impact) | NR | | | |
| | (D) | Disposal areas (trash, excavated material, constraints) | R | A | | |
| | (E) | Borrow and spoil areas | NR | | | |
| | (F) | Grades or contours existing | NR | | | |
| | (G) | Existing trees, turf, ground cover, landscape development, erosion control | NR | | | |
| | (H) | Bridges and fences (applicable design criteria) | NR | | | |
| | (I) | Railroads (routing, sidings, docks, yards, grounding) | NR | | | |
| | (J) | Fire station and security police location | NR | | | |
| | (K) | Site utilities—capacity and quantity available to project (sanitary and storm sewers, drainage ditches, water and gas service, communication lines, hydrants and sprinklers, etc.) | R | D | | |
| | (L) | New facilities clearly identified | NR | | | |
| | (M) | Necessary support facilities required for complete functional project (warehouse, igloo, fuel storage, waste treatment, etc.) | NR | | | |
| C-4 | B-2 | Subsoil conditions (actual or expected—groundwater, permafrost, etc.) | NR | | | |
| B-2 | B-3 | Real estate actions (acquisition, disposal, lease, right-of-way) | NR | | | |
| B-3 | B-4 | Demolition/relocation required to clear site (date) | NR | | | |
| B-4 | B-5 | Pavement types and requirements | | | | |
| | (A) | Design loading and use frequency by type of paving | NR | | | |
| | (B) | Street size and layout (traffic control) | NR | | | |
| | (C) | Parking lots (signage, etc.) | NR | | | |
| | (D) | Sidewalks and curbs (handicapped, etc.) | NR | | | |
| | (E) | Gutters, culverts and other drainage factors | NR | | | |
| | (F) | Runways, aprons and taxiways | NR | | | |
| | (G) | Tie-down anchors or grounds | NR | | | |
| | (H) | Special surface conditions required | NR | | | |
| D-9, D-10 | B-6 | Energy conservation siting and features (wind solar, etc.). See also DDC Item D-13 (D) & (E) | NR | | | |

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# design data checklist

DA FORM 5025-B-1-R, Feb 82

| See Tech. Data Checklist Item | | B. SITE DEVELOPMENT (Continued) — ITEM | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| B-5 | B-7 | Landscape treatment | | | | |
| | (A) | Preservation of existing features | NR | | | |
| | (B) | Proposed planting (low maintenance species, locations away from power lines, etc.) | NR | | | |
| B-5 | B-8 | Storm drainage (See also Item E-4) | | | | |
| | (A) | Total run-off area affecting project | NR | | | |
| | (B) | Design intensity for floods | NR | | | |
| | (C) | Design of storm drainage system to include pick-up system and outfall lines | NR | | | |
| | B-9 | Consideration of Coastal Zone Management Act (PL 92-583, 1972; Amendment PL 94-370, 1976) | NR | | | |
| | | Other Site Development Considerations (List and number items) | | | | |

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**design data checklist**

DA FORM 5025-B-2-R, Feb 82

## C. ARCHITECTURAL & STRUCTURAL

| See Tech. Data Checklist Item | | ITEM | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| | C-1 | Material availability limitations (include fill and paving) | NR | | | |
| | C-2 | Architectural style (existing, planned or desired, use of pre-engineered buildings considered) | NR | | | |
| C-7 | C-3 | Floors (type, finish, special loading, subgrade moisture control, low maintenance types particularly in spill areas) | NR | | | |
| C-3 | C-4 | Walls | NR | | | |
| | (A) | Exterior (materials, sealing of joints, general maintenance) | NR | | | |
| | (B) | Interior walls and partitions (material, finish, fire resistance, subgrade moisture control) | NR | | | |
| | C-5 | Ceilings (height, finish, acoustics) | NR | | | |
| | C-6 | Windows (type, size, special treatment) | NR | | | |
| | C-7 | Doors (type, size, power operation, panic hardware, durability) | NR | | | |
| | C-8 | Hardware (finish, location, special metal restrictions, durability) | NR | | | |
| | C-9 | Special finishes (protective coatings, non-sparking, conductive, acid-resistant) | NR | | | |
| C-8 | C-10 | Security features (windows, doors, hardware, construction of walls, floors & ceilings, arms rooms, vaults, etc.) | NR | | | |
| | C-11 | Sound attenuation requirements (expected and required levels, location) | R | D | | |
| | C-12 | Stairs, elevators and chutes (location, size, type of usage) | NR | | | |
| | C-13 | Loading docks and canopies | NR | | | |
| C-1 | C-14 | Vibration-producing equipment requiring isolation | R | D | | |
| C-4 | C-15 | Unusual foundation requirements (pier, pile, caisson, deep foundations, mat, special treatment, creep control) | NR | | | |
| | C-16 | Span or unusual clearance requirements (span or height) | NR | | | |
| | C-17 | Special bay sizes (reflect access dimensions) | NR | | | |
| | C-18 | Overhead support requirements (hoists, cranes) | NR | | | |
| C-7 | C-19 | Roof loads and requirements (live/dead loads, materials, access, low maintenance features like exterior drains, etc.) | NR | | | |
| | C-20 | Structural specialities (slabs, sumps, trenches, pits) | NR | | | |
| C-2 | C-21 | Seismic zone design criteria | NR | | | |
| C-2 | C-22 | Area wind loads (summer/winter prevailing wind, hurricane, typhoon) | NR | | | |
| C-3 | C-23 | Protective shelter evaluation and resistant design criteria | NR | | | |
| | (A) | Explosive/nuclear blast (protective, resistive, suppressive, venting and containment structures) | NR | | | |
| | (B) | Radiation protection (type of radiation, intensity, source) | NR | | | |
| | (C) | Chemical/biological protection | NR | | | |

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# design data checklist

| See Tech. Data Checklist Item | C. ARCHITECTURAL & STRUCTURAL (Continued) ITEM | | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| C-5 | C-24 | Designation and strength of units to be accommodated | NR | | | |
| C-6 | C-25 | Requirements for special design projects | NR | | | |
| | C-26 | Safety features (occupant load, maximum travel distance to exits, hazard to be controlled or eliminated) | NR | | | |
| | C-27 | Special design features for handicapped. | NR | | | |
| | | Other Architectural and Structural (list and number items) | | | | |

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**design data checklist**

DA FORM 5025-C-2-R, Feb 82

| See Tech. Data Checklist Item | | D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS — ITEM | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| D-1 | D-1 | Special mechanical requirements or considerations | NR | | | |
| D-2 | D-2 | Special peak usage periods and peak leveling techniques | NR | | | |
| D-3 | D-3 | Maintenance considerations (equipment room size, layout, location, general accessibility of equipment, compatibility with existing equipment.) | R | D | | |
| D-9 | D-4 | Energy monitoring control system (EMCS) and permanent utilities metering | NR | | | |
| D-4 | D-5 | Plumbing system (proposed and/or existing) | R | D | | |
| | (A) | General piping and storage system | NR | | | |
| | (1) | Materials (galvanized, copper, etc.) | R | D | | |
| | (2) | Insulation | R | D | | |
| | (3) | Natural or LP gas | R | D | | |
| | (4) | Venting | R | D | | |
| | (5) | Distilled water | NR | | | |
| | (6) | Compressed air | R | | | |
| | (7) | Hospital & surgical gases | NR | | | |
| | (8) | Other (chemical, fuel) | NR | | | |
| | (B) | Facility water supply | R | D | | |
| | (C) | Garbage disposal | NR | | | |
| | (D) | Sanitary drainage system | R | D | | |
| | (E) | Grease interception | NR | | | |
| | (F) | Chemical waste drainage & disposal (incl. explosive process waste) | NR | | | |
| | (G) | Radioactive waste | NR | | | |
| | (H) | Drinking fountains | NR | | | |
| | (I) | Water treatment | NR | | | |
| | (J) | Emergency fixtures (showers, eyewash fountains) | NR | | | |
| D-5 | D-6 | Heating system | R | D | | |
| | (A) | Existing generation plant | R | D | | |
| | (1) | Location and distance from new facility | R | D | | |
| | (2) | Equipment (type, age, fuel, etc.) | R | D | | |
| | (3) | Current loads (average, peak, reserves for this and other projects, load leveling system) | NR | | | |
| | (4) | Type of plant | NR | | | |
| | (5) | Manning & support requirements | NR | | | |
| | (6) | Pollution controls | NR | | | |
| | (7) | Type of product | NR | | | |

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DA FORM 5025-D-1-R, Feb 82

| See Tech. Data Checklist Item | D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS (Continued) ITEM | | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| D-5 | D-6 | Heating system (continued) | NR | | | |
| | (B) | Requirements for proposed facility | NR | | | |
| | (1) | Type of system | NR | | | |
| | (2) | Heat load requirements (special temperature demands) | NR | | | |
| | (3) | Controls, metering & EMCS requirements | NR | | | |
| | (4) | Distribution system (valves, steam pressure, fluid temperature) | NR | | | |
| | (5) | Corrosion control | NR | | | |
| | (6) | Insulation | NR | | | |
| | (7) | Additional equipment specifications | NR | | | |
| D-6 | D-7 | Ventilating/air conditioning/refrigeration system | NR | | | |
| | (A) | Existing facilities | NR | | | |
| | (1) | Location | NR | | | |
| | (2) | Type of plant (refrigeration, chilled water, etc.) | NR | | | |
| | (3) | Current loads (average, peak, reserves for this and other projects, load leveling system) | NR | | | |
| | (4) | Type of product (CFM, temperature, GPM, etc.) | NR | | | |
| | (5) | Distribution system | NR | | | |
| | (6) | Special filtration requirements | NR | | | |
| | (7) | Special humidity, ventilation, or temperature requirements | NR | | | |
| | (8) | Security restrictions for open ducting | NR | | | |
| | (9) | Freezers or coolers | NR | | | |
| | (B) | Requirements for proposed facility | | | | |
| | (1) | Type of system | NR | | | |
| | (2) | Temperature, humidity and vent conditions special to this design | NR | | | |
| | (3) | Control, cycling, metering and EMCS requirements | NR | | | |
| | (4) | Distribution (length of extension, location, fluid temperature) | NR | | | |
| | (5) | Corrosion control | NR | | | |
| | (6) | Insulation | NR | | | |
| | (7) | Special fire and security considerations for this project | NR | | | |
| | (8) | Occupancy hours and days per week | NR | | | |
| D-5, D-6 | D-8 | Heat and chilled water distribution system | NR | | | |
| | (A) | Heat system | NR | | | |
| | (1) | Type of service | NR | | | |
| | (2) | Existing system components | NR | | | |
| | (3) | Valving and sectionalizing requirements | NR | | | |
| | (4) | Allowable shut-down of service for main connections | NR | | | |
| | (5) | Sizing for future facilities | NR | | | |

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DA FORM 5025-D-2-R, Feb 82

## D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS (Continued)

| See Tech. Data Checklist Item | ITEM | | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| D-5 | D-8 | Heat and chilled water distribution system (continued) | NR | | | |
| D-6 | (B) | Chilled water system | NR | | | |
| | (1) | Type of service | NR | | | |
| | (2) | Existing system components | NR | | | |
| | (3) | Valving and sectionalizing requirements | NR | | | |
| | (4) | Allowable shut-down of service for main connections | NR | | | |
| | (5) | Sizing for future facilities | NR | | | |
| D-7 | D-9 | Electrical system | | | | |
| | (A) | Power service characteristics & location | R | D | | |
| | (B) | Stand-by power (available & required) | NR | | | |
| | (C) | Special interior functional lighting requirements (brightness, night, emergency, justification) | NR | | | |
| | (D) | Uninterruptible power required | NR | | | |
| | (E) | Commercial tie-in requirements & restrictions | R | D | | |
| | (F) | Potential for increased power service needed | | D | | |
| | (G) | Service outage duration limitations | NR | | | |
| | (H) | Security alarm systems (type & location) | NR | | | |
| | (I) | Street, parking or security lighting (brightness, hours, switching, etc.) | NR | | | |
| | (J) | Types of fixtures required (including mounting, NEC classification, etc.) | R | D | | |
| | (K) | Telephone extension circuits or conduit (functional support & outlet location) | NR | | | |
| | (L) | Television circuits or conduit (functional support & outlet location) | NR | | | |
| | (M) | Intercom requirements (locations, type) | NR | | | |
| | (N) | Equipment list w/power requirements | NR | | | |
| | (O) | Special communications requirements (filtering, maximum fluctuation limitations, convertors, etc.) | NR | | | |
| | (P) | Electronic shielding & interference measures (frequency involved) | NR | | | |
| | (Q) | Special switches & control outlets, receptacle requirements, etc. | NR | | | |
| | (R) | Grounding requirements, lightning protection | NR | | | |
| | (S) | Hazardous environment requirements (location, activity involved, NEC classification, type of hazard) | NR | | | |
| | (T) | Corrosion control (cathodic protection) | NR | | | |

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# design data checklist

DA FORM 5025-D-3-R, Feb 82

| See Tech. Data Checklist Item | D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS (Continued) ITEM | | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| D-7 | D-9 | Electrical system (continued) | | | | |
| | (U) | Other special power requirements (traffic control, antenna, etc.) | NR | | | |
| | (V) | Applicability of task lighting considerations | NR | | | |
| | (W) | Power management and metering requirements | NR | | | |
| | D-10 | Electrical Distribution | | | | |
| | (A) | Actual & estimated loads (peak & average (KW demand)) | R | D | | |
| | (B) | Utility compnay distribution system (substations, transmission lines, rate schedule, etc.) | NR | | | |
| | (C) | Government owned distribution system (switching station, transmission lines, feeders, etc.) | NR | | | |
| | (D) | Estimated impact of proposed equipment installation on power factor, load balance and costs for corrective action proposed | R | D | | |
| | (E) | Overhead/underground (voltage, conductor size, grounding, etc.) | NR | | | |
| | (F) | Estimated power demand factor and diversity factor | R | D | | |
| | (G) | Power quality requirements (voltage and frequency regulation) | R | D | | |
| | (H) | Power to intrusion, detection alarm systems around perimeter | NR | | | |
| | D-11 | Airfield lighting requirements | NR | | | |
| | (A) | Area & location to be served | NR | | | |
| | (B) | Source of power (normal & emergency) | NR | | | |
| | (C) | Vault requirements | NR | | | |
| | (D) | Primary feeders | NR | | | |
| | (E) | Control cabling | NR | | | |
| | (F) | Runway lighting (centerline, edge, distance markers, intensity control) | NR | | | |
| | (G) | Threshold, approach, & strobe beacon lighting | NR | | | |
| | (H) | Visual approach slope indicators (VASI) | NR | | | |
| | (I) | Obstructions lighting/barrier markers | NR | | | |
| | (J) | Taxiway edge lighting | NR | | | |
| | (K) | Helipad/heliport lighting (perimeter, landing direction, hoverlane, etc.) | NR | | | |
| D-8 | D-12 | Water supply system | R | | | |
| | (A) | Source (commercial, well, storage, etc.) | R | D | | |
| | (B) | Average rate of supply (FPD at PSI) Current & Future | R | D | | |
| | (C) | Treatment requirements | NR | | | |
| | (D) | Existing system components (type, size, capacity, age, material, location, valving, pressure, etc.) | R | D | | |

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# design data checklist

DA FORM 5025-D-4-R, Feb 82

| See Tech. Data Checklist Item | | D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS (Continued) — ITEM | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| D-8 | D-12 | Water supply system (continued) | | | | |
| | (E) | Chemical analysis of water | NR | | | |
| | (F) | Emergency storage requirements | R | D | | |
| | (G) | Peak hours of supply (hours & estimated quantity) | R | D | | |
| | (H) | Known minimal requirements of supported function or Government equipment (quantity & quality) | R | D | | |
| | (I) | Chemical feeder & piping systems | NR | | | |
| | (J) | Corrosion control (existing & planned) | NR | | | |
| | (K) | Metering or usage restrictions | R | D | | |
| | (L) | Location of tie points (available capacity, interruption schedule) | R | D | | |
| D-8 | D-13 | Waste water treatment system | | | | |
| | (A) | Existing system & components (size, capacity, characteristics) | | | | |
| | (1) | Treatment plant | NR | | | |
| | (2) | Collector sewers | NR | | | |
| | (3) | Sewer mains (materials, depth) | NR | | | |
| | (4) | Complete treatment — industrial process | NR | | | |
| | (5) | Chemical, fuel or oil spill collection facilities | NR | | | |
| | (6) | Existing flows (min., avg., peak) | NR | | | |
| | (7) | Hydraulic capacity | NR | | | |
| | (B) | Known/estimated industrial or functional discharges (quantity & quality) | NR | | | |
| | (C) | Contributory population & per capita contribution | NR | | | |
| | (D) | Proposed system & components | NR | | | |
| | (1) | Treatment plant | NR | | | |
| | (2) | Collection sewers | NR | | | |
| | (3) | Lift station | NR | | | |
| | (4) | Complete treatment (additions or modifications) | NR | | | |
| | (5) | Chemical, fuel or oil spill collection facilities | NR | | | |
| | (6) | Waste water from portable water treatment plant | NR | | | |
| | (7) | Projected flows—average or peak | NR | | | |
| | (8) | By-pass restrictions | NR | | | |
| | (9) | Location of tie points (available capacity, interruption schedule) | R | | | |
| | (E) | Compliance requirements (federal, state, local) | R | D | | |
| | (F) | National Pollution Discharge Elimination System (NPDES) permit | NR | | | |
| | (G) | Corrosion control (existing or planned) | NR | | | |

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**design data checklist**

DA FORM 5025-D-5-R, Feb 82

## D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS (Cont.)

| See Tech. Data Checklist Item | ITEM | | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| D-9 | D-14 | Energy Sources | | | | |
| | (A) | Gas systems (LP, natural, special) | R | D | | |
| | (1) | Loads and areas served | R | D | | |
| | (2) | Source of gas & type of service | R | D | | |
| | (3) | Supply pressure average | R | D | | |
| | (4) | Heating valve & type of gas (BTU per cubic foot) | R | D | | |
| | (5) | Valving & sectionalizing criteria | R | D | | |
| | (6) | Pressure regulation — reduction stations | R | D | | |
| | (7) | Existing lines, pumping stations, pressurization, base system | R | D | | |
| | (8) | Control & metering | R | D | | |
| | (B) | POL systems | | | | |
| | (1) | Fuel (primary or standby source, grade and analysis) | NR | | | |
| | (2) | Storage (tank size, location, type, number of storage days) | NR | | | |
| | (3) | Areas served | NR | | | |
| | (4) | Fuel requirements (known, estimated, quantity & type) | NR | | | |
| | (5) | Distribution system characteristics (piping, types of fuel, pumps, capacities) | NR | | | |
| | (6) | Ventilation system (Vapor Emission Control) | NR | | | |
| | (7) | Safety specifications | NR | | | |
| | (8) | Filter separators | NR | | | |
| | (C) | Coal systems | | | | |
| | (1) | Storage (location & capacity) | NR | | | |
| | (2) | Source of supply (primary & emergency) | NR | | | |
| | (3) | Type, energy value, analysis (i.e. sulfur, ash, etc.) | NR | | | |
| | (D) | Solar energy systems | | | | |
| | (1) | Building heating, air conditioning, domestic hot water | NR | | | |
| | (2) | Heating process water | NR | | | |
| | (3) | Collector type & location | NR | | | |
| | (4) | Liquid, chemical or rock storage | NR | | | |
| | (5) | Freeze protection | NR | | | |
| | (E) | Energy conservation data (U values, orientation, passive solar considerations, etc.) | NR | | | |
| | | Other Mechanical & Utility Systems (list and number items) | | | | |

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# design data checklist

DA FORM 5025-D-6-R, Feb 82

# E. ENVIRONMENTAL CONSIDERATIONS

| See Tech. Data Checklist Item | | ITEM | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| E-1 | E-1 | Water quality | | | | |
| | (A) | Waste water treatment management program (PL 92-500 & PL 95-217) | NR | | | |
| | (B) | Water quality criteria & standards (federal, state and local) | NR | | | |
| | (C) | Treatment requirements coordinated with EPA | NR | | | |
| | (D) | Facilities to be installed to meet regulatory agency criteria | NR | | | |
| E-1 | E-2 | Air quality | | | | |
| | (A) | Applicable air quality criteria (federal, state and local; PL 95-95 and Clean Air Act Amendment of 1977) | NR | | | |
| | (B) | Action taken to comply with requirements | NR | | | |
| | (C) | Type & amount of pollutants generated | NR | | | |
| | (D) | Results of proposed abatement measures | NR | | | |
| | (E) | Existing control equipment & monitoring procedures | NR | | | |
| E-1 | E-3 | Solid waste disposal | | | | |
| | (A) | Applicable solid waste criteria (federal, state and local) | NR | | | |
| | (B) | Waste volume generated (type & characteristics) | NR | | | |
| | (C) | Method of disposal (land fill and availability of land, leachate, etc.) | NR | | | |
| | (D) | Disposition of recyclable materials for reuse or as combustion fuel | NR | | | |
| | (E) | Impact on installation recycling programs | NR | | | |
| | E-4 | Effects of terrain changes (such as excavations, roadways, drainage structures, etc.) | NR | | | |
| | (A) | Measures to control erosion | NR | | | |
| E-1 | E-5 | Treatment of hazardous material | NR | | | |
| | (A) | Handling and disposal of plychlorinated biphenyls (PCB) in electrical transformers | NR | | | |
| | (B) | Handling and disposal of asbestos materials | NR | | | |
| | (C) | Handling and disposal of fiberglass products | NR | | | |
| | (D) | Storage of fuels and solvents | NR | | | |
| | (E) | Coordination with installation spill control plans | NR | | | |
| | | Other Environmental Considerations (list and number items) | | | | |

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**design data checklist**

DA FORM 5025-E-R, Feb 82

## F. FIRE PROTECTION

| See Tech. Data Checklist Item | | ITEM | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| F-1 | F-1 | General design guidance | | | | |
| | (A) | Occupancy type (see NFPA 101, Chap 4) | NR | | | |
| | (B) | Water supply characteristics (existing or planned extensions) (capacity, pump activation, storage tanks and pumps, etc.) | NR | | | |
| | (C) | Mobile fire apparatus (response distance/time) | NR | | | |
| | (D) | Fire detection and alarm systems (existing or planned, type, location, etc.) | NR | | | |
| | (E) | Automatic suppression systems (water sprinkler, $CO_2$, foam etc.—existing or planned | NR | | | |
| | (F) | Hazard of contents (low, ordinary, high-see NFPA 101; type—explosives, flammable/toxic chemicals, radioactive materials) | NR | | | |
| F-1 | F-2 | Special fire suppression system requirements | NR | | | |
| | (A) | Means of egress | NR | | | |
| | (B) | Fire area limitations | NR | | | |
| | (C) | Fire walls, partitions, draft curtains | NR | | | |
| | (D) | Detection system (type, detectors, supervision, transmitters, annunciators, backup provisions) | NR | | | |
| | (E) | Suppression system (damage by water to costly equipment, shut down of operations) | NR | | | |
| | | Other Fire Protection (list and number items) | NR | | | |

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# design data checklist

DA FORM 5025-F-R, Feb 82

| 1. COMPONENT | FY 19 91 MILITARY CONSTRUCTION PROJECT DATA | 2. DATE |
|---|---|---|
| ARMY | | MARCH, 1991 |

| 3. INSTALLATION AND LOCATION | 4. PROJECT TITLE |
|---|---|
| FORT LEONARD WOOD, MISSOURI | REPLACE STEAM DRYERS (ECIP) |

| 5. PROGRAM ELEMENT | 6. CATEGORY CODE | 7. PROJECT NUMBER | 8. PROJECT COST ($000) |
|---|---|---|---|
| | | | 93.9 |

9. COST ESTIMATES

| ITEM | U/M | QUANTITY | UNIT COST | COST ($000) |
|---|---|---|---|---|
| 220 LB GAS DRYER | EA | 2 | 42,000 | 84.000 |
| DUCTWORK | LF | 40 | 2.65 | .106 |
| PIPING | LF | 30 | 4.79 | .144 |
| SUBTOTAL | | | | 84.25 |
| SIOH | | | | 4.64 |
| DESIGN | | | | 5.05 |
| TOTAL REQUEST (FY89) | | | | 93.9 |

10. DESCRIPTION OF PROPOSED CONSTRUCTION

THIS PROJECT CONSISTS OF INSTALLING 2 EACH, 220 LB GAS FIRED CLOTHES DRYERS. THESE DRYERS ARE TO BE USED IN LIEU OF THE 20 EXISTING 100 LB STEAM NOW IN USE AT THE LAUNDRY FACILITY (BUILDING 2352).

THE WORK CONSIST OF:

INSTALLING 2 EACH 220 LB GAS FIRED CLOTHES DRYERS WITH ALL ASSOCIATED EXHAUST DUCTWORK, PIPING AND CONNECTION TO EXISTING ELECTRICAL SERVICE.

11. QUANTITATIVE DATA, JUSTIFICATION AND ADDITIONAL DATA

11.A - 0 -

11.B thru 11.K NOT APPLICABLE

11.L PROJECT

INSTALL TWO GAS FIRED (220 LB) DRYERS, WITH ALL ASSOCIATED EXHAUST DUCTWORK, GAS PIPING AND ELECTRICAL SERVICE CONNECTION.

11.M REQUIREMENTS

INSTALLATION OF GAS DRYERS WILL PROVIDE IMMEDIATE CONSERVATION OF LP GAS. THIS PROJECT WILL ALLOW CONTINUED PRODUCTION OF LAUNDERED ITEMS AT A REDUCED RATE OF ENERGY CONSUMPTION.

11.N CURRENT SITUATION

EXISTING EQUIPMENT IS INEFFICIENT AND OUTDATED. CURRENT ENERGY CONSUMPTION PER LB. OF PRODUCTION IS EXTREMELY HIGH COMPARED TO SIMILAR COMMERCIAL LAUNDRIES.

11.O IMPACT IF NOT PROVIDED

IF THIS PROJECT IS NOT APPROVED, FUEL REQUIREMENT REDUCTIONS AFFORDED BY THIS PROJECT WILL NOT BE REALIZED. THIS PROJECT WILL CONTRIBUTE ITS SMALL SHARE TO A REDUCED NATIONAL REQUIREMENT FOR FOREIGN OIL.

11.P ADDITIONAL

A FORMAL ECONOMIC ANALYSIS HAS BEEN PREPARED. SEE SRP-1 FOR DETAILED INFORMATION.

PER ECIP CRITERIA, ANNUAL SAVINGS ARE AS FOLLOWS:

| | | |
|---|---|---|
| LP GAS | | 3123 MBTU/YR |
| ELECTRICITY | | 2.8 MBTU/YR |
| ANNUAL ENERGY SAVINGS | $10,255 | |
| SAVING INVESTMENT RATION (SIR) | 1.96 | |
| SIMPLE AMORTIZATION | 8.24 YEARS | |

CONSTRUCTION COSTS HAVE BEEN PROJECTED USING THE TRI-SERVICE MILITARY CONSTRUCTION PROGRAM INDICES OF 4.0% FOR FY-89 AND 3.7% FOR FY-90.

THIS PROJECT IS A RESULT OF EEAP/ESOS STUDY DACA41-89-D0007.

DETAILED JUSTIFICATION

D-1 GENERAL

THIS PROJECT IS NECESSARY TO SUPPORT THE ARMY'S EFFORT TO REDUCE ENERGY CONSUMPTION. THE PROJECT COMPRISES OF INSTALLING TWO GAS FIRED DRYERS.

D-2 ACCOMMODATIONS NOW IN USE

THE LAUNDRY FACILITY CURRENTLY USES 20 STEAM DRYERS WITH A CAPACITY OF 100 LBS. EACH.

EXISTING STEAM DRYERS ARE OUTDATED AND INEFFICIENT.

DRYER HEAT IS CURRENTLY GENERATED THROUGH STEAM SUPPLIED BY CENTRAL PLANT BOILERS, THEREFORE EFFICIENCY IS LIMITED TO THAT OF CENTRAL PLANT EQUIPMENT.

D-3 ANALYSIS OF DEFICIENCY

MUCH OF THE PROCESS EQUIPMENT AT THE LAUNDRY FACILITY IS OVER 20 YEARS OLD AND CONSIDERABLE ENERGY IS WASTED DUE TO EQUIPMENT INEFFICIENCIES. THE INSTALLATION OF A NEW HOT WATER HEATER AND NEW GAS DRYERS WILL IMPROVE EFFICIENCY AND REDUCE CONSUMPTION.

D-4 CONSIDERATION OF ALTERNATIVES

STEAM DRYER REPLACEMENT

STEAM DRYERS COULD BE REPLACED WITH GAS DRYERS OF THE SAME CAPACITY, HOWEVER, 100 LB GAS DRYERS ARE NOT AS EFFICIENT AS THOSE SELECTED AND EQUIPMENT INSTALLATION COSTS WOULD INCREASE OVER THE ALTERNATIVE SLECTED.

D-5 CRITERIA FOR PROPOSED CONSTRUCTION

THIS PROJECT IS PROPOSED TO FACILITATE ENERGY CONSERVATION AT FORT LEONARD WOOD.

ALL EQUIPMENT SELECTED FOR INSTALLATION WILL MEET OR EXCEED THOSE EFFICIENCIES INDICATED IN THE CALCULATIONS.

D-6 PROGRAM FOR RELATED FURNISHINGS AND EQUIPMENT

NO RELATED FURNISHINGS AND EQUIPMENT ARE INVOLVED IN THIS PROJECT. BUILDING INTERIOR FUNCTION IS NOT CHANGED BY THIS PROJECT.

D-7 DISPOSAL OF PRESENT ASSETS

EXISTING DRYERS MAY REMAIN IN PLACE, HOWEVER, IF REMOVED UNDER THIS PROJECT, STEAM DRYERS WILL BE TURNED OVER TO THE POST PROPERTY DISPOSAL OFFICER.

D-8 SURVIVAL MEASURES

THIS PROJECT IS NOT SUITABLE FOR INCLUSION OF PROTECTIVE SHELTER.

D-9 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

THIS PROJECT SHOULD HAVE NO IMPACT ON AIR OR WATER POLLUTION AT FORT LEONARD WOOD. THESE SHOULD BE NO NEGATIVE IMPACT ON THE QUALITY OF HUMAN ENVIRONMENT.

D-10 EVALUATION OF FLOOD HAZARDS

THESE FACILITIES ARE NOT SITED WITHIN AREAS KNOWN TO BE SUBJECT TO FLOODING.

D-11 ECONOMIC JUSTIFICATION

THIS PROJECT IS PART OF THE ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP). AN ECONOMIC ANALYSIS HAS BEEN PREPARED TO SHOW THAT THIS PROJECT MEETS ALL ECIP CRITERIA FOR SAVINGS INVESTMENT RATIO (SIR) AND SIMPLE PAYBACK. AN ECONOMIC ANALYSIS CONFORMING TO ECIP GUIDELINES MAY BE FOUND IN SPR-1.

D-12 UTILITY AND COMMUNICATION SUPPORT

NO RELATED UTILITY SUPPORT PROJECTS ARE NEEDED. EXISTING UTILITY SUPPORT IS ADEQUATE.

D-13 PROTECTION OF HISTORIC PLACES AND ARCHAEOLOGICAL SITES

NO BUILDINGS AT FORT LEONARD WOOD ARE ON THE NATIONAL REGISTER OF HISTORIC PLACES. THE ENTIRE FORT IS ON AN ARCHAEOLOGICAL SITE.

THIS PROJECT WILL HAVE NO EFFECT UPON THE ARCHAEOLOGICAL SITE.

D-14 PROJECT DEVELOPMENT BROCHURE (PDB)

A PROJECT DEVELOPMENT BROCHURE HAS BEEN PREPARED FOR THIS PROJECT AND HAS BEEN PROVIDED AS AN ATTACHMENT.

D-15 ENERGY REQUIREMENTS

THE PROPOSED PROJECT WILL REDUCE THE ENERGY REQUIRED BY AFFECTED FACILITIES BY 3123 MBTU/YR OF LP GAS AND 2.8 MBTU/YR OF ELECTRICITY.

SEE ENERGY REQUIREMENT APPRAISAL IN SRP-3.

## SPECIAL REQUIREMENTS PARAGRAPHS (SRP)

### SRP-1 ECONOMIC ANALYSIS

I. NONRECURRING INITIAL CAPITAL COSTS

| | |
|---|---|
| DUCTWORK | 106 |
| PIPING | 144 |
| 220 LB DRYERS | 84,000 |
| TOTAL CONSTRUCTION COST | 84,250 |
| SIOH (5.5%) | 4,640 |
| DESIGN (6%) | 5,050 |
| TOTAL REQUEST (FY91) | $93,900 |

II. RECURRING ENERGY SAVINGS

INSTALLATION COSTS FOR UNIT, GAS DRYERS BY LAUNDRY MACHINERY CO., 2210 CAMBELL STREET, KANSAS CITY, MO.

ENERGY COST DATA IS FROM ECIP GUIDANCE FOR LIFE CYCLE COST ANALYSIS. REGIONAL COSTS ARE SPECIFIED RATHER THAN ACTUAL INSTALLATION COSTS.

A. ELECTRICAL

MBTU SAVED = 2.80 MBTU/YR

$$\text{KWH SAVED} = \frac{2.80 \text{ MBTU/YR}}{3.413 \text{ BTU/KWH}} = 820 \text{ KWH/YR}$$

$ SAVED = 2.8 MBTU/YR X 12.97 $/MBTU X 1.06 INDEX
= 38/YR

B. LIQUID PETROLEUM (LP) GAS

MBTU SAVED = 3.23 MBTU/YR

$$\text{GALLONS SAVED} = \frac{3.23 \text{ MBTU/YR}}{95{,}000 \text{ BTU/GAL}} = 32{,}874 \text{ GAL/YR}$$

$ SAVED = 32,874 GAL/YR X 0.311 $/GAL
= 10,219

SRP-2 COMMERCIAL ACTIVITIES ANALYSIS, NOT APPLICABLE

# SRP-3 ENERGY REQUIREMENTS APPRAISAL (ERA)

## I. PROJECT DESCRIPTION

THIS PROJECT IS TO INSTALL TWO GAS FIRED (220 LB) DRYERS.

## II. ESTIMATED ENERGY CONSUMPTION

THIS PROJECT WILL DECREASE (-) CONSUMPTION OF RESOURCES BY THE FOLLOWING AMOUNTS:

| | | |
|---|---|---|
| 1. | ELECTRICITY | 820 KWH/YR |
| 2. | LP GAS | 3123 MBTU/YR |
| 3. | ELECTRICAL DEMAND | MINIMAL |
| 4. | WATER SUPPLY | - 0 - |
| 5. | SEWERAGE | - 0 - |
| 6. | OTHER | - 0 - |

THIS PROJECT WILL HAVE NO AFFECT ON THE CAPACITY OF THE FOLLOWING DELIVERY SYSTEMS.

1. HEATING
2. AIR CONDITIONING
3. ELECTRICAL POWER
4. WATER SUPPLY

THE NEW IMPACT OF THIS PROJECT WILL BE THE REDUCTION OF REQUIRED HEATING AND ELECTRICAL ENERGY. THIS SAVINGS IS COMPATIBLE WITH THE ARMY DIRECTIVE TO REDUCE THE TOTAL ENERGY USE.

## III. ENERGY SAVINGS CALCULATIONS

ENERGY SAVINGS WERE CALCULATED FOR EACH BUILDING AND ECO COMBINATION COMPRISING THIS PROJECT. A SUMMARY OF THE SAVINGS FOR INDIVIDUAL ECO'S ARE INCLUDED WITHIN THIS SECTION.

THE ATTACHED SAMPLE CALCULATION SHEETS WERE USED TO CALCULATE THE INDIVIDUAL SAVINGS. EACH SAMPLE CALCULATION PAGE INCLUDES SOURCE DOCUMENTATION.

ECO # 20A

DESCRIPTION: REPLACE EXISTING STEAM DRYERS WITH GAS DRYERS (220LB).

SAVINGS POTENTIAL: NEW GAS DRYERS (200LB CAP) USE APPROXIMATELY 3000 BTU TO REMOVE 1 POUND OF WATER. EXISTING STEAM DRYERS USE APPROXIMATELY 4050 BTU TO REMOVE 1 POUND OF WATER.

A: SAVINGS BASED ON EXISTING USE.

| | |
|---|---|
| AVERAGE ANNUAL PROD. FOR 1 STEAM DRYER (LBS): | 100000 |
| AVERAGE ANNUAL WATER REMOVAL (LBS OF H2O): | 65000 |
| EXISTING ENERGY USE (BTU PER LB H2O): | 4052 |
| EXISTING ANNUAL ENERGY USE PER DRYER (MBTU): (PLANT EFFICIENCY NOT INCLUDED) | 263.38 |
| EXISTING ANNUAL ENERGY USE PER DRYER (MBTU): (USING 75 % PLANT EFFICIENCY) | 351.1733 |
| NEW ENERGY USE (BTU PER LB H2O): | 3000 |
| NEW ANNUAL ENERGY USE PER DRYER (MBTU): | 195 |
| SAVINGS PER DRYER PER YEAR (MBTU) | 156.1733 |
| SAVINGS FOR 20 DRYERS | 3123.467 |
| SAVINGS AT $ 3.27 PER MBTU | 10219.39 |

B. NUMBER OF NEW DRYERS REQUIRED

| | |
|---|---|
| EXISTING ANNUAL PROD.OF STEAM DRYERS (LBS) | 2000000 |
| NEW PRODUCTION RATE PER CYCLE (LBS) | 220 |
| CYCLE TIME 15 MINUTES | |
| NEW PRODUCTION RATE PER HOUR (LBS) | 880 |
| HOURS REQUIRED PER YEAR (USE TWO SYSTEMS) | 2272.727 |

C. ELECTRICITY SAVINGS

EXISTING ELECT. USE (TAKEN FROM TABLE II-5)

| DRYER TYPE | # | ANNUAL KWH | TOTAL KWH |
|---|---|---|---|
| A | 2 | 895.2 | 1790.4 |
| B | 7 | 895.2 | 6266.4 |
| C | 2 | 2238 | 4476 |
| D | 2 | 1044.4 | 2088.8 |
| E | 6 | 1342.2 | 8053.2 |
| H | 1 | 1044.4 | 1044.4 |
| | | | --------- |
| | | | 23719.2 |

| NEW ELECTRICITY USE | | HRS | KWH |
|---|---|---|---|
| BLOWER MTR (KW) | 7.46 | 2273 | 16956.58 |
| BASKET MTR (KW) | 2.24 | 2273 | 5091.52 |
| BURNER MTR (KW) | .373 | 2273 | 847.829 |
| | | | --------- |
| | | | 22895.93 |

| | |
|---|---|
| KWH SAVINGS | 823.271 |
| MBTU SAVINGS | 2.809824 |
| $ SAVINGS @ 12.97 | 36.32 |

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO    REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007    REPLACE STM. DRYERS
FISCAL YEAR: 1989    ECO #,s 20A
ANALYSIS DATE:    ECON LIFE 25

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 84250 | |
| B. | SIOH | 4634 | |
| C. | DESIGN COST | 5055 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 84545 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 84545 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | 2.8 | 36 | 11.16 | 405 | |
| B. | DIST | 4.34 | 0 | 0 | 17.79 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 17.12 | 0 | |
| D. | LPG | 3.27 | 3123 | 10212 | 16.15 | 164927 | |
| E. | WOOD | 2.00 | 0 | 0 | 13.47 | 0 | |
| F. | TOTAL | | 3125.8 | 10249 | | | 165332 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

A. ANNUAL RECURRING 0
(1) DISCOUNT FACTOR (TABLE A) * 11.65
(2) DISCOUNTED SAVINGS/COST (3A X 3A1) 0

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST    0

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33)    54560
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE))    10249

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C)    165332

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F)    1.96

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

## COST ESTIMATE ANALYSIS

For use of this form, see TM 5 800-2; the proponent agency is USACE.

PROJECT: INSTALL TWO 220 lb DRYERS (GAS)

LOCATION: FORT LEONARD WOOD

INVITATION/CONTRACTOR:

CODE (Check one) ☐ A ☐ B ☐ C ☐ OTHER

EFFECTIVE PRICING DATE:

DRAWING NO.:

ESTIMATOR:

DATE PREPARED: 25 MAY 89

SHEET 1 OF 1 SHEETS

CHECKED BY:

ECO # 20A

| TASK DESCRIPTION | QUANTITY | | LABOR | | | | EQUIPMENT | | MATERIAL | | TOTAL | SHIPPING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NO. OF UNITS | UNIT MEAS | MH UNIT | TOTAL HRS | UNIT PRICE | COST | UNIT PRICE | COST | UNIT PRICE | COST | | UNIT WT | TOTAL WT |
| 220 lb GAS DRYER | 2 | EA | | | 4000- | 8000- | 38,000 | 76,000- | | | 84,000- | | |
| DUCTWORK | 40 | LF | | | 1.26 | 50.40 | | | 1.39 | 55.60 | 106- | | |
| PIPING | 30 | LF | | | 3.40 | 102- | | | 1.39 | 41.70 | 144- | | |
| | | | | | | | | | | | 84,250 | | |
| TOTAL THIS SHEET | | | | | | | | | | | | | |

DA FORM 5418-R, Apr 85

**installation:** FORT LEONARD WOOD

**project:** ______

project number
temporary: ______ program year FY 91

permanent: ______ category code ______

## point of contact:

user
name ______ date ______

title ______ phone ______

autovon ______

dfae
name ______ date ______

title ______ phone ______

autovon ______

engineer district
name ______ date ______

title ______ phone ______

autovon ______

other (A-E)
name ______ date ______

title ______ phone ______

autovon ______

## reviewed by:

installation facility engineer
name ______ date ______

title ______ phone ______

autovon ______

## approved by:

macom engineer
name ______ date ______

title ______ phone ______

autovon ______

**project development brochure, PDB-1**

DA FORM 5020-R, Feb 82

# facility

FORT LEONARD WOOD, MISSOURI

# project coordinator for using service

functional requirements summary, PDB-1

DA FORM 5020-1-R, Feb 82

OBJECTIVE:

THE PURPOSE OF THIS PROJECT IS TO REDUCE HEATING ENERGY CONSUMPTION AT FORT LEONARD WOOD. THIS MAY BE ACCOMPLISHED BY INSTALLING 2 GAS FIRED DRYERS AT THE LAUNDRY FACILITY LOCATED IN BUILDING 2352.

LP GAS CONSUMPTION WILL BE REDUCED BY AN ESTIMATED 3123 MILLION BTU PER YEAR.

ELECTRICAL ENERGY CONSUMPTION WILL BE REDUCED BY AN ESTIMATED 2.8 MILLION BTU PER YEAR.

THE FIRST YEAR FUEL COST SAVINGS WILL BE ABOUT $10,255. THE SAVINGS INVESTMENT RATION FOR THIS PROJECT IS 1.96. THE SIMPLE PAYBACK IS 8.24 YEARS.

REQUIREMENTS:

THIS PROJECT IS REQUIRED TO REDUCE ENERGY CONSUMPTION AT FORT LEONARD WOOD, MISSOURI.

IMPACT SUMMARY:

IF THIS PROJECT IS APPROVED, AN ESTIMATED 3126 MBTU/YR WILL BE CONSERVED EACH YEAR. THIS WILL AMOUNT TO A COST SAVINGS OF $10,255.

IF THIS PROJECT IS NOT APPROVED, FORT LEONARD WOOD WILL NOT BE ABLE TO ACHIEVE THE POTENTIAL ENERGY SAVINGS THAT THIS PROJECT CAN PROVIDE.

**functional requirements summary, PDB-1**

DA FORM 5020-2-R, Feb 82

# facility

FORT LEONARD WOOD, MISSOURI

# project coordinator for using service

**detailed functional requirements, PDB-2**

facilities requirements sketch, PDB- ½

DA FORM 5022-R, Feb 82

## A. SPECIAL CONSIDERATIONS

| | ITEM | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| A-1 | Cost estimates for each primary and supporting facility | R | | X | |
| A-2 | Telecommunications system coordination with USACC and authorization for exceptions | NR | | | |
| A-3 | Coordination with state and local governmental requirements (blind vendors, medical facilities, construction and operating permits, clearinghouse ccoordination, etc.) | NR | | | |
| A-4 | Assignment of airspace | NR | | | |
| A-5 | Economic analysis of alternatives | R | | X | |
| A-6 | Approval for new starts | NR | | | |
| A-7 | International balance of payments (IBOP) coordination with U.S. European command and NATO—overseas cost estimates and comparables (include rate of exchange used in estimates) | NR | | | |
| A-8 | Impact on historic places—on site survey by authorized archeologist and coordination with state historic preservation officer and advisory council on historic preservation | NR | | | |
| A-9 | Exceptions to established criteria | NR | | | |
| A-10 | Coordination with various staff agencies (Provost Marshall-physical security, etc.) | NR | | | |
| A-11 | Identification of related or support projects (so projects can be coordinated) | R | A | | |
| A-12 | Required completion date | R | A | | |
| | Other Special Considerations (List and number items) | | | | |
| A-13 | ENERGY CONSERVATION INVESTMENT PROGRAM | R | | X | |
| A-14 | ENERGY ENGINEERING - ANALYSIS PROGRAM | R | | X | |
| A-15 | INSTALLATION SCHEDULE | R | C | | |

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED – Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED – Significant information summarized or explained and attached.

DOCUMENT ATTACHED – Significant information is in an existing document which is attached.

* BY WHOM (Check and insert appropriate letter)

A – DFAE
B – Using Service
C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

# documentation checklist

DA FORM 5023-A-R, Feb 82

## B. SITE DEVELOPMENT

| | ITEM | Required or Not Required | * To Be Determined | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| B-1 | Consultation with the District Office to determine and evaluate flood plain hazards | NR | | | |
| B-2 | Preparation, submission, and/or approval of new | | | | |
| (A) | General Site Plan | NR | | | |
| (B) | Annotated General Site Plan | NR | | | |
| (C) | Sketch Site Plan | NR | | | |
| (D) | Facilities Requirements Sketch | NR | | | |
| B-3 | Preparation of | | | | |
| (A) | Site Survey | NR | | | |
| (B) | Subsoil information | NR | | | |
| B-4 | Approval by Department of Defense Explosive Safety Board (DDESB) for Safety Site Plan | NR | | | |
| | Other Site Development Considerations (List and number items) | | | | |

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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**documentation checklist**

DA FORM 5023-B-R, Feb 82

## C. ARCHITECTURAL & STRUCTURAL

| | ITEM | Required or Not Required | * To Be Determined | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| C-1 | Reconciliation with troop housing programs and requirements | NR | | | |
| C-2 | Evaluation of existing facilities (including degree of utilization) | NR | | | |
| C-3 | Approval for removal and relocation of existing useable facilities | NR | | | |
| C-4 | Evaluation of off-post community facilities | NR | | | |
| C-5 | Storage and maintenance facilities (including nuclear weapons) | NR | | | |
| C-6 | Coordination hospitals, medical and dental facilities with Surgeon General | NR | | | |
| C-7 | Coordination of aviation facilities with FAA | NR | | | |
| C-8 | Coordination air traffic control and navigational aids with USACC | NR | | | |
| C-9 | Tabulation of types and numbers of aircraft | NR | | | |
| C-10 | Evaluation of laboratory, research and development, and technical maintenance facilities | NR | | | |
| C-11 | Coordination chapels with Chief of Chaplains | NR | | | |
| C-12 | Review food service facilities by USATSA | NR | | | |
| C-13 | Automated data processing system or equipment approvals—cost analysis when ADP and/or communication centers not co-located with related facilities | NR | | | |
| C-14 | Coordination postal facilities with U.S. Postal Service Regional Director | NR | | | |
| C-15 | Laundry and dry cleaning facilities coordination with ASD(I&L) | NR | | | |
| C-16 | Tenant facilities coordination with installation where sited | NR | | | |
| C-17 | Facilities for or exposed to explosions, toxic chemicals, or ammunition—review by DDESB (See also Item B-4) | NR | | | |
| C-18 | Analysis of deficiencies | R | | X | |
| C-19 | Consideration of alternatives | R | | X | |
| C-20 | Determination whether occupants will include physically handicapped or disabled persons | NR | | | |
| C-21 | As-build drawings for alterations or additions | NR | | | |
| C-22 | Availability of Standard Design or site adaptable designs | NR | | | |
| | Other Architectural & Structural (List and number items) | | | | |

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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E – Other (Check Comments Attached and explain)

# documentation checklist

DA FORM 5023-C-R, Feb 82

## E. ENVIRONMENTAL CONSIDERATIONS

| | ITEM | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| E-1 | Environmental impact assessment | R | A | | |
| E-2 | EIA conclusions require Environmental Impact Statement | NR | | | |
| E-3 | Determination of health, environmental or related hazards. Assistance to determine existence of any health, environmental or related hazard may be requested from Aberdeen Proving Ground, MD 21010, the Office of the Surgeon General, Attn: DASG-HCH (Army Environmental Hygiene Agency) | NR | | | |
| E-4 | Air/water pollution permit, coordination with agencies and compliance with standards at Federal, state and local level | NR | | | |
| E-5 | Corrective measures associated with Environmental Impact Statements or assessment—list separately and evaluate. | NR | | | |
| | Other environmental considerations (list and number items) | | | | |

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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E – Other (Check Comments Attached and explain)

**documentation checklist**

DA FORM 5023-E-R, Feb 82

COMMENTS

DOCUMENTATION CHECK LIST

| ITEM | COMMENT |
|---|---|
| A-1 | COST ESTIMATE: THE COST OF INSTALLED GAS DRYERS IS $93,900. |

| | |
|---|---|
| DUCT WORK | 106 |
| PIPING | 144 |
| 220 LB DRYERS | 84,000 |
| TOTAL CONSTRUCTION COST | 84,250 |
| SIOH (5.5%) | 4,640 |
| DESIGN (6%) | 5,050 |
| TOTAL REQUEST (FY91) | $93,940 |

A DETAILED BREAKDOWN OF THE COST ESTIMATE IS SUPPLIED IN THE DD 1391 DOCUMENTATION.

| | |
|---|---|
| A-5 | ECONOMIC ANALYSIS OF ALTERNATIVES: SEE ATTACHED DD 1391, DETAILED JUSTIFICATION, SECTION 4. |
| A-13 | THIS PROJECT MEETS ALL ECIP REQUIREMENTS FOR FUNDING. |
| A-14 | THIS PROJECT IS PART OF THE EEAP CONDUCTED AT FORT LEONARD WOOD DURING FY 89. |
| C-18 | ANALYSIS OF DEFICIENCIES: SEE ATTACHED DD 1391. |
| C-19 | CONSIDERATION OF ALTERNATIVES: SEE ATTACHED DD 1391, DETAILED JUSTIFICATION, SECTION 4. |

## A. SPECIAL CONSIDERATIONS

| | ITEM | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| A-1 | Factors of risk, restriction or unusual circumstance expected to increase costs beyond applicable area averages | NR | | | |
| A-2 | Construction phasing requirements | NR | | | |
| A-3 | Functional support equipment (mechanical, electrical, structural, and security) to be built in | NR | | | |
| A-4 | Equipment in place and justification | NR | | | |
| A-5 | Other equipment and furniture (O&MA, OPA) and costs | NR | | | |
| A-6 | Special studies and tests (hazards analyses, compatibility testing, new technology testing, etc.) | NR | | | |
| A-7 | Type of construction (permanent, temporary, semi-permanent) | NR | | | |
| A-8 | Government furnished equipment (quantities, procurement time, availability and special handling and storage requirements). Funds used for procurement. | NR | | | |
| | Other special considerations (list and number items) | | | | |

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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E – Other (Check Comments Attached and explain)

# technical data checklist

DA FORM 5024-A-R, Feb 82

## B. SITE DEVELOPMENT

| | ITEM | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| B-1 | Construction restrictions or guidelines pertaining to | | | | |
| (A) | site access and preferred construction routes | NR | | | |
| (B) | Airfield clearance, explosive storage, working hours, safety, etc. | NR | | | |
| (C) | Facilities and/or functions or adjoining areas (structures, materials, impact) | NR | | | |
| B-2 | Real estate actions (acquisition, disposal, lease, right-of-way) | NR | | | |
| B-3 | Demolition/relocation required (data) | | | | |
| (A) | Special considerations due to explosives/radioactivity/ chemical contamination/asbestos emissions/toxic gases | NR | | | |
| (B) | Restrictions on disposal of demolished/relocated material including hazardous waste | NR | | | |
| B-4 | Pavement types and requirements (including traffic surveys and MTMC coordination) | NR | | | |
| B-5 | Landscape considerations | | | | |
| (A) | Protection of existing vegetation | NR | | | |
| (B) | Stockpile topsoil | NR | | | |
| | Other Site Development (List and number items) | | | | |

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED – Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED – Significant information summarized or explained and attached.

DOCUMENT ATTACHED – Significant information is in an existing document which is attached.

*BY WHOM (Check and insert appropriate letter)

- A – DFAE
- B – Using Service
- C – Construction Service
- D – Designer
- E – Other (Check Comments Attached and explain)

**technical data checklist**

DA FORM 5024-B-R, Feb 82

## C. ARCHITECTURAL & STRUCTURAL

| | ITEM | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| C-1 | Vibration-producing equipment requiring isolation | NR | | | |
| C-2 | Seismic zone and other design load criteria (typhoon, hurricane, earthquake loads, high or low loss potential) | NR | | | |
| C-3 | Protective shelter evaluation and resistant design criteria (conventional/nuclear blast and radiation, chemical/biological) | NR | | | |
| C-4 | Unusual foundation requirements (pier, pile, caisson, deep foundations, mat, special treatment, permafrost areas, soil bearing) | NR | | | |
| C-5 | Designation and strength of units to be accommodated | NR | | | |
| C-6 | Requirements and data for special design projects | NR | | | |
| C-7 | Unusual floor and roof loads (safes, equipment) | NR | | | |
| C-8 | Security features (arms rooms, vaults, interior secure areas) | NR | | | |
| | Other Architectural & Structural (List and number items) | | | | |

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED – Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED – Significant information summarized or explained and attached.

DOCUMENT ATTACHED – Significant information is in an existing document which is attached.

*BY WHOM (Check and insert appropriate letter)

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C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

# technical data checklist

DA FORM 5024-C-R, Feb 82

## D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS

| | ITEM | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| D-1 | Special mechanical requirements or considerations (elevator, crane, hoist, etc.) | R | D | | |
| D-2 | Special peak usage periods and peak leveling techniques | NR | | | |
| D-3 | Maintenance considerations (accessibility of equipment, compatibility with existing equipment) | R | D | | |
| D-4 | Plumbing—availability, general system type and characteristics (proposed and/or existing, incl. compressed air and gas) | R | D | | |
| D-5 | Heating—availability, general system type and characteristics (proposed and/or existing) | R | D | | |
| D-6 | Ventilating, air condition/refrigeration—availability, general system type and characteristics (proposed and/or existing) | R | D | | |
| D-7 | Electrical—availability, general system type and characteristics incl. airfield lighting, communication, etc. (proposed and/or existing) | R | D | | |
| D-8 | Water supply/waste treatment—availability, general system type and characteristics (proposed and/or existing) | R | D | | |
| D-9 | Energy requirements/fuel conversion (sources, availability, loads, types of fuel, etc.) | R | D | | |
| D-10 | Solar energy evaluation | NR | | | |
| | Other Mechanical & Utility Systems (List and number items) | | | | |

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED – Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED – Significant information summarized or explained and attached.

DOCUMENT ATTACHED – Significant information is in an existing document which is attached.

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A – DFAE
B – Using Service
C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

# technical data checklist

## E. ENVIRONMENTAL CONSIDERATIONS

| | ITEM | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| E-1 | Waste water treatment, air quality, and solid waste disposal criteria | NR | | | |
| | Other Environmental Considerations (List and number items) | | | | |

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED – Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED – Significant information summarized or explained and attached.

DOCUMENT ATTACHED – Significant information is in an existing document which is attached.

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B – Using Service
C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

**technical data checklist**

DA FORM 5024-E-R, Feb 82

## F. FIRE PROTECTION

| | ITEM | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| F-1 | Special fire protection systems or features (detection and suppression equipment, hazards, etc.) | NR | | | |
| | Other Fire Protection Considerations (List and number items) | | | | |

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED – Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED – Significant information summarized or explained and attached.

DOCUMENT ATTACHED – Significant information is in an existing document which is attached.

*BY WHOM (Check and insert appropriate letter)

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B – Using Service
C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

**technical data checklist**

DA FORM 5024-F-R, Feb 82

| See Tech. Data Checklist Item | | A. SPECIAL CONSIDERATIONS — ITEM | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| A-1 | A-1 | Factors of risk, restriction, or unusual circumstance expected to increase costs beyond applicable area averages. | NR | | | |
| | (A) | Special applicable construction codes/criteria (NATO, SOFA, base regulations, use of government furnished documents, etc.) | NR | | | |
| | (B) | Skilled labor and/or structural material availability impact. | NR | | | |
| A-2 | A-2 | Construction phasing requirements | NR | | | |
| | A-3 | Unique contractor requirements (24 hr/day work capability; safety requirements—AR 385-10, DODI 1000.18, DODD 1000.3, DODI 6055.1; etc.) | NR | | | |
| | A-4 | Utilities available to contractor (types, metering, costs, billing, etc.) | NR | | | |
| | A-5 | Secure area availability for contractor equipment and materials storage | NR | | | |
| | A-6 | Clearances required of contractor | NR | | | |
| | A-7 | Contractor work area (location, limits) | R | A | | |
| A-3 | A-8 | Function support equipment (mechanical, electrical, structural support requirements) | R | D | | |
| D-1 | (A) | Cranes and hoists (loads, controls, uses, etc.) | R | D | | |
| | A-9 | Trash handling system (availability, storage area for recyclable material to coincide with installation resource recovery plan) | NR | | | |
| A-3, A-4, A-5 | A-10 | Real property installed equipment and furniture | NR | | | |
| | (A) | Functional support equipment | NR | | | |
| | (B) | Equipment in place | NR | | | |
| | (C) | Other equipment and furniture (O&MA, OPA) | NR | | | |
| | A-11 | Disposition of scrap and salvage | R | A | | |
| | A-12 | Training of using service operating personnel (Operating Manual, etc.) | R | D | | |
| | A-13 | Contingency plan for incidental discovery of archeological artifacts | R | | | |
| | A-14 | Maintenance and maintainability (i.e. avoiding features which have high maintenance requirements or new maintenance skills, etc.) | R | D | | |
| | A-15 | Economic Considerations | NR | | | |
| | (A) | Projected economic life associated with specified functional requirements. | NR | | | |
| | (B) | Special economic ranking considerations—design features for which factors other than economics (i.e., other than lowest LCC) should govern the decision as to which of the feasible alternatives should be selected, including statement of locally unacceptable alternatives and reasons therefor. | NR | | | |
| | (C) | Projected facility utilization operation schedule. | NR | | | |
| | (D) | Planned changes in facility usage during economic life and alterations to be required. | NR | | | |
| | (E) | Projected preventive-maintenance (p-m) strategy (e.g., full p-m as recommended by manufacturer; minimum p-m—replace failures as they occur, and little else; full p-m on critical items only; etc.). | NR | | | |
| | (F) | Projected strategy for custodial care and maintenance for most commonly used types of exterior and interior finishes (e.g., frequencies for sweeping, vacuuming, washing, painting, etc.). | NR | | | |
| | (G) | Design features that experience has shown require excessive M&R. | NR | | | |

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# design data checklist

DA FORM 5025-A-R, Feb 82

## B. SITE DEVELOPMENT

| See Tech. Data Checklist Item | Item No. | ITEM | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| B-1 | B-1 | Required site plans (incl. design and construction factors) | | | | |
| | (A) | Site access and preferred construction routes | NR | | | |
| | (B) | Site restrictions (airfield clearance, explosive storage, etc.) | NR | | | |
| | (C) | Existing facilities/functions on adjoining areas (structures, materials, impact) | NR | | | |
| | (D) | Disposal areas (trash, excavated material, constraints) | R | A | | |
| | (E) | Borrow and spoil areas | NR | | | |
| | (F) | Grades or contours existing | NR | | | |
| | (G) | Existing trees, turf, ground cover, landscape development, erosion control | NR | | | |
| | (H) | Bridges and fences (applicable design criteria) | NR | | | |
| | (I) | Railroads (routing, sidings, docks, yards, grounding) | NR | | | |
| | (J) | Fire station and security police location | NR | | | |
| | (K) | Site utilities—capacity and quantity available to project (sanitary and storm sewers, drainage ditches, water and gas service, communication lines, hydrants and sprinklers, etc.) | R | D | | |
| | (L) | New facilities clearly identified | NR | | | |
| | (M) | Necessary support facilities required for complete functional project (warehouse, igloo, fuel storage, waste treatment, etc.) | NR | | | |
| C-4 | B-2 | Subsoil conditions (actual or expected—groundwater, permafrost, etc.) | NR | | | |
| B-2 | B-3 | Real estate actions (acquisition, disposal, lease, right-of-way) | NR | | | |
| B-3 | B-4 | Demolition/relocation required to clear site (date) | NR | | | |
| B-4 | B-5 | Pavement types and requirements | | | | |
| | (A) | Design loading and use frequency by type of paving | NR | | | |
| | (B) | Street size and layout (traffic control) | NR | | | |
| | (C) | Parking lots (signage, etc.) | NR | | | |
| | (D) | Sidewalks and curbs (handicapped, etc.) | NR | | | |
| | (E) | Gutters, culverts and other drainage factors | NR | | | |
| | (F) | Runways, aprons and taxiways | NR | | | |
| | (G) | Tie-down anchors or grounds | NR | | | |
| | (H) | Special surface conditions required | NR | | | |
| D-9, D-10 | B-6 | Energy conservation siting and features (wind solar, etc.). See also DDC Item D-13 (D) & (E) | NR | | | |

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# design data checklist

DA FORM 5025-B-1-R, Feb 82

| See Tech. Data Checklist Item | B. SITE DEVELOPMENT (Continued) ITEM | | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| B-5 | B-7 | Landscape treatment | | | | |
| | (A) | Preservation of existing features | NR | | | |
| | (B) | Proposed planting (low maintenance species, locations away from power lines, etc.) | NR | | | |
| B-5 | B-8 | Storm drainage (See also Item E-4) | | | | |
| | (A) | Total run-off area affecting project | NR | | | |
| | (B) | Design intensity for floods | NR | | | |
| | (C) | Design of storm drainage system to include pick-up system and outfall lines | NR | | | |
| | B-9 | Consideration of Coastal Zone Management Act (PL 92-583, 1972; Amendment PL 94-370, 1976) | NR | | | |
| | | Other Site Development Considerations (List and number items) | | | | |

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**design data checklist**

DA FORM 5025-B-2-R, Feb 82

## C. ARCHITECTURAL & STRUCTURAL

| See Tech. Data Checklist Item | | ITEM | Required or Not Required | * To Be Determined | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| | C-1 | Material availability limitations (include fill and paving) | NR | | | |
| | C-2 | Architectural style (existing, planned or desired, use of pre-engineered buildings considered) | NR | | | |
| C-7 | C-3 | Floors (type, finish, special loading, subgrade moisture control, low maintenance types particularly in spill areas) | NR | | | |
| C-3 | C-4 | Walls | NR | | | |
| | (A) | Exterior (materials, sealing of joints, general maintenance) | NR | | | |
| | (B) | Interior walls and partitions (material, finish, fire resistance, subgrade moisture control) | NR | | | |
| | C-5 | Ceilings (height, finish, acoustics) | NR | | | |
| | C-6 | Windows (type, size, special treatment) | NR | | | |
| | C-7 | Doors (type, size, power operation, panic hardware, durability) | NR | | | |
| | C-8 | Hardware (finish, location, special metal restrictions, durability) | NR | | | |
| | C-9 | Special finishes (protective coatings, non-sparking, conductive, acid-resistant) | NR | | | |
| C-8 | C-10 | Security features (windows, doors, hardware, construction of walls, floors & ceilings, arms rooms, vaults, etc.) | NR | | | |
| | C-11 | Sound attenuation requirements (expected and required levels, location) | R | D | | |
| | C-12 | Stairs, elevators and chutes (location, size, type of usage) | NR | | | |
| | C-13 | Loading docks and canopies | NR | | | |
| C-1 | C-14 | Vibration-producing equipment requiring isolation | R | D | | |
| C-4 | C-15 | Unusual foundation requirements (pier, pile, caisson, deep foundations, mat, special treatment, creep control) | NR | | | |
| | C-16 | Span or unusual clearance requirements (span or height) | NR | | | |
| | C-17 | Special bay sizes (reflect access dimensions) | NR | | | |
| | C-18 | Overhead support requirements (hoists, cranes) | NR | | | |
| C-7 | C-19 | Roof loads and requirements (live/dead loads, materials, access, low maintenance features like exterior drains, etc.) | NR | | | |
| | C-20 | Structural specialities (slabs, sumps, trenches, pits) | NR | | | |
| C-2 | C-21 | Seismic zone design criteria | NR | | | |
| C-2 | C-22 | Area wind loads (summer/winter prevailing wind, hurricane, typhoon) | NR | | | |
| C-3 | C-23 | Protective shelter evaluation and resistant design criteria | NR | | | |
| | (A) | Explosive/nuclear blast (protective, resistive, suppressive, venting and containment structures) | NR | | | |
| | (B) | Radiation protection (type of radiation, intensity, source) | NR | | | |
| | (C) | Chemical/biological protection | NR | | | |

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# design data checklist

DA FORM 5025-C-1-R, Feb 82

| See Tech. Data Checklist Item | C. ARCHITECTURAL & STRUCTURAL (Continued) ITEM | | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| C-5 | C-24 | Designation and strength of units to be accommodated | NR | | | |
| C-6 | C-25 | Requirements for special design projects | NR | | | |
| | C-26 | Safety features (occupant load, maximum travel distance to exits, hazard to be controlled or eliminated) | NR | | | |
| | C-27 | Special design features for handicapped. | NR | | | |
| | | Other Architectural and Structural (list and number items) | | | | |

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**design data checklist**

DA FORM 5025-C-2-R, Feb 82

## D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS

| See Tech. Data Checklist Item | | ITEM | Required or Not Required | * To Be Determined | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| D-1 | D-1 | Special mechanical requirements or considerations | NR | | | |
| D-2 | D-2 | Special peak usage periods and peak leveling techniques | NR | | | |
| D-3 | D-3 | Maintenance considerations (equipment room size, layout, location, general accessibility of equipment, compatibility with existing equipment.) | R | D | | |
| D-9 | D-4 | Energy monitoring control system (EMCS) and permanent utilities metering | NR | | | |
| D-4 | D-5 | Plumbing system (proposed and/or existing) | R | D | | |
| | (A) | General piping and storage system | NR | | | |
| | (1) | Materials (galvanized, copper, etc.) | R | D | | |
| | (2) | Insulation | R | D | | |
| | (3) | Natural or LP gas | R | D | | |
| | (4) | Venting | R | D | | |
| | (5) | Distilled water | NR | | | |
| | (6) | Compressed air | R | | | |
| | (7) | Hospital & surgical gases | NR | | | |
| | (8) | Other (chemical, fuel) | NR | | | |
| | (B) | Facility water supply | R | D | | |
| | (C) | Garbage disposal | NR | | | |
| | (D) | Sanitary drainage system | R | D | | |
| | (E) | Grease interception | NR | | | |
| | (F) | Chemical waste drainage & disposal (incl. explosive process waste) | NR | | | |
| | (G) | Radioactive waste | NR | | | |
| | (H) | Drinking fountains | NR | | | |
| | (I) | Water treatment | NR | | | |
| | (J) | Emergency fixtures (showers, eyewash fountains) | NR | | | |
| D-5 | D-6 | Heating system | R | D | | |
| | (A) | Existing generation plant | R | D | | |
| | (1) | Location and distance from new facility | R | D | | |
| | (2) | Equipment (type, age, fuel, etc.) | R | D | | |
| | (3) | Current loads (average, peak, reserves for this and other projects, load leveling system) | NR | | | |
| | (4) | Type of plant | NR | | | |
| | (5) | Manning & support requirements | NR | | | |
| | (6) | Pollution controls | NR | | | |
| | (7) | Type of product | NR | | | |

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# design data checklist

DA FORM 5025-D-1-R, Feb 82

| See Tech. Data Checklist Item | D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS (Continued) ITEM | | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| D-5 | D-6 | Heating system (continued) | NR | | | |
| | (B) | Requirements for proposed facility | NR | | | |
| | (1) | Type of system | NR | | | |
| | (2) | Heat load requirements (special temperature demands) | NR | | | |
| | (3) | Controls, metering & EMCS requirements | NR | | | |
| | (4) | Distribution system (valves, steam pressure, fluid temperature) | NR | | | |
| | (5) | Corrosion control | NR | | | |
| | (6) | Insulation | NR | | | |
| | (7) | Additional equipment specifications | NR | | | |
| D-6 | D-7 | Ventilating/air conditioning/refrigeration system | NR | | | |
| | (A) | Existing facilities | NR | | | |
| | (1) | Location | NR | | | |
| | (2) | Type of plant (refrigeration, chilled water, etc.) | NR | | | |
| | (3) | Current loads (average, peak, reserves for this and other projects, load leveling system) | NR | | | |
| | (4) | Type of product (CFM, temperature, GPM, etc.) | NR | | | |
| | (5) | Distribution system | NR | | | |
| | (6) | Special filtration requirements | NR | | | |
| | (7) | Special humidity, ventilation, or temperature requirements | NR | | | |
| | (8) | Security restrictions for open ducting | NR | | | |
| | (9) | Freezers or coolers | NR | | | |
| | (B) | Requirements for proposed facility | | | | |
| | (1) | Type of system | NR | | | |
| | (2) | Temperature, humidity and vent conditions special to this design | NR | | | |
| | (3) | Control, cycling, metering and EMCS requirements | NR | | | |
| | (4) | Distribution (length of extension, location, fluid temperature) | NR | | | |
| | (5) | Corrosion control | NR | | | |
| | (6) | Insulation | NR | | | |
| | (7) | Special fire and security considerations for this project | NR | | | |
| | (8) | Occupancy hours and days per week | NR | | | |
| D-5, D-6 | D-8 | Heat and chilled water distribution system | NR | | | |
| | (A) | Heat system | NR | | | |
| | (1) | Type of service | NR | | | |
| | (2) | Existing system components | NR | | | |
| | (3) | Valving and sectionalizing requirements | NR | | | |
| | (4) | Allowable shut-down of service for main connections | NR | | | |
| | (5) | Sizing for future facilities | NR | | | |

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# design data checklist

DA FORM 5025-D-2-R, Feb 82

| See Tech. Data Checklist Item | D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS (Continued) — ITEM | | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| D-5 | D-8 | Heat and chilled water distribution system (continued) | NR | | | |
| D-6 | (B) | Chilled water system | NR | | | |
| | (1) | Type of service | NR | | | |
| | (2) | Existing system components | NR | | | |
| | (3) | Valving and sectionalizing requirements | NR | | | |
| | (4) | Allowable shut-down of service for main connections | NR | | | |
| | (5) | Sizing for future facilities | NR | | | |
| D-7 | D-9 | Electrical system | | | | |
| | (A) | Power service characteristics & location | R | D | | |
| | (B) | Stand-by power (available & required) | NR | | | |
| | (C) | Special interior functional lighting requirements (brightness, night, emergency, justification) | NR | | | |
| | (D) | Uninterruptible power required | NR | | | |
| | (E) | Commercial tie-in requirements & restrictions | R | D | | |
| | (F) | Potential for increased power service needed | | D | | |
| | (G) | Service outage duration limitations | NR | | | |
| | (H) | Security alarm systems (type & location) | NR | | | |
| | (I) | Street, parking or security lighting (brightness, hours, switching, etc.) | NR | | | |
| | (J) | Types of fixtures required (including mounting, NEC classification, etc.) | R | D | | |
| | (K) | Telephone extension circuits or conduit (functional support & outlet location) | NR | | | |
| | (L) | Television circuitsor conduit (functional support & outlet location) | NR | | | |
| | (M) | Intercom requirements (locations, type) | NR | | | |
| | (N) | Equipment list w/power requirements | NR | | | |
| | (O) | Special communications requirements (filtering, maximum fluctuation limitations, convertors, etc.) | NR | | | |
| | (P) | Electronic shielding & interference measures (frequency involved) | NR | | | |
| | (Q) | Special switches & control outlets, receptacle requirements, etc. | NR | | | |
| | (R) | Grounding requirements, lightning protection | NR | | | |
| | (S) | Hazardous environment requirements (location, activity involved, NEC classification, type of hazard) | NR | | | |
| | (T) | Corrosion control (cathodic protection) | NR | | | |

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|---|---|---|---|---|---|---|
| D-7 | D-9 | Electrical system (continued) | | | | |
| | (U) | Other special power requirements (traffic control, antenna, etc.) | NR | | | |
| | (V) | Applicability of task lighting considerations | NR | | | |
| | (W) | Power management and metering requirements | NR | | | |
| | D-10 | Electrical Distribution | | | | |
| | (A) | Actual & estimated loads (peak & average (KW demand)) | R | D | | |
| | (B) | Utility compnay distribution system (substations, transmission lines, rate schedule, etc.) | NR | | | |
| | (C) | Government owned distribution system (switching station, transmission lines, feeders, etc.) | NR | | | |
| | (D) | Estimated impact of proposed equipment installation on power factor, load balance and costs for corrective action proposed | R | D | | |
| | (E) | Overhead/underground (voltage, conductor size, grounding, etc.) | NR | | | |
| | (F) | Estimated power demand factor and diversity factor | R | D | | |
| | (G) | Power quality requirements (voltage and frequency regulation) | R | D | | |
| | (H) | Power to intrusion, detection alarm systems around perimeter | NR | | | |
| | D-11 | Airfield lighting requirements | NR | | | |
| | (A) | Area & location to be served | NR | | | |
| | (B) | Source of power (normal & emergency) | NR | | | |
| | (C) | Vault requirements | NR | | | |
| | (D) | Primary feeders | NR | | | |
| | (E) | Control cabling | NR | | | |
| | (F) | Runway lighting (centerline, edge, distance markers, intensity control) | NR | | | |
| | (G) | Threshold, approach, & strobe beacon lighting | NR | | | |
| | (H) | Visual approach slope indicators (VASI) | NR | | | |
| | (I) | Obstructions lighting/barrier markers | NR | | | |
| | (J) | Taxiway edge lighting | NR | | | |
| | (K) | Helipad/heliport lighting (perimeter, landing direction, hoverlane, etc.) | NR | | | |
| D-8 | D-12 | Water supply system | R | | | |
| | (A) | Source (commercial, well, storage, etc.) | R | D | | |
| | (B) | Average rate of supply (FPD at PSI) Current & Future | R | D | | |
| | (C) | Treatment requirements | NR | | | |
| | (D) | Existing system components (type, size, capacity, age, material, location, valving, pressure, etc.) | R | D | | |

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|---|---|---|---|---|---|---|
| D-8 | D-12 | Water supply system (continued) | | | | |
| | (E) | Chemical analysis of water | NR | | | |
| | (F) | Emergency storage requirements | R | D | | |
| | (G) | Peak hours of supply (hours & estimated quantity) | R | D | | |
| | (H) | Known minimal requirements of supported function or Government equipment (quantity & quality) | R | D | | |
| | (I) | Chemical feeder & piping systems | NR | | | |
| | (J) | Corrosion control (existing & planned) | NR | | | |
| | (K) | Metering or usage restrictions | R | D | | |
| | (L) | Location of tie points (available capacity, interruption schedule) | R | D | | |
| D-8 | D-13 | Waste water treatment system | | | | |
| | (A) | Existing system & components (size, capacity, characteristics) | | | | |
| | (1) | Treatment plant | NR | | | |
| | (2) | Collector sewers | NR | | | |
| | (3) | Sewer mains (materials, depth) | NR | | | |
| | (4) | Complete treatment – industrial process | NR | | | |
| | (5) | Chemical, fuel or oil spill collection facilities | NR | | | |
| | (6) | Existing flows (min., avg., peak) | NR | | | |
| | (7) | Hydraulic capacity | NR | | | |
| | (B) | Known/estimated industrial or functional discharges (quantity & quality) | NR | | | |
| | (C) | Contributory population & per capita contribution | NR | | | |
| | (D) | Proposed system & components | NR | | | |
| | (1) | Treatment plant | NR | | | |
| | (2) | Collection sewers | NR | | | |
| | (3) | Lift station | NR | | | |
| | (4) | Complete treatment (additions or modifications) | NR | | | |
| | (5) | Chemical, fuel or oil spill collection facilities | NR | | | |
| | (6) | Waste water from portable water treatment plant | NR | | | |
| | (7) | Projected flows—average or peak | NR | | | |
| | (8) | By-pass restrictions | NR | | | |
| | (9) | Location of tie points (available capacity, interruption schedule) | R | | | |
| | (E) | Compliance requirements (federal, state, local) | R | D | | |
| | (F) | National Pollution Discharge Elimination System (NPDES) permit | NR | | | |
| | (G) | Corrosion control (existing or planned) | NR | | | |

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED – Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED – Significant information summarized or explained and attached.

DOCUMENT ATTACHED – Significant information is in an existing document which is attached.

*BY WHOM (Check and insert appropriate letter)

A – DFAE
B – Using Service
C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

**design data checklist**

DA FORM 5025-D-5-R, Feb 82

| See Tech. Data Checklist Item | | D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS (Cont.) ITEM | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| D-9 | D-14 | Energy Sources | | | | |
| | (A) | Gas systems (LP, natural, special) | R | D | | |
| | (1) | Loads and areas served | R | D | | |
| | (2) | Source of gas & type of service | R | D | | |
| | (3) | Supply pressure average | R | D | | |
| | (4) | Heating valve & type of gas (BTU per cubic foot) | R | D | | |
| | (5) | Valving & sectionalizing criteria | R | D | | |
| | (6) | Pressure regulation — reduction stations | R | D | | |
| | (7) | Existing lines, pumping stations, pressurization, base system | R | D | | |
| | (8) | Control & metering | R | D | | |
| | (B) | POL systems | | | | |
| | (1) | Fuel (primary or standby source, grade and analysis) | NR | | | |
| | (2) | Storage (tank size, location, type, number of storage days) | NR | | | |
| | (3) | Areas served | NR | | | |
| | (4) | Fuel requirements (known, estimated, quantity & type) | NR | | | |
| | (5) | Distribution system characteristics (piping, types of fuel, pumps, capacities) | NR | | | |
| | (6) | Ventilation system (Vapor Emission Control) | NR | | | |
| | (7) | Safety specifications | NR | | | |
| | (8) | Filter separators | NR | | | |
| | (C) | Coal systems | | | | |
| | (1) | Storage (location & capacity) | NR | | | |
| | (2) | Source of supply (primary & emergency) | NR | | | |
| | (3) | Type, energy value, analysis (i.e. sulfur, ash, etc.) | NR | | | |
| | (D) | Solar energy systems | | | | |
| | (1) | Building heating, air conditioning, domestic hot water | NR | | | |
| | (2) | Heating process water | NR | | | |
| | (3) | Collector type & location | NR | | | |
| | (4) | Liquid, chemical or rock storage | NR | | | |
| | (5) | Freeze protection | NR | | | |
| | (E) | Energy conservation data (U values, orientation, passive solar considerations, etc.) | NR | | | |
| | | Other Mechanical & Utility Systems (list and number items) | | | | |

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED – Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED – Significant information summarized or explained and attached.

DOCUMENT ATTACHED – Significant information is in an existing document which is attached.

*BY WHOM (Check and insert appropriate letter)

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C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

**design data checklist**

DA FORM 5025-D-6-R, Feb 82

| See Tech. Data Checklist Item | E. ENVIRONMENTAL CONSIDERATIONS | ITEM | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| E-1 | E-1 | Water quality | | | | |
| | (A) | Waste water treatment management program (PL 92-500 & PL 95-217) | NR | | | |
| | (B) | Water quality criteria & standards (federal, state and local) | NR | | | |
| | (C) | Treatment requirements coordinated with EPA | NR | | | |
| | (D) | Facilities to be installed to meet regulatory agency criteria | NR | | | |
| E-1 | E-2 | Air quality | | | | |
| | (A) | Applicable air quality criteria (federal, state and local; PL 95-95 and Clean Air Act Amendment of 1977) | NR | | | |
| | (B) | Action taken to comply with requirements | NR | | | |
| | (C) | Type & amount of pollutants generated | NR | | | |
| | (D) | Results of proposed abatement measures | NR | | | |
| | (E) | Existing control equipment & monitoring procedures | NR | | | |
| E-1 | E-3 | Solid waste disposal | | | | |
| | (A) | Applicable solid waste criteria (federal, state and local) | NR | | | |
| | (B) | Waste volume generated (type & characteristics) | NR | | | |
| | (C) | Method of disposal (land fill and availability of land, leachate, etc.) | NR | | | |
| | (D) | Disposition of recyclable materials for reuse or as combustion fuel | NR | | | |
| | (E) | Impact on installation recycling programs | NR | | | |
| | E-4 | Effects of terrain changes (such as excavations, roadways, drainage structures, etc.) | NR | | | |
| | (A) | Measures to control erosion | NR | | | |
| E-1 | E-5 | Treatment of hazardous material | NR | | | |
| | (A) | Handling and disposal of plychlorinated biphenyls (PCB) in electrical transformers | NR | | | |
| | (B) | Handling and disposal of asbestos materials | NR | | | |
| | (C) | Handling and disposal of fiberglass products | NR | | | |
| | (D) | Storage of fuels and solvents | NR | | | |
| | (E) | Coordination with installation spill control plans | NR | | | |
| | | Other Environmental Considerations (list and number items) | | | | |

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED – Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED – Significant information summarized or explained and attached.

DOCUMENT ATTACHED – Significant information is in an existing document which is attached.

*BY WHOM (Check and insert appropriate letter)

A – DFAE
B – Using Service
C – Construction Service
D – Designer
E – Other (Check Comments Attached and explain)

**design data checklist**

DA FORM 5025-E-R, Feb 82

## F. FIRE PROTECTION

| See Tech. Data Checklist Item | ITEM | | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| F-1 | F-1 | General design guidance | | | | |
| | (A) | Occupancy type (see NFPA 101, Chap 4) | NR | | | |
| | (B) | Water supply characteristics (existing or planned extensions) (capacity, pump activation, storage tanks and pumps, etc.) | NR | | | |
| | (C) | Mobile fire apparatus (response distance/time) | NR | | | |
| | (D) | Fire detection and alarm systems (existing or planned, type, location, etc.) | NR | | | |
| | (E) | Automatic suppression systems (water sprinkler, $CO_2$, foam etc.—existing or planned | NR | | | |
| | (F) | Hazard of contents (low, ordinary, high-see NFPA 101; type—explosives, flammable/toxic chemicals, radioactive materials) | NR | | | |
| F-1 | F-2 | Special fire suppression system requirements | NR | | | |
| | (A) | Means of egress | NR | | | |
| | (B) | Fire area limitations | NR | | | |
| | (C) | Fire walls, partitions, draft curtains | NR | | | |
| | (D) | Detection system (type, detectors, supervision, transmitters, annunciators, backup provisions) | NR | | | |
| | (E) | Suppression system (damage by water to costly equipment, shut down of operations) | NR | | | |
| | | Other Fire Protection (list and number items) | NR | | | |

REQUIRED OR NOT REQUIRED – Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED – Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED – Significant information summarized or explained and attached.

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*BY WHOM (Check and insert appropriate letter)
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- B – Using Service
- C – Construction Service
- D – Designer
- E – Other (Check Comments Attached and explain)

**design data checklist**

DA FORM 5025-F-R, Feb 82

| 1. COMPONENT | FY 19 91 MILITARY CONSTRUCTION PROJECT DATA | 2. DATE |
|---|---|---|
| ARMY | | MARCH, 1991 |

| 3. INSTALLATION AND LOCATION | 4. PROJECT TITLE |
|---|---|
| FORT LEONARD WOOD, MISSOURI | RECYCLE RINSE WATER (PECIP) |

| 5. PROGRAM ELEMENT | 6. CATEGORY CODE | 7. PROJECT NUMBER | 8. PROJECT COST ($000) |
|---|---|---|---|
| | | | 36.37 |

9. COST ESTIMATES

| ITEM | U/M | QUANTITY | UNIT COST | COST ($000) |
|---|---|---|---|---|
| SPLIT DISCHARGE VALVES | EA | 8 | 1150 | 9.200 |
| PIPING 6" | LF | 50 | 40.34 | 2.017 |
| PIPING 2" | LF | 200 | 7.81 | 1.562 |
| PUMP | EA | 2 | 465 | 0.930 |
| SUMP | EA | 1 | 5700 | 5.700 |
| STORAGE TANK | EA | 1 | 4181 | 4.181 |
| CONTROLS | EA | 1 | 9000 | 9.000 |
| SUBTOTAL | | | | 32.590 |
| SIOH | | | | 1.792 |
| DESIGN | | | | 1.955 |
| TOTAL REQUEST | | | | 36.377 |

10. DESCRIPTION OF PROPOSED CONSTRUCTION

THIS PROJECT CONSISTS OF MODIFYING 8 EXISTING CLOTHES WASHERS AT THE LAUNDRY FACILITY SUCH THAT RINSE CYCLE WATER CAN BE RE-USED IN FOLLOWING WASH CYCLES.

THE WORK CONSIST OF:

INSTALLING SPLIT DISCHARGE VALVES ON 8 WASHERS.
INSTALLING 2 NEW PUMPS.
INSTALLING NEW WASTE WATER SUMP.
INSTALLING NEW 600 GALLON STORAGE TANK.
MODIFYING WASTE WATER PIPING.
INSTALLING NEW CONTROLS.
INSTALLING RINSE WATER RECOVERY PIPING.

11. QUANTITATIVE DATA, JUSTIFICATION AND ADDITIONAL DATA

11.A - 0 -

11.B thru 11.K NOT APPLICABLE

11.L PROJECT

MODIFY EXISTING WASHERS TO ALLOW FOR RECYCLING OF WATER USED DURING RINSE CYCLE.

11.M REQUIREMENTS

RECYCLING OF RINSE WATER WILL PROVIDE IMMEDIATE CONSERVATION OF LP GAS. THIS PROJECT WILL ALLOW CONTINUED PRODUCTION OF LAUNDERED ITEMS AT A REDUCED RATE OF ENERGY CONSUMPTION.

11.N CURRENT SITUATION

EXISTING PROCESS IS INEFFICIENT AND OUTDATED. CURRENT ENERGY CONSUMPTION PER LB. OF PRODUCTION IS EXTREMELY HIGH COMPARED TO SIMILAR COMMERCIAL LAUNDRIES.

11.O IMPACT IF NOT PROVIDED

IF THIS PROJECT IS NOT APPROVED, FUEL REQUIREMENT REDUCTIONS AFFORDED BY THIS PROJECT WILL NOT BE REALIZED. THIS PROJECT WILL CONTRIBUTE ITS SMALL SHARE TO A REDUCED NATIONAL REQUIREMENT FOR FOREIGN OIL.

11.P ADDITIONAL

A FORMAL ECONOMIC ANALYSIS HAS BEEN PREPARED. SEE SRP-1 FOR DETAILED INFORMATION.

PER ECIP CRITERIA, ANNUAL SAVINGS ARE AS FOLLOWS:

| | | |
|---|---|---|
| LP GAS | | 2479 MBTU/YR |
| ELECTRICITY | | 0 MBTU/YR |
| ANNUAL ENERGY SAVINGS | $8,106 | |
| SAVING INVESTMENT RATION (SIR) | 3.82 | |
| SIMPLE AMORTIZATION | 4.0 YEARS | |

CONSTRUCTION COSTS HAVE BEEN PROJECTED USING THE TRI-SERVICE MILITARY CONSTRUCTION PROGRAM INDICES OF 4.0% FOR FY-89 AND 3.7% FOR FY-90.

THIS PROJECT IS A RESULT OF EEAP/ESOS STUDY DACA41-89-D0007.

DETAILED JUSTIFICATION

D-1 GENERAL

THIS PROJECT IS NECESSARY TO SUPPORT THE ARMY'S EFFORT TO REDUCE ENERGY CONSUMPTION. THE PROJECT COMPRISES OF MODIFYING EIGHT EXISTING WASHERS AND INSTALLING PUMPS, PIPING, SUMP, STORAGE TANK AND CONTROLS.

D-2 ACCOMMODATIONS NOW IN USE

THE LAUNDRY FACILITY HAS NO PROVISIONS FOR RECYCLING RINSE WATER.

EXISTING PROCESS ALLOWS HEAT TO BE WASTED BY DISCHARGING USEABLE RINSE WATER INTO SEWER.

D-3 ANALYSIS OF DEFICIENCY

ALL OF THE CLOTHES WASHERS AT THE LAUNDRY FACILITY DISCHARGE RINSE WATER TO SEWER. MODIFICATIONS TO EXISTING WASHERS WILL CONSERVE ENERGY WITHOUT AFFECTING LAUNDRY PRODUCTION.

D-4 CONSIDERATION OF ALTERNATIVES

HOT WATER RECOVERY

WASTE WATER HEAT MAY ALSO BE RECOVERED BY INSTALLING A HEAT RECOVERY UNIT. THIS ALTERNATIVE WAS ANALYZED AND REJECTED DUE TO HIGH CONSTRUCTION COST.

D-5 CRITERIA FOR PROPOSED CONSTRUCTION

THIS PROJECT IS PROPOSED TO FACILITATE ENERGY CONSERVATION AT FORT LEONARD WOOD.

ALL EQUIPMENT SELECTED FOR INSTALLATION WILL MEET OR EXCEED THOSE EFFICIENCIES INDICATED IN THE CALCULATIONS.

D-6 PROGRAM FOR RELATED FURNISHINGS AND EQUIPMENT

NO RELATED FURNISHINGS AND EQUIPMENT ARE INVOLVED IN THIS PROJECT. BUILDING INTERIOR FUNCTION IS NOT CHANGED BY THIS PROJECT.

D-7 DISPOSAL OF PRESENT ASSETS

NO EQUIPMENT WILL BE REMOVED UNDER THIS PROJECT.

D-8 SURVIVAL MEASURES

THIS PROJECT IS NOT SUITABLE FOR INCLUSION OF PROTECTIVE SHELTER.

D-9 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

THIS PROJECT SHOULD HAVE NO IMPACT ON AIR OR WATER POLLUTION AT FORT LEONARD WOOD. THESE SHOULD BE NO NEGATIVE IMPACT ON THE QUALITY OF HUMAN ENVIRONMENT.

D-10 EVALUATION OF FLOOD HAZARDS

THESE FACILITIES ARE NOT SITED WITHIN AREAS KNOWN TO BE SUBJECT TO FLOODING.

D-11 ECONOMIC JUSTIFICATION

THIS PROJECT IS PART OF THE PRODUCTIVITY ENHANCEMENT INVESTMENT PROGRAM (PECIP). AN ECONOMIC ANALYSIS HAS BEEN PREPARED TO SHOW THAT THIS PROJECT MEETS ALL PECIP CRITERIA. AN ECONOMIC ANALYSIS CONFORMING TO ECIP GUIDELINES MAY BE FOUND IN SPR-1.

D-12 UTILITY AND COMMUNICATION SUPPORT

NO RELATED UTILITY SUPPORT PROJECTS ARE NEEDED. EXISTING UTILITY SUPPORT IS ADEQUATE.

D-13 PROTECTION OF HISTORIC PLACES AND ARCHAEOLOGICAL SITES

NO BUILDINGS AT FORT LEONARD WOOD ARE ON THE NATIONAL REGISTER OF HISTORIC PLACES. THE ENTIRE FORT IS ON AN ARCHAEOLOGICAL SITE.

THIS PROJECT WILL HAVE NO EFFECT UPON THE ARCHAEOLOGICAL SITE.

D-14 PROJECT DEVELOPMENT BROCHURE (PDB)

A PROJECT DEVELOPMENT BROCHURE HAS BEEN PREPARED FOR THIS PROJECT AND HAS BEEN PROVIDED AS AN ATTACHMENT.

D-15 ENERGY REQUIREMENTS

THE PROPOSED PROJECT WILL REDUCE THE ENERGY REQUIRED BY AFFECTED FACILITIES BY 2479 MBTU/YR OF LP GAS 2479.

SEE ENERGY REQUIREMENT APPRAISAL IN SRP-3.

## SPECIAL REQUIREMENTS PARAGRAPHS (SRP)

### SRP-1 ECONOMIC ANALYSIS

I. NONRECURRING INITIAL CAPITAL COSTS

| | |
|---|---|
| SPLIT DISCHARGE VALVES | 9,200 |
| PIPING 6" | 2,017 |
| PIPING 2" | 1,562 |
| PUMPS | 930 |
| SUMP | 5,700 |
| STORAGE TANK | 4,181 |
| CONTROLS | 9,000 |
| TOTAL CONSTRUCTION COST | 32,590 |
| SIOH (5.5%) | 1,792 |
| DESIGN (6%) | 1,955 |
| TOTAL REQUEST (FY89) | $36,377 |

II. RECURRING ENERGY SAVINGS

INSTALLATION COSTS FOR RECYCLE EQUIPMENT BY LAUNDRY MACHINERY CO., 2210 CAMBELL STREET, KANSAS CITY, MO.

ENERGY COST DATA IS FROM ECIP GUIDANCE FOR LIFE CYCLE COST ANALYSIS. REGIONAL COSTS ARE SPECIFIED RATHER THAN ACTUAL INSTALLATION COSTS.

LIQUID PETROLEUM (LP) GAS

MBTU SAVED = 2479 MBTU/YR

$$\text{GALLONS SAVED} = \frac{2479 \text{ MBTU/YR}}{95{,}000 \text{ BTU/GAL}} = 26{,}095 \text{ GAL/YR}$$

$ SAVED = 26,095 GAL/YR X 0.311 $/GAL
= 8,106

SRP-2 COMMERCIAL ACTIVITIES ANALYSIS, NOT APPLICABLE

## SRP-3 ENERGY REQUIREMENTS APPRAISAL (ERA)

### I. PROJECT DESCRIPTION

THIS PROJECT IS TO MODIFY EXISTING CLOTHES WASHERS TO ALLOW FOR THE RECYCLING OF RINSE WATER.

### II. ESTIMATED ENERGY CONSUMPTION

THIS PROJECT WILL DECREASE (-) CONSUMPTION OF RESOURCES BY THE FOLLOWING AMOUNTS:

| | | |
|---|---|---|
| 1. | ELECTRICITY | 0 KWH/YR |
| 2. | LP GAS | 2,479 MBTU/YR |
| 3. | ELECTRICAL DEMAND | MINIMAL |
| 4. | WATER SUPPLY | - 0 - |
| 5. | SEWERAGE | - 0 - |
| 6. | OTHER | - 0 - |

THIS PROJECT WILL HAVE NO AFFECT ON THE CAPACITY OF THE FOLLOWING DELIVERY SYSTEMS.

1. HEATING
2. AIR CONDITIONING
3. ELECTRICAL POWER
4. WATER SUPPLY

THE NEW IMPACT OF THIS PROJECT WILL BE THE REDUCTION OF REQUIRED HEATING ENERGY. THIS SAVINGS IS COMPATIBLE WITH THE ARMY DIRECTIVE TO REDUCE THE TOTAL ENERGY USE.

### III. ENERGY SAVINGS CALCULATIONS

ENERGY SAVINGS WERE CALCULATED FOR EACH BUILDING AND ECO COMBINATION COMPRISING THIS PROJECT. A SUMMARY OF THE SAVINGS FOR INDIVIDUAL ECO'S ARE INCLUDED WITHIN THIS SECTION.

THE ATTACHED SAMPLE CALCULATION SHEETS WERE USED TO CALCULATE THE INDIVIDUAL SAVINGS. EACH SAMPLE CALCULATION PAGE INCLUDES SOURCE DOCUMENTATION.

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT. LEONARD WOOD, MO REGION NO. 7
PROJECT NO. & TITLE: DACA41-89-D-0007 RECYCLE RINSE WATER
FISCAL YEAR: 1989 ECO #,s 23
ANALYSIS DATE: ECON LIFE 25

1. INVESTMENT

| | | | |
|---|---|---|---|
| A. | CONSTRUCTION COST | 32590 | |
| B. | SIOH | 1792 | |
| C. | DESIGN COST | 1955 | |
| D. | ENERGY CREDIT CALC (1A+1B+1C) X .9 | 32704 | |
| E. | SALVAGE VALUE | 0 | |
| F. | TOTAL INVESTMENT (1D - 1E) | | 32704 |

2. ENERGY SAVINGS or (COST)
ANALYSIS DATE ANNUAL SAVINGS,UNIT COST & DISCOUNTED SAVINGS

| | | COST * $/MBTU | SAVINGS MBTU/YR | ANNUAL SAVINGS | DISCOUNT FACTOR * | DISCOUNTED SAVINGS | |
|---|---|---|---|---|---|---|---|
| A. | ELEC | 12.97 | 0 | 0 | 11.16 | 0 | |
| B. | DIST | 4.34 | 0 | 0 | 17.19 | 0 | |
| C. | RESD | 3.49 | 0 | 0 | 17.12 | 0 | |
| D. | LPG | 3.27 | 2479 | 8106 | 16.15 | 130917 | |
| E. | WOOD | 2.00 | 0 | 0 | 13.47 | 0 | |
| F. | TOTAL | | 2479 | 8106 | | | 130917 |

3. NON ENERGY SAVINGS or (COST), disc = 7.00%

| | | |
|---|---|---|
| A. | ANNUAL RECURRING | -500 |
| | (1) DISCOUNT FACTOR (TABLE A) * | 11.65 |
| | (2) DISCOUNTED SAVINGS/COST (3A X 3A1) | -5825 |

| B. NON RECURRING ITEM | (1) SAVINGS (COST) | (2) YEAR OF OCCURANCE | (3) DISCOUNT FACTOR | (4) DISCOUNTED SAVE(COST) |
|---|---|---|---|---|
| a. | 0 | | 1.00 | 0 |
| b. | 0 | | 1.00 | 0 |
| c. | 0 | | 1.00 | 0 |
| d. TOTAL | 0 | | | 0 |

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (or) COST -5825

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F X .33) 43203
a. IF 3D1 IS = OR GREATER THAN 3C GO TO ITEM 4
b. IF 3D1 IS LESS THAN 3C SIR = (2F + 3D1)/1F
IF 3D1b IS GREATER THAN 1 GO TO ITEM 4, IF NOT

4. FIRST YEAR DOLLAR SAVINGS (2F3+3A+(3B1d/YEARS LIFE)) 7606

5. TOTAL NET DISCOUNTED SAVINGS (2F5+ 3C) 125092

6. DISCOUNTED SAVINGS RATIO (SIR = 5/1F) 3.82

* COST AND DISCOUNT FACTORS FROM ECIP GUIDANCE UPDATED 15 JUN 89

## COST ESTIMATE ANALYSIS

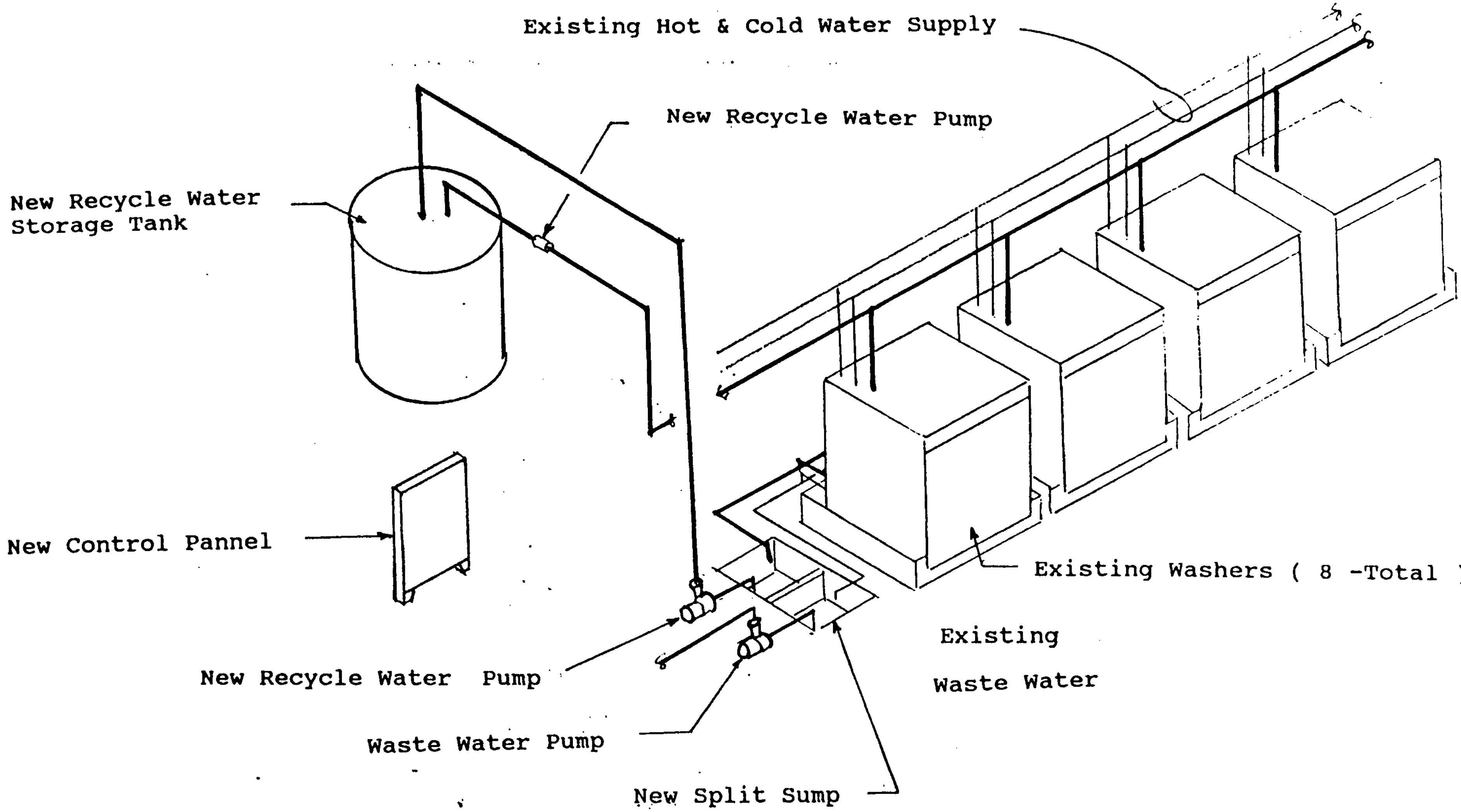
For use of this form, see TM 5 800-2; the proponent agency is USACE.

| | | | |
|---|---|---|---|
| PROJECT: RECYCLE RINSE WATER | INVITATION/CONTRACTOR | EFFECTIVE PRICING DATE | DATE PREPARED: 24 MAY 89 |
| LOCATION: FORT LEONARD WOOD | CODE (Check one) ☐ A ☐ B ☐ C ☐ OTHER | DRAWING NO. | SHEET 1 OF 1 SHEETS |
| | | ESTIMATOR | CHECKED BY |

| ECO #23 TASK DESCRIPTION | QUANTITY NO. OF UNITS | QUANTITY UNIT MEAS | LABOR MH UNIT | LABOR TOTAL HRS | LABOR UNIT PRICE | LABOR COST | EQUIPMENT UNIT PRICE | EQUIPMENT COST | MATERIAL UNIT PRICE | MATERIAL COST | TOTAL | SHIPPING UNIT WT | SHIPPING TOTAL WT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SPLIT DISCHARGE VALVE | 8 | EA | | | 150- | 1200- | | | $1000 | $8000- | $9200- | | |
| | | | | | | | | | | | | | |
| PIPING 6" | 50 | LF | | | 16.30 | 815- | | | 24.04 | 1202- | 2017- | | |
| 2" | 200 | LF | | | 5.05 | 1010- | | | 2.76 | 552- | 1562- | | |
| PUMP | 2 | EA | | | 45- | 90- | | | 420- | 840- | 930- | | |
| | | | | | | | | | | | | | |
| SUMP | 1 | EA | | | | 2200- | | | | 3500- | 5700- | | |
| | | | | | | | | | | | | | |
| STORAGE TANK | 1 | EA | | | 81- | 81- | | | | 4100- | 4181- | | |
| | | | | | | | | | | | | | |
| CONTROLS | | | | | | 2500- | | | | 6500- | 9000- | | |
| | | | | | | | | | | | 32,590 | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| TOTAL THIS SHEET | | | | | | | | | | | | | |

DA FORM 5418-R, Apr 85

RECYCLE RINSE WATER



**installation:** FORT LEONARD WOOD

**project:** ____

project number
temporary: ____ program year FY 91

permanent: ____ category code ____

**point of contact:**

user
name ____ date ____

title ____ phone ____

autovon ____

dfae
name ____ date ____

title ____ phone ____

autovon ____

engineer district
name ____ date ____

title ____ phone ____

autovon ____

other (A-E)
name ____ date ____

title ____ phone ____

autovon ____

**reviewed by:**

installation facility engineer
name ____ date ____

title ____ phone ____

autovon ____

**approved by:**

macom engineer
name ____ date ____

title ____ phone ____

autovon ____

**project development brochure, PDB-1**

DA FORM 5020-R, Feb 82

facility

FORT LEONARD WOOD, MISSOURI

project coordinator for
using service

functional requirements summary, PDB-1

OBJECTIVE:

THE PURPOSE OF THIS PROJECT IS TO REDUCE HEATING ENERGY CONSUMPTION AT FORT LEONARD WOOD. THIS MAY BE ACCOMPLISHED BY INSTALLING A RECYCLE RINSE WATER SYSTEM AT THE LAUNDRY FACILITY LOCATED IN BUILDING 2352.

LP GAS CONSUMPTION WILL BE REDUCED BY AN ESTIMATED 2479 MILLION BTU PER YEAR.

THE FIRST YEAR FUEL COST SAVINGS WILL BE ABOUT $8,106. THE SAVINGS INVESTMENT RATION FOR THIS PROJECT IS 3.82. THE SIMPLE PAYBACK IS 4.0 YEARS.

REQUIREMENTS:

THIS PROJECT IS REQUIRED TO REDUCE ENERGY CONSUMPTION AT FORT LEONARD WOOD, MISSOURI.

IMPACT SUMMARY:

IF THIS PROJECT IS APPROVED, AN ESTIMATED 2479 MBTU/YR WILL BE CONSERVED EACH YEAR. THIS WILL AMOUNT TO A COST SAVINGS OF $8,106.

IF THIS PROJECT IS NOT APPROVED, FORT LEONARD WOOD WILL NOT BE ABLE TO ACHIEVE THE POTENTIAL ENERGY SAVINGS THAT THIS PROJECT CAN PROVIDE.

**functional requirements summary, PDB-1**

# facility

FORT LEONARD WOOD, MISSOURI

# project coordinator for using service

detailed functional requirements, PDB-2

facilities requirements sketch, PDB- ½

DA FORM 5022-R, Feb 82

## A. SPECIAL CONSIDERATIONS

| | ITEM | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| A-1 | Cost estimates for each primary and supporting facility | R | | X | |
| A-2 | Telecommunications system coordination with USACC and authorization for exceptions | NR | | | |
| A-3 | Coordination with state and local governmental requirements (blind vendors, medical facilities, construction and operating permits, clearinghouse ccoordination, etc.) | NR | | | |
| A-4 | Assignment of airspace | NR | | | |
| A-5 | Economic analysis of alternatives | R | | X | |
| A-6 | Approval for new starts | NR | | | |
| A-7 | International balance of payments (IBOP) coordination with U.S. European command and NATO—overseas cost estimates and comparables (include rate of exchange used in estimates) | NR | | | |
| A-8 | Impact on historic places—on site survey by authorized archeologist and coordination with state historic preservation officer and advisory council on historic preservation | NR | | | |
| A-9 | Exceptions to established criteria | NR | | | |
| A-10 | Coordination with various staff agencies (Provost Marshall-physical security, etc.) | NR | | | |
| A-11 | Identification of related or support projects (so projects can be coordinated) | R | A | | |
| A-12 | Required completion date | R | A | | |
| | Other Special Considerations (List and number items) | | | | |
| A-13 | ENERGY CONSERVATION INVESTMENT PROGRAM | R | | X | |
| A-14 | ENERGY ENGINEERING - ANALYSIS PROGRAM | R | | X | |
| A-15 | INSTALLATION SCHEDULE | R | C | | |

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# documentation checklist

DA FORM 5023-A-R, Feb 82

## B. SITE DEVELOPMENT

| | ITEM | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| B-1 | Consultation with the District Office to determine and evaluate flood plain hazards | NR | | | |
| B-2 | Preparation, submission, and/or approval of new | | | | |
| (A) | General Site Plan | NR | | | |
| (B) | Annotated General Site Plan | NR | | | |
| (C) | Sketch Site Plan | NR | | | |
| (D) | Facilities Requirements Sketch | NR | | | |
| B-3 | Preparation of | | | | |
| (A) | Site Survey | NR | | | |
| (B) | Subsoil information | NR | | | |
| B-4 | Approval by Department of Defense Explosive Safety Board (DDESB) for Safety Site Plan | NR | | | |
| | Other Site Development Considerations (List and number items) | | | | |

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# documentation checklist

DA FORM 5023-B-R, Feb 82

## C. ARCHITECTURAL & STRUCTURAL

| | ITEM | Required or Not Required | * To Be Determined | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| C-1 | Reconciliation with troop housing programs and requirements | NR | | | |
| C-2 | Evaluation of existing facilities (including degree of utilization) | NR | | | |
| C-3 | Approval for removal and relocation of existing useable facilities | NR | | | |
| C-4 | Evaluation of off-post community facilities | NR | | | |
| C-5 | Storage and maintenance facilities (including nuclear weapons) | NR | | | |
| C-6 | Coordination hospitals, medical and dental facilities with Surgeon General | NR | | | |
| C-7 | Coordination of aviation facilities with FAA | NR | | | |
| C-8 | Coordination air traffic control and navigational aids with USACC | NR | | | |
| C-9 | Tabulation of types and numbers of aircraft | NR | | | |
| C-10 | Evaluation of laboratory, research and development, and technical maintenance facilities | NR | | | |
| C-11 | Coordination chapels with Chief of Chaplains | NR | | | |
| C-12 | Review food service facilities by USATSA | NR | | | |
| C-13 | Automated data processing system or equipment approvals—cost analysis when ADP and/or communication centers not co-located with related facilities | NR | | | |
| C-14 | Coordination postal facilities with U.S. Postal Service Regional Director | NR | | | |
| C-15 | Laundry and dry cleaning facilities coordination with ASD(I&L) | NR | | | |
| C-16 | Tenant facilities coordination with installation where sited | NR | | | |
| C-17 | Facilities for or exposed to explosions, toxic chemicals, or ammunition—review by DDESB (See also Item B-4) | NR | | | |
| C-18 | Analysis of deficiencies | R | | X | |
| C-19 | Consideration of alternatives | R | | X | |
| C-20 | Determination whether occupants will include physically handicapped or disabled persons | NR | | | |
| C-21 | As-build drawings for alterations or additions | NR | | | |
| C-22 | Availability of Standard Design or site adaptable designs | NR | | | |
| | Other Architectural & Structural (List and number items) | | | | |

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# documentation checklist

DA FORM 5023-C-R, Feb 82

## E. ENVIRONMENTAL CONSIDERATIONS

| | ITEM | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| E-1 | Environmental impact assessment | R | A | | |
| E-2 | EIA conclusions require Environmental Impact Statement | NR | | | |
| E-3 | Determination of health, environmental or related hazards. Assistance to determine existence of any health, environmental or related hazard may be requested from Aberdeen Proving Ground, MD 21010, the Office of the Surgeon General, Attn: DASG-HCH (Army Environmental Hygiene Agency) | NR | | | |
| E-4 | Air/water pollution permit, coordination with agencies and compliance with standards at Federal, state and local level | NR | | | |
| E-5 | Corrective measures associated with Environmental Impact Statements or assessment—list separately and evaluate. | NR | | | |
| | Other environmental considerations (list and number items) | | | | |

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**documentation checklist**

DA FORM 5023-E-R, Feb 82

COMMENTS

DOCUMENTATION CHECK LIST

| ITEM | COMMENT |
|---|---|
| A-1 | COST ESTIMATE: THE COST OF INSTALLED RECYCLE RINSE WATER EQUIPMENT IS $36.377. |

| | |
|---|---|
| SPLIT DISCHARGE VALVES | 9,200 |
| PIPING 6" | 2,017 |
| PIPING 2" | 1,562 |
| PUMPS | 930 |
| SUMP | 5,700 |
| STORAGE TANK | 4,181 |
| CONTROLS | 9,000 |
| TOTAL CONSTRUCTION COST | 32,590 |
| SIOH (5.5%) | 1,792 |
| DESIGN (6%) | 1,955 |
| TOTAL REQUEST (FY91) | $36,377 |

A DETAILED BREAKDOWN OF THE COST ESTIMATE IS SUPPLIED IN THE DD 1391 DOCUMENTATION.

| | |
|---|---|
| A-5 | ECONOMIC ANALYSIS OF ALTERNATIVES: SEE ATTACHED DD 1391, DETAILED JUSTIFICATION, SECTION 4. |
| A-13 | THIS PROJECT MEETS ALL ECIP REQUIREMENTS FOR FUNDING. |
| A-14 | THIS PROJECT IS PART OF THE EEAP CONDUCTED AT FORT LEONARD WOOD DURING FY 89. |
| C-18 | ANALYSIS OF DEFICIENCIES: SEE ATTACHED DD 1391. |
| C-19 | CONSIDERATION OF ALTERNATIVES: SEE ATTACHED DD 1391, DETAILED JUSTIFICATION, SECTION 4. |

## A. SPECIAL CONSIDERATIONS

| | ITEM | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| A-1 | Factors of risk, restriction or unusual circumstance expected to increase costs beyond applicable area averages | NR | | | |
| A-2 | Construction phasing requirements | NR | | | |
| A-3 | Functional support equipment (mechanical, electrical, structural, and security) to be built in | NR | | | |
| A-4 | Equipment in place and justification | NR | | | |
| A-5 | Other equipment and furniture (O&MA, OPA) and costs | NR | | | |
| A-6 | Special studies and tests (hazards analyses, compatibility testing, new technology testing, etc.) | NR | | | |
| A-7 | Type of construction (permanent, temporary, semi-permanent) | NR | | | |
| A-8 | Government furnished equipment (quantities, procurement time, availability and special handling and storage requirements). Funds used for procurement. | NR | | | |
| | Other special considerations (list and number items) | | | | |

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# technical data checklist

DA FORM 5024-A-R, Feb 82

## B. SITE DEVELOPMENT

| | ITEM | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| B-1 | Construction restrictions or guidelines pertaining to | | | | |
| (A) | site access and preferred construction routes | NR | | | |
| (B) | Airfield clearance, explosive storage, working hours, safety, etc. | NR | | | |
| (C) | Facilities and/or functions or adjoining areas (structures, materials, impact) | NR | | | |
| B-2 | Real estate actions (acquisition, disposal, lease, right-of-way) | NR | | | |
| B-3 | Demolition/relocation required (data) | | | | |
| (A) | Special considerations due to explosives/radioactivity/ chemical contamination/asbestos emissions/toxic gases | NR | | | |
| (B) | Restrictions on disposal of demolished/relocated material including hazardous waste | NR | | | |
| B-4 | Pavement types and requirements (including traffic surveys and MTMC coordination) | NR | | | |
| B-5 | Landscape considerations | | | | |
| (A) | Protection of existing vegetation | NR | | | |
| (B) | Stockpile topsoil | NR | | | |
| | Other Site Development (List and number items) | | | | |

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# technical data checklist

DA FORM 5024-B-R, Feb 82

## C. ARCHITECTURAL & STRUCTURAL

| | ITEM | Required or Not Required | * To Be Determined | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| C-1 | Vibration-producing equipment requiring isolation | NR | | | |
| C-2 | Seismic zone and other design load criteria (typhoon, hurricane, earthquake loads, high or low loss potential) | NR | | | |
| C-3 | Protective shelter evaluation and resistant design criteria (conventional/nuclear blast and radiation, chemical/biological) | NR | | | |
| C-4 | Unusual foundation requirements (pier, pile, caisson, deep foundations, mat, special treatment, permafrost areas, soil bearing) | NR | | | |
| C-5 | Designation and strength of units to be accommodated | NR | | | |
| C-6 | Requirements and data for special design projects | NR | | | |
| C-7 | Unusual floor and roof loads (safes, equipment) | NR | | | |
| C-8 | Security features (arms rooms, vaults, interior secure areas) | NR | | | |
| | Other Architectural & Structural (List and number items) | | | | |

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**technical data checklist**

DA FORM 5024-C-R, Feb 82

## D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS

| | ITEM | Required or Not Required | * To Be Determined | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| D-1 | Special mechanical requirements or considerations (elevator, crane, hoist, etc.) | R | D | | |
| D-2 | Special peak usage periods and peak leveling techniques | NR | | | |
| D-3 | Maintenance considerations (accessibility of equipment, compatibility with existing equipment) | R | D | | |
| D-4 | Plumbing—availability, general system type and characteristics (proposed and/or existing, incl. compressed air and gas) | R | D | | |
| D-5 | Heating—availability, general system type and characteristics (proposed and/or existing) | R | D | | |
| D-6 | Ventilating, air condition/refrigeration—availability, general system type and characteristics (proposed and/or existing) | R | D | | |
| D-7 | Electrical—availability, general system type and characteristics incl. airfield lighting, communication, etc. (proposed and/or existing) | R | D | | |
| D-8 | Water supply/waste treatment—availability, general system type and characteristics (proposed and/or existing) | R | D | | |
| D-9 | Energy requirements/fuel conversion (sources, availability, loads, types of fuel, etc.) | R | D | | |
| D-10 | Solar energy evaluation | NR | | | |
| | Other Mechanical & Utility Systems (List and number items) | | | | |

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# technical data checklist

DA FORM 5024-D-R, Feb 82

## E. ENVIRONMENTAL CONSIDERATIONS

| | ITEM | Required or Not Required | * To Be Determined | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| E-1 | Waste water treatment, air quality, and solid waste disposal criteria | NR | | | |
| | Other Environmental Considerations (List and number items) | | | | |

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**technical data checklist**

DA FORM 5024-E-R, Feb 82

## F. FIRE PROTECTION

| | ITEM | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|
| F-1 | Special fire protection systems or features (detection and suppression equipment, hazards, etc.) | NR | | | |
| | Other Fire Protection Considerations (List and number items) | | | | |

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# technical data checklist

DA FORM 5024-F-R, Feb 82

# A. SPECIAL CONSIDERATIONS

| See Tech. Data Checklist Item | | ITEM | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| A-1 | A-1 | Factors of risk, restriction, or unusual circumstance expected to increase costs beyond applicable area averages. | NR | | | |
| | (A) | Special applicable construction codes/criteria (NATO, SOFA, base regulations, use of government furnished documents, etc.) | NR | | | |
| | (B) | Skilled labor and/or structural material availability impact. | NR | | | |
| A-2 | A-2 | Construction phasing requirements | NR | | | |
| | A-3 | Unique contractor requirements (24 hr/day work capability; safety requirements—AR 385-10, DODI 1000.18, DODD 1000.3, DODI 6055.1; etc.) | NR | | | |
| | A-4 | Utilities available to contractor (types, metering, costs, billing, etc.) | NR | | | |
| | A-5 | Secure area availability for contractor equipment and materials storage | NR | | | |
| | A-6 | Clearances required of contractor | NR | | | |
| | A-7 | Contractor work area (location, limits) | R | A | | |
| A-3 | A-8 | Function support equipment (mechanical, electrical, structural support requirements) | R | D | | |
| D-1 | (A) | Cranes and hoists (loads, controls, uses, etc.) | R | D | | |
| | A-9 | Trash handling system (availability, storage area for recyclable material to coincide with installation resource recovery plan) | NR | | | |
| A-3, A-4, A-5 | A-10 | Real property installed equipment and furniture | NR | | | |
| | (A) | Functional support equipment | NR | | | |
| | (B) | Equipment in place | NR | | | |
| | (C) | Other equipment and furniture (O&MA, OPA) | NR | | | |
| | A-11 | Disposition of scrap and salvage | R | A | | |
| | A-12 | Training of using service operating personnel (Operating Manual, etc.) | R | D | | |
| | A-13 | Contingency plan for incidental discovery of archeological artifacts | R | | | |
| | A-14 | Maintenance and maintainability (i.e. avoiding features which have high maintenance requirements or new maintenance skills, etc.) | R | D | | |
| | A-15 | Economic Considerations | NR | | | |
| | (A) | Projected economic life associated with specified functional requirements. | NR | | | |
| | (B) | Special economic ranking considerations—design features for which factors other than economics (i.e., other than lowest LCC) should govern the decision as to which of the feasible alternatives should be selected, including statement of locally unacceptable alternatives and reasons therefor. | NR | | | |
| | (C) | Projected facility utilization operation schedule. | NR | | | |
| | (D) | Planned changes in facility usage during economic life and alterations to be required. | NR | | | |
| | (E) | Projected preventive-maintenance (p-m) strategy (e.g., full p-m as recommended by manufacturer; minimum p-m—replace failures as they occur, and little else; full p-m on critical items only; etc.). | NR | | | |
| | (F) | Projected strategy for custodial care and maintenance for most commonly used types of exterior and interior finishes (e.g., frequencies for sweeping, vacuuming, washing, painting, etc.). | NR | | | |
| | (G) | Design features that experience has shown require excessive M&R. | NR | | | |

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# design data checklist

DA FORM 5025-A-R, Feb 82

| See Tech. Data Checklist Item | | B. SITE DEVELOPMENT — ITEM | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| B-1 | B-1 | Required site plans (incl. design and construction factors) | | | | |
| | (A) | Site access and preferred construction routes | NR | | | |
| | (B) | Site restrictions (airfield clearance, explosive storage, etc.) | NR | | | |
| | (C) | Existing facilities/functions on adjoining areas (structures, materials, impact) | NR | | | |
| | (D) | Disposal areas (trash, excavated material, constraints) | R | A | | |
| | (E) | Borrow and spoil areas | NR | | | |
| | (F) | Grades or contours existing | NR | | | |
| | (G) | Existing trees, turf, ground cover, landscape development, erosion control | NR | | | |
| | (H) | Bridges and fences (applicable design criteria) | NR | | | |
| | (I) | Railroads (routing, sidings, docks, yards, grounding) | NR | | | |
| | (J) | Fire station and security police location | NR | | | |
| | (K) | Site utilities—capacity and quantity available to project (sanitary and storm sewers, drainage ditches, water and gas service, communication lines, hydrants and sprinklers, etc.) | R | D | | |
| | (L) | New facilities clearly identified | NR | | | |
| | (M) | Necessary support facilities required for complete functional project (warehouse, igloo, fuel storage, waste treatment, etc.) | NR | | | |
| C-4 | B-2 | Subsoil conditions (actual or expected—groundwater, permafrost, etc.) | NR | | | |
| B-2 | B-3 | Real estate actions (acquisition, disposal, lease, right-of-way) | NR | | | |
| B-3 | B-4 | Demolition/relocation required to clear site (date) | NR | | | |
| B-4 | B-5 | Pavement types and requirements | | | | |
| | (A) | Design loading and use frequency by type of paving | NR | | | |
| | (B) | Street size and layout (traffic control) | NR | | | |
| | (C) | Parking lots (signage, etc.) | NR | | | |
| | (D) | Sidewalks and curbs (handicapped, etc.) | NR | | | |
| | (E) | Gutters, culverts and other drainage factors | NR | | | |
| | (F) | Runways, aprons and taxiways | NR | | | |
| | (G) | Tie-down anchors or grounds | NR | | | |
| | (H) | Special surface conditions required | NR | | | |
| D-9, D-10 | B-6 | Energy conservation siting and features (wind solar, etc.). See also DDC Item D-13 (D) & (E) | NR | | | |

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**design data checklist**

| See Tech. Data Checklist Item | B. SITE DEVELOPMENT (Continued) ITEM | | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| B-5 | B-7 | Landscape treatment | | | | |
| | (A) | Preservation of existing features | NR | | | |
| | (B) | Proposed planting (low maintenance species, locations away from power lines, etc.) | NR | | | |
| B-5 | B-8 | Storm drainage (See also Item E-4) | | | | |
| | (A) | Total run-off area affecting project | NR | | | |
| | (B) | Design intensity for floods | NR | | | |
| | (C) | Design of storm drainage system to include pick-up system and outfall lines | NR | | | |
| | B-9 | Consideration of Coastal Zone Management Act (PL 92-583, 1972; Amendment PL 94-370, 1976) | NR | | | |
| | | Other Site Development Considerations (List and number items) | | | | |

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**design data checklist**

## C. ARCHITECTURAL & STRUCTURAL

| See Tech. Data Checklist Item | | ITEM | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| | C-1 | Material availability limitations (include fill and paving) | NR | | | |
| | C-2 | Architectural style (existing, planned or desired, use of pre-engineered buildings considered) | NR | | | |
| C-7 | C-3 | Floors (type, finish, special loading, subgrade moisture control, low maintenance types particularly in spill areas) | NR | | | |
| C-3 | C-4 | Walls | NR | | | |
| | (A) | Exterior (materials, sealing of joints, general maintenance) | NR | | | |
| | (B) | Interior walls and partitions (material, finish, fire resistance, subgrade moisture control) | NR | | | |
| | C-5 | Ceilings (height, finish, acoustics) | NR | | | |
| | C-6 | Windows (type, size, special treatment) | NR | | | |
| | C-7 | Doors (type, size, power operation, panic hardware, durability) | NR | | | |
| | C-8 | Hardware (finish, location, special metal restrictions, durability) | NR | | | |
| | C-9 | Special finishes (protective coatings, non-sparking, conductive, acid-resistant) | NR | | | |
| C-8 | C-10 | Security features (windows, doors, hardware, construction of walls, floors & ceilings, arms rooms, vaults, etc.) | NR | | | |
| | C-11 | Sound attenuation requirements (expected and required levels, location) | R | D | | |
| | C-12 | Stairs, elevators and chutes (location, size, type of usage) | NR | | | |
| | C-13 | Loading docks and canopies | NR | | | |
| C-1 | C-14 | Vibration-producing equipment requiring isolation | R | D | | |
| C-4 | C-15 | Unusual foundation requirements (pier, pile, caisson, deep foundations, mat, special treatment, creep control) | NR | | | |
| | C-16 | Span or unusual clearance requirements (span or height) | NR | | | |
| | C-17 | Special bay sizes (reflect access dimensions) | NR | | | |
| | C-18 | Overhead support requirements (hoists, cranes) | NR | | | |
| C-7 | C-19 | Roof loads and requirements (live/dead loads, materials, access, low maintenance features like exterior drains, etc.) | NR | | | |
| | C-20 | Structural specialities (slabs, sumps, trenches, pits) | NR | | | |
| C-2 | C-21 | Seismic zone design criteria | NR | | | |
| C-2 | C-22 | Area wind loads (summer/winter prevailing wind, hurricane, typhoon) | NR | | | |
| C-3 | C-23 | Protective shelter evaluation and resistant design criteria | NR | | | |
| | (A) | Explosive/nuclear blast (protective, resistive, suppressive, venting and containment structures) | NR | | | |
| | (B) | Radiation protection (type of radiation, intensity, source) | NR | | | |
| | (C) | Chemical/biological protection | NR | | | |

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B – Using Service

C – Construction Service

D – Designer

E – Other (Check Comments Attached and explain)

# design data checklist

DA FORM 5025-C-1-R, Feb 82

| See Tech. Data Checklist Item | C. ARCHITECTURAL & STRUCTURAL (Continued) ITEM | | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| C-5 | C-24 | Designation and strength of units to be accommodated | NR | | | |
| C-6 | C-25 | Requirements for special design projects | NR | | | |
| | C-26 | Safety features (occupant load, maximum travel distance to exits, hazard to be controlled or eliminated) | NR | | | |
| | C-27 | Special design features for handicapped. | NR | | | |
| | | Other Architectural and Structural (list and number items) | | | | |

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**design data checklist**

DA FORM 5025-C-2-R, Feb 82

| See Tech. Data Checklist Item | | D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS — ITEM | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| D-1 | D-1 | Special mechanical requirements or considerations | NR | | | |
| D-2 | D-2 | Special peak usage periods and peak leveling techniques | NR | | | |
| D-3 | D-3 | Maintenance considerations (equipment room size, layout, location, general accessibility of equipment, compatibility with existing equipment.) | R | D | | |
| D-9 | D-4 | Energy monitoring control system (EMCS) and permanent utilities metering | NR | | | |
| D-4 | D-5 | Plumbing system (proposed and/or existing) | R | D | | |
| | (A) | General piping and storage system | NR | | | |
| | (1) | Materials (galvanized, copper, etc.) | R | D | | |
| | (2) | Insulation | R | D | | |
| | (3) | Natural or LP gas | R | D | | |
| | (4) | Venting | R | D | | |
| | (5) | Distilled water | NR | | | |
| | (6) | Compressed air | R | | | |
| | (7) | Hospital & surgical gases | NR | | | |
| | (8) | Other (chemical, fuel) | NR | | | |
| | (B) | Facility water supply | R | D | | |
| | (C) | Garbage disposal | NR | | | |
| | (D) | Sanitary drainage system | R | D | | |
| | (E) | Grease interception | NR | | | |
| | (F) | Chemical waste drainage & disposal (incl. explosive process waste) | NR | | | |
| | (G) | Radioactive waste | NR | | | |
| | (H) | Drinking fountains | NR | | | |
| | (I) | Water treatment | NR | | | |
| | (J) | Emergency fixtures (showers, eyewash fountains) | NR | | | |
| D-5 | D-6 | Heating system | R | D | | |
| | (A) | Existing generation plant | R | D | | |
| | (1) | Location and distance from new facility | R | D | | |
| | (2) | Equipment (type, age, fuel, etc.) | R | D | | |
| | (3) | Current loads (average, peak, reserves for this and other projects, load leveling system) | NR | | | |
| | (4) | Type of plant | NR | | | |
| | (5) | Manning & support requirements | NR | | | |
| | (6) | Pollution controls | NR | | | |
| | (7) | Type of product | NR | | | |

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**design data checklist**

DA FORM 5025-D-1-R, Feb 82

| See Tech. Data Checklist Item | D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS (Continued) — ITEM | | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| D-5 | D-6 | Heating system (continued) | NR | | | |
| | (B) | Requirements for proposed facility | NR | | | |
| | (1) | Type of system | NR | | | |
| | (2) | Heat load requirements (special temperature demands) | NR | | | |
| | (3) | Controls, metering & EMCS requirements | NR | | | |
| | (4) | Distribution system (valves, steam pressure, fluid temperature) | NR | | | |
| | (5) | Corrosion control | NR | | | |
| | (6) | Insulation | NR | | | |
| | (7) | Additional equipment specifications | NR | | | |
| D-6 | D-7 | Ventilating/air conditioning/refrigeration system | NR | | | |
| | (A) | Existing facilities | NR | | | |
| | (1) | Location | NR | | | |
| | (2) | Type of plant (refrigeration, chilled water, etc.) | NR | | | |
| | (3) | Current loads (average, peak, reserves for this and other projects, load leveling system) | NR | | | |
| | (4) | Type of product (CFM, temperature, GPM, etc.) | NR | | | |
| | (5) | Distribution system | NR | | | |
| | (6) | Special filtration requirements | NR | | | |
| | (7) | Special humidity, ventilation, or temperature requirements | NR | | | |
| | (8) | Security restrictions for open ducting | NR | | | |
| | (9) | Freezers or coolers | NR | | | |
| | (B) | Requirements for proposed facility | | | | |
| | (1) | Type of system | NR | | | |
| | (2) | Temperature, humidity and vent conditions special to this design | NR | | | |
| | (3) | Control, cycling, metering and EMCS requirements | NR | | | |
| | (4) | Distribution (length of extension, location, fluid temperature) | NR | | | |
| | (5) | Corrosion control | NR | | | |
| | (6) | Insulation | NR | | | |
| | (7) | Special fire and security considerations for this project | NR | | | |
| | (8) | Occupancy hours and days per week | NR | | | |
| D-5, D-6 | D-8 | Heat and chilled water distribution system | NR | | | |
| | (A) | Heat system | NR | | | |
| | (1) | Type of service | NR | | | |
| | (2) | Existing system components | NR | | | |
| | (3) | Valving and sectionalizing requirements | NR | | | |
| | (4) | Allowable shut-down of service for main connections | NR | | | |
| | (5) | Sizing for future facilities | NR | | | |

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# design data checklist

DA FORM 5025-D-2-R, Feb 82

| See Tech. Data Checklist Item | D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS (Continued) | ITEM | Required or Not Required | * To Be Determined | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| D-5 | D-8 | Heat and chilled water distribution system (continued) | NR | | | |
| D-6 | (B) | Chilled water system | NR | | | |
| | (1) | Type of service | NR | | | |
| | (2) | Existing system components | NR | | | |
| | (3) | Valving and sectionalizing requirements | NR | | | |
| | (4) | Allowable shut-down of service for main connections | NR | | | |
| | (5) | Sizing for future facilities | NR | | | |
| D-7 | D-9 | Electrical system | | | | |
| | (A) | Power service characteristics & location | R | D | | |
| | (B) | Stand-by power (available & required) | NR | | | |
| | (C) | Special interior functional lighting requirements (brightness, night, emergency, justification) | NR | | | |
| | (D) | Uninterruptible power required | NR | | | |
| | (E) | Commercial tie-in requirements & restrictions | R | D | | |
| | (F) | Potential for increased power service needed | | D | | |
| | (G) | Service outage duration limitations | NR | | | |
| | (H) | Security alarm systems (type & location) | NR | | | |
| | (I) | Street, parking or security lighting (brightness, hours, switching, etc.) | NR | | | |
| | (J) | Types of fixtures required (including mounting, NEC classification, etc.) | R | D | | |
| | (K) | Telephone extension circuits or conduit (functional support & outlet location) | NR | | | |
| | (L) | Television circuits or conduit (functional support & outlet location) | NR | | | |
| | (M) | Intercom requirements (locations, type) | NR | | | |
| | (N) | Equipment list w/power requirements | NR | | | |
| | (O) | Special communications requirements (filtering, maximum fluctuation limitations, convertors, etc.) | NR | | | |
| | (P) | Electronic shielding & interference measures (frequency involved) | NR | | | |
| | (Q) | Special switches & control outlets, receptacle requirements, etc. | NR | | | |
| | (R) | Grounding requirements, lightning protection | NR | | | |
| | (S) | Hazardous environment requirements (location, activity involved, NEC classification, type of hazard) | NR | | | |
| | (T) | Corrosion control (cathodic protection) | NR | | | |

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# design data checklist

DA FORM 5025-D-3-R, Feb 82

| See Tech. Data Checklist Item | D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS (Continued) ITEM | | Required or Not Required | To Be Determined * | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| D-7 | D-9 | Electrical system (continued) | | | | |
| | (U) | Other special power requirements (traffic control, antenna, etc.) | NR | | | |
| | (V) | Applicability of task lighting considerations | NR | | | |
| | (W) | Power management and metering requirements | NR | | | |
| | D-10 | Electrical Distribution | | | | |
| | (A) | Actual & estimated loads (peak & average (KW demand)) | R | D | | |
| | (B) | Utility compnay distribution system (substations, transmission lines, rate schedule, etc.) | NR | | | |
| | (C) | Government owned distribution system (switching station, transmission lines, feeders, etc.) | NR | | | |
| | (D) | Estimated impact of proposed equipment installation on power factor, load balance and costs for corrective action proposed | R | D | | |
| | (E) | Overhead/underground (voltage, conductor size, grounding, etc.) | NR | | | |
| | (F) | Estimated power demand factor and diversity factor | R | D | | |
| | (G) | Power quality requirements (voltage and frequency regulation) | R | D | | |
| | (H) | Power to intrusion, detection alarm systems around perimeter | NR | | | |
| | D-11 | Airfield lighting requirements | NR | | | |
| | (A) | Area & location to be served | NR | | | |
| | (B) | Source of power (normal & emergency) | NR | | | |
| | (C) | Vault requirements | NR | | | |
| | (D) | Primary feeders | NR | | | |
| | (E) | Control cabling | NR | | | |
| | (F) | Runway lighting (centerline, edge, distance markers, intensity control) | NR | | | |
| | (G) | Threshold, approach, & strobe beacon lighting | NR | | | |
| | (H) | Visual approach slope indicators (VASI) | NR | | | |
| | (I) | Obstructions lighting/barrier markers | NR | | | |
| | (J) | Taxiway edge lighting | NR | | | |
| | (K) | Helipad/heliport lighting (perimeter, landing direction, hoverlane, etc.) | NR | | | |
| D-8 | D-12 | Water supply system | R | | | |
| | (A) | Source (commercial, well, storage, etc.) | R | D | | |
| | (B) | Average rate of supply (FPD at PSI) Current & Future | R | D | | |
| | (C) | Treatment requirements | NR | | | |
| | (D) | Existing system components (type, size, capacity, age, material, location, valving, pressure, etc.) | R | D | | |

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# design data checklist

| See Tech. Data Checklist Item | D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS (Continued) ITEM | | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| D-8 | D-12 | Water supply system (continued) | | | | |
| | (E) | Chemical analysis of water | NR | | | |
| | (F) | Emergency storage requirements | R | D | | |
| | (G) | Peak hours of supply (hours & estimated quantity) | R | D | | |
| | (H) | Known minimal requirements of supported function or Government equipment (quantity & quality) | R | D | | |
| | (I) | Chemical feeder & piping systems | NR | | | |
| | (J) | Corrosion control (existing & planned) | NR | | | |
| | (K) | Metering or usage restrictions | R | D | | |
| | (L) | Location of tie points (available capacity, interruption schedule) | R | D | | |
| D-8 | D-13 | Waste water treatment system | | | | |
| | (A) | Existing system & components (size, capacity, characteristics) | | | | |
| | (1) | Treatment plant | NR | | | |
| | (2) | Collector sewers | NR | | | |
| | (3) | Sewer mains (materials, depth) | NR | | | |
| | (4) | Complete treatment – industrial process | NR | | | |
| | (5) | Chemical, fuel or oil spill collection facilities | NR | | | |
| | (6) | Existing flows (min., avg., peak) | NR | | | |
| | (7) | Hydraulic capacity | NR | | | |
| | (B) | Known/estimated industrial or functional discharges (quantity & quality) | NR | | | |
| | (C) | Contributory population & per capita contribution | NR | | | |
| | (D) | Proposed system & components | NR | | | |
| | (1) | Treatment plant | NR | | | |
| | (2) | Collection sewers | NR | | | |
| | (3) | Lift station | NR | | | |
| | (4) | Complete treatment (additions or modifications) | NR | | | |
| | (5) | Chemical, fuel or oil spill collection facilities | NR | | | |
| | (6) | Waste water from portable water treatment plant | NR | | | |
| | (7) | Projected flows—average or peak | NR | | | |
| | (8) | By-pass restrictions | NR | | | |
| | (9) | Location of tie points (available capacity, interruption schedule) | R | | | |
| | (E) | Compliance requirements (federal, state, local) | R | D | | |
| | (F) | National Pollution Discharge Elimination System (NPDES) permit | NR | | | |
| | (G) | Corrosion control (existing or planned) | NR | | | |

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# design data checklist

DA FORM 5025-D-5-R, Feb 82

| See Tech. Data Checklist Item | D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS (Cont.) ITEM | | Required or Not Required | * To Be Determined | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| D-9 | D-14 | Energy Sources | | | | |
| | (A) | Gas systems (LP, natural, special) | R | D | | |
| | (1) | Loads and areas served | R | D | | |
| | (2) | Source of gas & type of service | R | D | | |
| | (3) | Supply pressure average | R | D | | |
| | (4) | Heating valve & type of gas (BTU per cubic foot) | R | D | | |
| | (5) | Valving & sectionalizing criteria | R | D | | |
| | (6) | Pressure regulation – reduction stations | R | D | | |
| | (7) | Existing lines, pumping stations, pressurization, base system | R | D | | |
| | (8) | Control & metering | R | D | | |
| | (B) | POL systems | | | | |
| | (1) | Fuel (primary or standby source, grade and analysis) | NR | | | |
| | (2) | Storage (tank size, location, type, number of storage days) | NR | | | |
| | (3) | Areas served | NR | | | |
| | (4) | Fuel requirements (known, estimated, quantity & type) | NR | | | |
| | (5) | Distribution system characteristics (piping, types of fuel, pumps, capacities) | NR | | | |
| | (6) | Ventilation system (Vapor Emission Control) | NR | | | |
| | (7) | Safety specifications | NR | | | |
| | (8) | Filter separators | NR | | | |
| | (C) | Coal systems | | | | |
| | (1) | Storage (location & capacity) | NR | | | |
| | (2) | Source of supply (primary & emergency) | NR | | | |
| | (3) | Type, energy value, analysis (i.e. sulfur, ash, etc.) | NR | | | |
| | (D) | Solar energy systems | | | | |
| | (1) | Building heating, air conditioning, domestic hot water | NR | | | |
| | (2) | Heating process water | NR | | | |
| | (3) | Collector type & location | NR | | | |
| | (4) | Liquid, chemical or rock storage | NR | | | |
| | (5) | Freeze protection | NR | | | |
| | (E) | Energy conservation data (U values, orientation, passive solar considerations, etc.) | NR | | | |
| | | Other Mechanical & Utility Systems (list and number items) | | | | |

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# design data checklist

DA FORM 5025-D-6-R, Feb 82

# E. ENVIRONMENTAL CONSIDERATIONS

| See Tech. Data Checklist Item | | ITEM | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| E-1 | E-1 | Water quality | | | | |
| | (A) | Waste water treatment management program (PL 92-500 & PL 95-217) | NR | | | |
| | (B) | Water quality criteria & standards (federal, state and local) | NR | | | |
| | (C) | Treatment requirements coordinated with EPA | NR | | | |
| | (D) | Facilities to be installed to meet regulatory agency criteria | NR | | | |
| E-1 | E-2 | Air quality | | | | |
| | (A) | Applicable air quality criteria (federal, state and local; PL 95-95 and Clean Air Act Amendment of 1977) | NR | | | |
| | (B) | Action taken to comply with requirements | NR | | | |
| | (C) | Type & amount of pollutants generated | NR | | | |
| | (D) | Results of proposed abatement measures | NR | | | |
| | (E) | Existing control equipment & monitoring procedures | NR | | | |
| E-1 | E-3 | Solid waste disposal | | | | |
| | (A) | Applicable solid waste criteria (federal, state and local) | NR | | | |
| | (B) | Waste volume generated (type & characteristics) | NR | | | |
| | (C) | Method of disposal (land fill and availability of land, leachate, etc.) | NR | | | |
| | (D) | Disposition of recyclable materials for reuse or as combustion fuel | NR | | | |
| | (E) | Impact on installation recycling programs | NR | | | |
| | E-4 | Effects of terrain changes (such as excavations, roadways, drainage structures, etc.) | NR | | | |
| | (A) | Measures to control erosion | NR | | | |
| E-1 | E-5 | Treatment of hazardous material | NR | | | |
| | (A) | Handling and disposal of plychlorinated biphenyls (PCB) in electrical transformers | NR | | | |
| | (B) | Handling and disposal of asbestos materials | NR | | | |
| | (C) | Handling and disposal of fiberglass products | NR | | | |
| | (D) | Storage of fuels and solvents | NR | | | |
| | (E) | Coordination with installation spill control plans | NR | | | |
| | | Other Environmental Considerations (list and number items) | | | | |

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**design data checklist**

DA FORM 5025-E-R, Feb 82

## F. FIRE PROTECTION

| See Tech. Data Checklist Item | ITEM | | Required or Not Required | To Be Determined* | Comment Attached | Document Attached |
|---|---|---|---|---|---|---|
| F-1 | F-1 | General design guidance | | | | |
| | (A) | Occupancy type (see NFPA 101, Chap 4) | NR | | | |
| | (B) | Water supply characteristics (existing or planned extensions) (capacity, pump activation, storage tanks and pumps, etc.) | NR | | | |
| | (C) | Mobile fire apparatus (response distance/time) | NR | | | |
| | (D) | Fire detection and alarm systems (existing or planned, type, location, etc.) | NR | | | |
| | (E) | Automatic suppression systems (water sprinkler, $CO_2$, foam etc.—existing or planned | NR | | | |
| | (F) | Hazard of contents (low, ordinary, high-see NFPA 101; type—explosives, flammable/toxic chemicals, radioactive materials) | NR | | | |
| F-1 | F-2 | Special fire suppression system requirements | NR | | | |
| | (A) | Means of egress | NR | | | |
| | (B) | Fire area limitations | NR | | | |
| | (C) | Fire walls, partitions, draft curtains | NR | | | |
| | (D) | Detection system (type, detectors, supervision, transmitters, annunciators, backup provisions) | NR | | | |
| | (E) | Suppression system (damage by water to costly equipment, shut down of operations) | NR | | | |
| | | Other Fire Protection (list and number items) | NR | | | |

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# design data checklist

DA FORM 5025-F-R, Feb 82

APPENDIX "A"

PRODUCTION RECORDS

F Y [illegible] 87

LOT #1 HOSP. LAUNDRY

| | | OCT. 86 | NOV. 86 | DEC. 86 | JAN. 87 | FEB. 87 | MARCH | APRIL 87 | MAY 87 | JUNE 87 | JULY 87 | AUG. 87 | SEPT. 87 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MISC. SMALL | 66 | 60 | 46 | 9 | 3 | 71 | 79 | 93 | 110 | 1 | [illegible] | 22728 |
| | MEDIUM | 3 | | 40 | | 55 | 30 | 34 | 4 | [illegible] | [illegible] | [illegible] | 85222 |
| | LARGE | | | | 1 | | | | | | | | 1 |
| .13 | PILLOWCASES | 5295 | 5319 | 5183 | 5163 | 5670 | 5726 | 5264 | 5455 | [illegible] | [illegible] | [illegible] | 604464223 |
| 1.35 | SHEET COTTON | [illegible] | 9323 | 8619 | 8735 | 9314 | [illegible] | 7801 | [illegible] | [illegible] | [illegible] | 8160 | [illegible] |
| 1.94 | TABLECLOTH | 132 | 911 | 1494 | 11026 | 11386 | 11803 | 2303 | [illegible] | [illegible] | [illegible] | 1637 | 174519672 |
| .18 | TOWEL HAND | [illegible] | 7993 | 7551 | 7882 | 8953 | [illegible] | [illegible] | 8493 | [illegible] | [illegible] | 1834 | 981044337 |
| | LAUNDRY BAG LARGE | 692 | 650 | 672 | 1819 | 631 | [illegible] | 713 | 1634 | [illegible] | [illegible] | [illegible] | 6978543 |
| | BABY ITEMS PER LB. | 545 | 575 | [illegible] | 570 | 635 | [illegible] | 576 | 470 | [illegible] | [illegible] | [illegible] | 9877275 |
| | BATHROBE | [illegible] | 2560 | [illegible] | 2149 | 2370 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 206522953 |
| 4.2 | BLANKET COTTON | [illegible] | 2269 | 2357 | 2824 | 2835 | 2991 | 2488 | 11701 | 1336 | [illegible] | 1864 | 271628437 |
| | BLANKET WOOL | 4 | | | | | | | 25 | 5 | | | 34 |
| .04 | CLOTH WASH | [illegible] | 5060 | 5737 | 5958 | 5202 | 6216 | 5474 | 5007 | [illegible] | [illegible] | 5377 | 612566697 |
| | COAT CONVALESCENT | [illegible] | 30 | 33 | 30 | 35 | 46 | 44 | 20 | 40 | [illegible] | [illegible] | 20445 |
| | COAT OPERATING/SCRUB | [illegible] | 2290 | [illegible] | 2436 | 1761 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 231027266 |
| | GOWN OPERATING/XRAY | [illegible] | 3195 | [illegible] | 4068 | [illegible] | 2335 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 398541898 |
| .10 | GYM SHORTS | [illegible] | 230 | 174 | 425 | 383 | 1188 | 1195 | 176 | 167 | [illegible] | [illegible] | 1982839 |
| .11 | PAJAMA COAT | 4156 | 2880 | 3234 | 2824 | [illegible] | 31834 | 2625 | 2248 | 2131 | [illegible] | [illegible] | 331736446 |
| .11 | TROUSERS | [illegible] | 2740 | 2400 | 2914 | 3290 | 3766 | 2666 | 2276 | 1916 | 2456 | 2443 | 356734804 |
| | PAD FLOOR 3X5 | [illegible] | 131 | 91 | 122 | 112 | 152 | [illegible] | [illegible] | [illegible] | [illegible] | 141 | [illegible] |
| | PANTS CONVALESCENT/SCRUB | [illegible] | [illegible] | 2657 | 1883 | 11788 | [illegible] | 2091 | 3011 | [illegible] | [illegible] | [illegible] | [illegible] |
| | TOWEL BATH | 11094 | 9382 | 8790 | 10577 | 7405 | 12087 | 9814 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| | WRAPPER | [illegible] | 4913 | 4218 | 5218 | [illegible] | 5521 | 5134 | [illegible] | 4735 | [illegible] | 5378 | 622568422 |
| | COVER HAMPER | [illegible] | 338 | 268 | 299 | 276 | 305 | 271 | 200 | 238 | [illegible] | 307 | 794 3853 |
| | PILLOW | [illegible] | 63 | 85 | 65 | 24 | 41 | 68 | 28 | [illegible] | [illegible] | 40 | [illegible] 631 |
| | SHEEPSKIN | 3 | | | 3 | | 2 | 10 | 3 | | | | 1 22 |
| | COAT DR/ORTHO/FOOD H | 3 | 1 | | | | 148 | | | [illegible] | | 2 | 201 |
| | SMOCK | | | | | | 44 | 50 | 17 | [illegible] | [illegible] | 140 | [illegible] 614 |
| | DRESS HOSP. | [illegible] | 105 | 125 | 105 | 130 | 184 | 177 | 130 | [illegible] | [illegible] | [illegible] | 1251557 |
| | SALVAGE HOSP. DYED | | | | | | | 363 | | | | | 353 |
| | DYE NEW ITEMS | [illegible] | 1808 | | 108 | 190 | 268 | | | | 237 | 496 | 3717 |
| | SHEET FITTED | | | 9689 | 2676 | 2517 | 3203 | 2380 | 2858 | 2371 | [illegible] | 3433 | 413735852 |
| | LOT #2 ORGANIZATIONAL [illegible] | | | | | | | | | | | | |
| | APRON FOOD H | [illegible] | 77 | 61 | 42 | 23 | 57 | 71 | 62 | [illegible] | [illegible] | 40 | 53 672 |
| | CLOTH WASH | [illegible] | 7157 | [illegible] | 2595 | 6970 | [illegible] | 9664 | 7883 | [illegible] | [illegible] | 9318 | [illegible] |
| | NAPKIN | 4253 | [illegible] | 5656 | 3771 | 3457 | 3519 | 4765 | 4399 | [illegible] | [illegible] | 3049 | 350947369 |
| .3 | PILLOWCASE | 46793 | [illegible] | 21709 | 17039 | 34486 | 35960 | 33783 | 34371 | 42731 | [illegible] | [illegible] | [illegible] |
| | SALVAGE DYE SHOP/TOWEL ORT. | [illegible] | | | 31 | 21 | | | 185 | | | 1527 | 3553 |
| 1.25 | SHEET COTTON | 84235 | [illegible] | 45736 | [illegible] | 67552 | 69865 | 65981 | 65465 | [illegible] | [illegible] | [illegible] | [illegible] |
| .99 | TABLECLOTH ALL | 3600 | 1784 | 2680 | 2389 | [illegible] | 2439 | 2951 | [illegible] | [illegible] | [illegible] | [illegible] | 311231665 |
| | UNIFORM, FROCK FOOD H | | 5 | 7 | | | | | | | | | 16 |
| | SMOCK | 286 | 244 | 290 | 208 | 289 | 249 | 274 | 274 | 203 | 312 | 258 | 322 3184 |
| | [illegible] SMALL | | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BAG SLEEPING | 5392 | 5177 | 11920 | 3620 | 3493 | 4003 | 4991 | 3301 | 3793 | 5658 | 4679 | 595456998 |
| BLANKET | 10640 | 10695 | 8483 | 9771 | 9586 | 12555 | 10528 | 11610 | 13627 | 11135 | 12308 | 12573130711 |
| TROUSERS SWEAT | 1637 | 2427 | 2908 | 3558 | 3910 | 3863 | 3526 | 2381 | 3000 | 4273 | 3550 | 3077738699 |
| TOWEL BATH | 10129 | 8599 | 7812 | 8477 | 9325 | 14218 | 17118 | 13772 | 12295 | 11974 | 13242 | 109151375 76 |
| SHORTS GYM | 4454 | 4107 | 4208 | 1281 | 3456 | 3813 | 3369 | 2501 | 2307 | 4052 | 5371 | 3787[illegible] |
| COVERALLS/OVERALLS | 207 | 168 | 85 | 242 | 306 | 262 | 175 | 146 | 143 | 141 | 48 | 1052028 |
| PAD MATTRESS | 591 | 363 | 187 | 1008 | 307 | 261 | 233 | 647 | 270 | 493 | 515 | 3475722 |
| SPREAD BED | 14 | 145 | 134 | 213 | 186 | 83 | 295 | 131 | 147 | 160 | 91 | 1231892 |
| SHIRT, TEE-SWEAT-JERSEY | 5326 | 4605 | 6497 | 4422 | 6253 | 5771 | 6270 | 5126 | 4793 | 5612 | 10381 | 649379949 |
| BAG LAUNDRY-DUFFEL | 3886 | 3898 | 4467 | 2378 | 2566 | 2486 | 3214 | 2148 | 2714 | 4945 | 5216 | 2730[illegible] |
| CAP BDU | 61 | | | 255 | 140 | 20 | | 71 | 43 | [illegible] | 154 | 127966 |
| COVER AMMO | | 147 | | | 43 | | 36 | 35 | [illegible] | 220 | [illegible] | 1531304 |
| COVER MATTRESS | 5509 | 3753 | 3490 | 3942 | 4690 | 5622 | 4610 | 3630 | [illegible] | 4803 | 5588 | [illegible]557358 |
| COVER CANTEEN | 79 | 1100 | 86 | 187 | 102 | 226 | 393 | 1352 | [illegible] | 1198 | 514 | [illegible] |
| COVER HELMET | | | | | 80 | | | 58 | [illegible] | 144 | 158 | 635 |
| DRAWERS COTTON/WOOL | | | 11 | 25 | 57 | 200 | 135 | 64 | 125 | | 87 | 704 |
| GLOVE/CHEMICAL/THIN | 651 | 42 | | 52 | 132 | 20 | 49 | 21 | 11 | 5 | | 6997 |
| JACKET FIELD NBC | 992 | 1589 | 1663 | 964 | 867 | 1204 | 912 | 747 | 190 | 733 | 243 | 7510863 |
| LINER FIELD JACKET | 79 | 1551 | 1378 | 360 | | | 1518 | 1804 | 416 | 325 | 200 | 856719 |
| LINER PARKA | | | | | | | | | | | | |
| MOP | 24 | 10 | | 5 | 11 | 66 | 19 | 14 | 22 | 2 | 7 | 78258 |
| NECK BAND HELMET | 2385 | 1865 | 2860 | 1650 | 2250 | 1850 | 2150 | 1550 | 1190 | 1180 | 2520 | 16502340 |
| PACKFIELD ALL | 53 | 182 | 140 | 55 | 93 | 76 | 95 | 202 | 58 | 445 | 244 | 4542097 |
| PILLOWS | 4818 | 3918 | 3606 | 3845 | 3276 | 4846 | 4107 | 5693 | 3662 | 4027 | 5299 | 6105 53099 |
| RUG, SQ. FT. | | | | | | | | | | | | |
| RAGS | 4944 | 2329 | 2527 | 4150 | 4189 | 4552 | 4876 | 4097 | 3343 | 4299 | [illegible] | [illegible]46320 |
| SHELTER HALFS | 4836 | 3754 | 4214 | 2599 | 2934 | 3584 | 3733 | [illegible] | 3627 | 5453 | 5068 | 4527 47098 |
| SHOE-TENNIS | 151 | 18 | 123 | 30 | 44 | 173 | 34 | 94 | 33 | 38 | | 94 882 |
| SOCKS | | | | | | 16 | | 437 | 26 | 382 | | 518 1379 |
| TROUSER FIELD NBC | 1265 | 1095 | 2424 | 2099 | 1456 | 2777 | 2930 | [illegible] | [illegible] | 416 | 307 | [illegible] 16399 |
| UNDERSHIRT WOOL | | | 17 | 50 | 160 | 440 | 317 | [illegible] | 70 | 19 | | 1315 |
| WEBBING HELMET/[illegible] | 4827 | 3742 | 4816 | 1988 | 4539 | 4624 | 4421 | [illegible] | [illegible] | 3185 | 6001 | 5966 4991 |
| MISC SMALL | 401 | 779 | 336 | 100 | 199 | 1444 | 879 | 2083 | 1733 | 3305 | 2466 | 1862 15637 |
| MEDIUM | 123 | 132 | 502 | 189 | 282 | 54 | 71 | 1 | | | 26 | 1380 |
| LARGE | 31 | | 6 | 7 | | | | | | | | 44 |
| SHIRT UTILITY/BDU | 419 | 348 | 255 | 335 | 1004 | 688 | 656 | 346 | 645 | 380 | 221 | 3415738 |
| TROUSER UTILITY/BDU | 607 | 756 | 863 | 577 | 645 | 683 | 613 | 493 | 443 | 573 | 480 | 1747207 |
| LOT #3 - LAUNDRY ORGANIZATIONAL 48 HOUR | | | | | | | | | | | | |
| COAT FOOD H./MED. | 473 | 343 | 383 | 359 | 367 | 411 | 403 | 422 | 478 | 480 | 406 | 5155040 |
| TROUSER FOOD H./MED. | 461 | 300 | 349 | 340 | 342 | 378 | 361 | 402 | 441 | 450 | 394 | 434 4672 |
| DRESS FOOD H./MED. | 39 | 37 | 46 | 28 | 65 | 92 | 55 | 86 | 78 | 51 | 44 | 70 691 |
| APRON | 6 | 11 | 2 | 8 | 4 | 2 | 54 | 8 | 9 | 8 | 2 | 114 |
| LOT #4 IPR 72 HOUR | | | | | | | | | | | | |
| BLOUSE | 3 | 9 | 3 | 3 | 4 | 12 | 3 | 6 | 4 | 24 | 10 | 20 101 |
| CURTAINS/DRAPES | 41 | | | | | | | 4 | | | 6 | 22 73 |
| JACKET FIELD | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 39 | [illegible] | [illegible] | [illegible] | [illegible] | 29 [illegible] |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SHIRT EXCEPT BDU | 95 | 81 | 98 | 45 | 123 | 156 | 140 | 145 | 82 | 169 | 151 | 18 1436 |
| SHIRT BDU | 346 | 260 | 283 | 107 | 326 | 336 | 438 | 392 | 402 | 437 | 360 | 47 4159 |
| SKIRT MIL/CIV. | 1 | | | | 3 | 1 | 1 | | | 5 | 8 | 10 87 |
| TROUSER EXCEPT BDU | 173 | 99 | 123 | 80 | 146 | 201 | 232 | 166 | 89 | 168 | 131 | 195 1773 |
| TROUSER BDU | 338 | 268 | 281 | 100 | 327 | 195 | 420 | 291 | 373 | 443 | 367 | 5 3873 |
| MISC. SMALL | | 58 | 6 | | 6 | 13 | 9 | 4 | 7 | 13 | 2 | 10 128 |
| MEDIUM | 7 | 8 | 9 | | 5 | 6 | 7 | 9 | | 19 | 6 | 10 86 |
| LARGE | 18 | 14 | 11 | 4 | 8 | 5 | 9 | 12 | 4 | 11 | 7 | 7 110 |
| COVERALL | 1 | | | | | | 9 | 4 | | | | 14 |
| HANDKERCHIEF | 1 | 2 | 1 | | 5 | 6 | 14 | 7 | 11 | 9 | 5 | 1 71 |
| NAPKIN | 12 | | 11 | | | | | | | | | 0 |
| PILLOWCASE | 14 | 10 | 1 | 2 | | 2 | 14 | 1 | | | | 44 |
| SHEET CONTOUR | 5 | 4 | | | | | | | | | | 0 |
| SHEET REGULAR | 6 | 4 | 1 | | | 6 | 9 | | | | | 20 |
| TABLECLOTH | 4 | 1 | 6 | | | 2 | | | | 2 | 2 | 22 |
| BAG LAUNDRY | 11 | 13 | 13 | 2 | 8 | 10 | 18 | 10 | 20 | 23 | 13 | 22 162 |
| BAG SLEEPING | | | | | | | | | | | | 0 |
| CAP | 2 | | | | | | | | | | | 0 |
| CLOTH WASH | 3 | 7 | 7 | | 9 | 3 | | | 1 | 2 | | 15 58 |
| DRAWERS | 8 | 22 | 19 | 2 | 23 | 31 | 22 | 11 | 48 | 56 | 31 | 162 489 |
| PAD BED | | | | | | 1 | | | | | | 1 |
| QUILT | | | | | | | | | | | | 0 |
| RUGS SQ.FT. | | | | | | | | | | | | 0 |
| SHIRT TEE | 15 | 27 | 59 | | 54 | 46 | 55 | 9 | 47 | 67 | 58 | 129 545 |
| SHORT ATHLETIC | 1 | | 8 | | | 2 | 1 | 2 | 2 | 1 | 5 | 22 |
| SOCKS | 7 | 44 | 22 | 5 | 34 | 31 | 49 | 11 | 44 | 64 | 40 | 129 482 |
| SPREAD BED | 2 | | | | | | | | | | | 0 |
| TOWEL BATH | 20 | 15 | 11 | 2 | 19 | 24 | 30 | 14 | 32 | 52 | 28 | 72 319 |
| TOWEL BENCH | | | | | | | | | | | | 0 |
| MISC SMALL | | | | | | | | | | | | 0 |
| MEDIUM | | | | | | | | | | | | 0 |
| LARGE | | | | | | | | | | | | 0 |
| LAT#5 IPR 24HOUR | | | | | | | | | | | | |
| BLOUSE | | | 1 | | | | 12 | 11 | 5 | 21 | 23 | 12 85 |
| COAT/JACKET | 8 | 7 | 12 | 3 | 16 | 9 | 9 | 2 | 8 | 10 | 5 | 8 97 |
| SHIRT EXCEPT BDU | 62 | 27 | 32 | 12 | 46 | 44 | 83 | 51 | 56 | 62 | 89 | 61 625 |
| SHIRT BDU | 88 | 37 | 42 | 25 | 142 | 191 | 185 | 297 | 787 | 635 | 366 | 203 2890 |
| SKIRT | | | | | | | 2 | 2 | 2 | 1 | 5 | 9 21 |
| TROUSER EXCEPT BDU | 99 | 70 | 75 | 33 | 96 | 78 | 123 | 85 | 98 | 89 | 87 | 78 1031 |
| TROUSER BDU | 95 | 40 | 42 | 28 | 136 | 182 | 183 | 299 | 727 | 608 | 368 | 205 2956 |
| MISC. SMALL | | 2 | | | | 1 | 1 | 1 | 31 | 9 | 12 | 8 65 |
| MEDIUM | 1 | 2 | 1 | | 1 | 1 | 8 | 25 | 1 | 2 | 1 | 2 45 |
| LARGE | 4 | 4 | 4 | | 3 | 2 | | 2 | | 1 | 1 | 1 22 |
| CLOTH WASH | | | | | | | | | 19 | | | 19 |
| DRAWERS | | | | | | 9 | | 2 | 101 | 4 | 17 | 2 135 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RUG. SQ. FT. | 18 | | | 24 | | 12 | | 18 | 34 | | | 14120 |
| SHIRT TEE | | | | | | 15 | | | 178 | 4 | 8 | 205 |
| SOCKS | | | | | | 12 | | 2 | 135 | 6 | 8 | 165 |
| TOWEL BATH | 2 | | | | | | | | 38 | 2 | 4 | 45 |
| LAUNDRY BAG | | | | | | | | | | | | 0 |
| MISC. SMALL | | | | | | | | 1 | 10 | | | 11 |
| MEDIUM | | | | | | | | | | | | 0 |
| LARGE | | | | | | | | | | | | 0 |
| HANKER CHIEF | 1 | | | | | 3 | 2 | 1 | 21 | 3 | 5 | 136 |
| PILLOWCASE | | | | | | | | 3 | | | | 3 |
| SHEET | | | | | | | | 4 | | | | 4 |
| LOT # 6 PAYROLL DEDUCTION | | | | | | | | | | | 1026892 | |
| 1 BUNDLE PER. WEEK | 9176 | [illegible] | 3826 | 4845 | 5944 | 6610 | 6460 | 8837 | 9052 | 11183 | 9360 | 98167[illegible] |
| 2 BUNDLE PER. WEEK | 102012 | 95570 | 47258 | 56110 | 69516 | 75670 | 75311 | 65409 | 96945 | 138083 | 120896 | 822[illegible] |
| PERMANT PARTY | 1931 | 433 | 1332 | 1512 | 1426 | 1620 | 1567 | 1176 | 1344 | 1452 | 1193 | 473[illegible] |
| | 16349 | 12[illegible] | 11093 | 13737 | 12237 | 14484 | 14471 | 13784 | 11809 | 12415 | 10193 | [illegible] |
| LOT II 8 ORGANIZATIONAL DRY CLEANING | | | | | | | | | | | | |
| ALB. | | | | | 3 | | | 4 | | 3 | | 212 |
| AMICE | | | | | | | | | | | | 0 |
| COAT SHORT | 77 | 73 | 52 | 27 | 160 | 88 | 112 | 112 | 101 | 291 | 10 | 1031212 |
| COAT LONG LINED | 41 | 15 | 52 | 90 | [illegible] | 123 | 32 | 1 | 2 | 357 | | [illegible]782 |
| CORPORAL | | | | | | | 1 | | | | | 12 |
| CURTAIN/DRAPES | 123 | 586 | 554 | 399 | 432 | 118 | 375 | 188 | 207 | 187 | 248 | 2903643 |
| HOOD WINTER LINED | 1 | 129 | 209 | | 50 | 19 | 21 | 55 | 39 | | | 75577 |
| JACKET ALL | 2 | | | | 1 | | 8 | | | | | 516 |
| ALTAR CLOTH ALL | 9 | 5 | | 4 | 7 | | | 20 | 2 | 5 | | 1167 |
| PARKA | 1 | | | 33 | 3 | 1 | 143 | 20 | 35 | 18 | 3 | 3287 |
| PURIFICATOR | | 7 | | | 7 | | 8 | 11 | | 5 | | 543 |
| SHIRT | 47 | 16 | 20 | 268 | 62 | 22 | 96 | 13 | 45 | 258 | 165 | 1501203 |
| SCARF ALL | | | | 14 | | 200 | 33 | 1 | | | | 52298 |
| TOWEL FINGER | | | | 3 | 4 | | 5 | 5 | | 4 | | 520 |
| TROUSER ALL | 39 | 109 | 47 | 322 | 148 | 53 | 12 | 104 | 65 | 694 | 223 | 2002022 |
| TABLECLOTH ALL | 4 | | | 6 | | 14 | 13 | 35 | 5 | 7 | 13 | 13107 |
| ROBE/GOWN ALL | 22 | | | | 39 | | 32 | | 24 | | 67 | 5187 |
| MISC. SMALL | 6 | 66 | 91 | | 61 | 172 | 130 | 9 | 30 | 61 | 610 | 1001410 |
| MEDIUM | 7 | | | 28 | 29 | 16 | 12 | 15 | 5 | 36 | 16 | 20184 |
| LARGE | | | | | | | | | | | | 0 |
| GLOVES/MITTEN | 22 | | 43 | 8 | 41 | 31 | 7 | 15 | 11 | 42 | 7 | 10237 |
| HAT DI [illegible] | | | | | 1 | 1 | | 4 | 1 | 1 | | 19 |
| TAPESTRY/FLAG | | 19 | | | 3 | 15 | 41 | 18 | 12 | | 5 | 10133 |
| MISC. SMALL | | | | | | | | 2 | | | | 57 |
| MEDIUM | | | | | | | | | | | 1 | 12 |
| LARGE | | | | | | | | | | | | 0 |
| CAP PILE | 30 | | 47 | 35 | 1 | 2 | 20 | 2 | 44 | 205 | 4 | 25415 |
| CAP GARRISON | | | | | | | | | | | | 0 |
| COVERALL/OVERALLS | 255 | 101 | 126 | 35 | 93 | 174 | 210 | 163 | 202 | 214 | 200 | 2251998 |
| SCARF WOOL | | | 68 | | | | | [illegible] | [illegible] | | | 7225 |
| DRESS | | | | | | | | | | | | 144 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **LOT # 8** | | | | | | | | | | | | |
| SHIRT WOOL | 109 | 143 | 24 | | 83 | 47 | | 63 | 30 | 17 | | 5 503 |
| TROUSER WOOL | 37 | | | | 66 | 45 | | 5 | | | | 10 105 |
| **LOT # 9 ORGANIZATIONAL DRY CLEANING 48 HR.** | | | | | | | | | | | | |
| COAT AG. PHASE II | 2716 | 3193 | 4143 | 379 | 1990 | 1839 | 1842 | 1234 | 2663 | 3335 | 2967 | 25 1028291 |
| TROUSER AG. PHASE II | 3098 | 3903 | 4348 | 1680 | 3541 | 2978 | 2669 | 2471 | 3089 | 4286 | 4194 | 35 5039757 |
| SHIRT | 2498 | 3107 | 4088 | 110 | 2170 | 1950 | 1684 | 1540 | 1643 | 3579 | [illegible] | 20 0027377 |
| **LOT # 10 IPR DRY CLEANING 72 HOUR** | | | | | | | | | | | | |
| BLOUSE | 37 | 31 | 31 | 29 | 32 | 55 | 59 | 73 | 48 | 41 | 33 | 25 484 |
| COAT FUR TRIMMED | | | | | 2 | | 1 | | | | | 2 15 |
| COAT SPORTS/UNIFORM | 55 | 46 | 71 | 32 | 75 | 28 | 131 | 67 | 70 | 58 | 34 | 70 787 |
| COAT LONG LINED MIL/CIV | 13 | 1 | 17 | 1 | 36 | 3 | 6 | 2 | 2 | 2 | 1 | 15 99 |
| COAT LONG W/LINER MIL/CIV | 15 | 21 | 26 | 16 | | 32 | 36 | 31 | 23 | 16 | 16 | 31 268 |
| CURTAIN/DRAPES SY | | 29 | 38 | 7 | 12 | 40 | 28 | 40 | 115 | 51 | 125 | 65 553 |
| DRESS EXCEPT EVENING | 19 | 34 | 7 | 7 | 8 | 36 | 51 | 54 | 51 | 31 | 39 | 27 366 |
| DRESS EVENING | | | 1 | | | 2 | 2 | 2 | 4 | 3 | 1 | 2 17 |
| RUG SQ. FT. | 79 | 16 | 88 | 20 | 17 | 16 | 25 | 58 | 172 | | 191 | 100 782 |
| SKIRT W/O PLEATS | 42 | 43 | 31 | 20 | 40 | 41 | 68 | 73 | 40 | 47 | 40 | 45 532 |
| SKIRT W/PLEATS | | 1 | | | 1 | | | | 3 | | | 2 7 |
| SHIRT ALL MIL/CIV | 61 | 49 | 200 | 32 | 121 | 121 | 146 | 100 | 94 | 70 | 48 | 133 1192 |
| SHIRT W/MILITARY CREASE | 1 | 4 | 6 | 5 | 4 | 2 | 6 | 6 | 7 | 4 | 4 | 5 54 |
| SUIT, CIV. 2 OR 3 PIECE | 34 | 50 | 34 | 16 | 56 | 82 | 96 | | 80 | 52 | 62 | 48 600 |
| SWEATER | 77 | 61 | 77 | 54 | 101 | 100 | 98 | 63 | 29 | 36 | 15 | 50 761 |
| TABLECLOTH | | 5 | 3 | 2 | | 8 | | | | 2 | 4 | 4 22 |
| NECK TIE | 1 | | 5 | 3 | 31 | 22 | 13 | 7 | 7 | 15 | 5 | 10 119 |
| TROUSER ALL | 292 | 160 | 166 | 185 | 296 | 304 | 370 | 278 | 266 | 253 | 221 | 250 2990 |
| UNIFORM MILITARY | 23 | 17 | 242 | 12 | 185 | 34 | 26 | 14 | 25 | 25 | 11 | 110 684 |
| MISC. SMALL | 6 | 10 | 9 | 4 | 12 | 12 | 14 | 21 | 26 | 18 | 10 | 15 157 |
| MEDIUM | 7 | 12 | 3 | 2 | 4 | 12 | 15 | 9 | 6 | 10 | 18 | 12 102 |
| LARGE | 4 | 2 | 3 | 1 | 5 | 4 | 3 | 7 | 10 | 1 | 7 | 8 55 |
| **LOT # 11 IPR DRY CLEANING (SAME DAY)** | | | | | | | | | | | | |
| BLOUSE | 22 | 15 | 9 | 7 | 10 | 21 | 23 | 22 | 13 | 14 | 28 | 15 199 |
| COAT FUR TRIMMED | | | | | | | | | | | | 0 |
| COAT SPORTS/UNIFORM | 67 | 39 | 45 | 18 | 72 | 70 | 56 | 38 | 24 | 19 | 21 | 40 509 |
| COAT LONG W/LINER | 2 | 5 | 2 | | 14 | 4 | 1 | | 1 | | | 1 30 |
| COAT LONG LINED MIL/CIV | 6 | 17 | 44 | 13 | 13 | 16 | 9 | 5 | 1 | 1 | | 14 139 |
| CURTAINS SQ. YDS | | 12 | 3 | | | 5 | 6 | 42 | 11 | 17 | | 21 115 |
| DRESS EXCEPT EVENING | 9 | 1 | 13 | 3 | 9 | 9 | 21 | 26 | 13 | 25 | 19 | 13 161 |
| RUG. SQ. FT. | | | | 42 | | 6 | | | 20 | | | 68 |
| SKIRT W/O PLEATS | 17 | 16 | 29 | 12 | 20 | 86 | 28 | 18 | 15 | 3 | 16 | 25 285 |
| SHIRT ALL MIL/CIV. | 138 | 62 | 102 | 24 | 139 | 123 | 132 | 99 | 116 | 56 | 73 | 113 1207 |
| SHIRT W/MIL. CREASE | 1 | 1 | | | 1 | | | 10 | | | 5 | 4 23 |
| SUIT CIV. 2 OR 3 PIECE | 18 | 12 | 16 | 11 | | 29 | 32 | 20 | 28 | 18 | 21 | 26 231 |
| TROUSERS ALL | 186 | 113 | 129 | 78 | 202 | 231 | 205 | 198 | 165 | 140 | 197 | 200 2044 |
| UNIFORM MILITARY | 60 | 56 | 60 | 20 | 67 | 80 | 34 | 36 | 25 | 10 | 18 | 38 504 |
| SWEATER | 26 | 22 | 47 | 21 | 35 | 58 | 40 | 16 | 10 | 6 | 7 | 27 314 |

| LOT. | OCT. 86 | NOV. 86 | DEC. 86 | JAN. 87 | FE | MARCH 87 | APRIL 87 | MAY 87 | JUNE 87 | JULY 87 | AU | SEPT. 87 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MISC: SMALL | 10 | 11 | 11 | 7 | 14 | 7 | 6 | 7 | 13 | 14 | 11 | 10121 |
| MEDIUM | 4 | | 7 | 4 | 4 | 3 | 6 | 3 | | 2 | 1 | 438 |
| LARGE | 1 | 1 | 1 | | 2 | 2 | 4 | 3 | 1 | 3 | 1 | 220 |
| NECKTIE | 16 | 1 | 11 | 4 | 20 | 14 | 4 | 5 | 6 | 8 | 10 | 15114 |
| LOT #12 HOSPITAL DRY CLEANING | | | | | | | | | | | | |
| COVERALL | 1 | | | | | | | | | | | 1 |
| COAT DR. | | | 7 | | | | | | | | | 7 |
| PAD FOAM RUBBER 4x6 | 7 | 22 | 41 | 23 | | | | | | | | 93 |
| TROUSERS | | | | | | 4 | | 2 | | | | 17 |
| SMOCK / PANT SUIT / DRESS | 417 | 670 | 290 | 333 | 271 | 381 | 363 | 250 | 270 | 267 | 316 | 2913719 |
| MISC. SMALL | 1 | 29 | | | | 11 | | 19 | 113 | | | 85258 |
| MEDIUM | | 4 | 1 | 2 | 2 | | | 16 | | 147 | | 9181 |
| LARGE | | | | | | | | | | | | 0 |
| CURTAINS/DRAPES | 521 | 156 | 78 | 178 | 298 | 449 | 23 | 120 | 12 | | | 1201947 |

TOTAL - 3,537,859

| | OCT. 87 | NOV. 87 | DEC. 87 | JAN. 88 | FEB. | MAR. 88 | APR. 88 | MAY 88 | JUN. 88 | JUL. 88 | AUG | SEP. 88 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MISC. SMALL | 189 | 4 | 1 | 212 | 145 | 71 | 15 | 110 | 7 | 74 27 | 47 | 15 | 793 |
| MED. | 25 | 44 | 46 | 88 | 92 | 95 | 18 | 22 | 33 | 245 11 | 234 | 29 | 474 |
| LARGE | | | | | | | | | | 16 | 11 | 5 | 16 |
| PILLOWCASE | 6724 | 6152 | 6093 | 4908 | 5583 | 5718 | 3887 | 4100 | 4205 | 3771 | 4887 | 3984 | 96046 |
| SHEET COTTON | 9539 | 9113 | 7692 | 8561 | 9645 | 9052 | 4873 | 4014 | 7079 | 5613 | 8881 | 6283 | 96295 |
| TABLECLOTH | 2180 | 1372 | 1663 | 1369 | 1454 | 1433 | 1159 | 1383 | 1401 | 1191 | 1250 | 1162 | 17007 |
| TOWEL HAND | 9776 | 8139 | 7260 | 7567 | 9909 | 9480 | 8077 | 9622 | 8345 | 5687 | 4441 | 8102 | 96417 |
| LAUNDRY BAG | 806 | 845 | 1858 | 700 | 826 | 897 | 620 | 607 | 671 | 524 | 937 | 720 | 9271 |
| BABY ITEMS PER.LB. | 528 | 537 | 389 | 334 | 523 | 618 | 484 | 612 | 384 | 492 | 1466 | 652 | 7035 |
| BATH ROBE | 2562 | 2460 | 1945 | 1510 | 2323 | 1659 | 1240 | 1190 | 967 | 1316 | 1269 | 850 | 19273 |
| BLANKET COTTON | 2333 | 2956 | 2762 | 2224 | 2850 | 2685 | 1788 | 1731 | 1811 | 1513 | 1726 | 1879 | 27358 |
| BLANKET WOOL | 2 | 27 | 5 | | 7 | | | | | | | 5321 | 5362 |
| CLOTH WASH | 8535 | 5568 | 5627 | 6236 | 6073 | 5806 | 5172 | 5081 | 5080 | 4300 | 5202 | | 62[illegible] |
| CART CONVALESCENT | 20 | 25 | 41 | 35 | 12 | 20 | 88 | 5 | 20 | 35 | 32 | 60 | [illegible]93 |
| CART OPERATING/SCB | 2277 | 2371 | 2318 | 1661 | 2515 | 2638 | 2168 | 2340 | 2116 | 1935 | 2430 | 2081 | 27[illegible] |
| GOWN OPERATING/X RAY | 4158 | 4153 | 3824 | 3808 | 4087 | 3339 | 3808 | 3216 | 3754 | 3401 | 4049 | 3861 | 39447 |
| GYM SHORTS | 169 | 156 | 128 | 145 | 236 | 254 | 133 | 188 | 182 | 131 | 180 | 204 | 2156 |
| PAJAMA COAT | 4090 | 4323 | 3992 | 2628 | 3701 | 2190 | 2150 | 1711 | 1968 | 2112 | 2495 | 1647 | 32987 |
| TROUSERS | 4059 | 4508 | 3006 | 3077 | 3895 | 2469 | 1590 | 1761 | 2085 | 211 | 2313 | 1756 | 32628 |
| PAD FLOOR 3X5 | 148 | 121 | 8 | 124 | 81 | 32 | 129 | 140 | 44 | 142 | 29 | 126 | 1171 |
| PANTS CONVALESCENT | 2116 | 1699 | 1977 | 1645 | 1972 | 2200 | 2067 | 2046 | 1764 | 1521 | 1995 | 1618 | 22680 |
| TOWEL BATH | 14803 | 11924 | 10191 | 10264 | 11822 | 10673 | 9016 | 9344 | 8587 | 8262 | 10196 | 8310 | 122,545 |
| WRAPPER | 5712 | 4951 | 4493 | 4029 | 5283 | 5752 | 3934 | 4639 | 4212 | 4637 | 4859 | 4300 | 56000 |
| COVER HAMPER | 352 | 436 | 478 | 603 | 597 | 438 | 580 | 259 | 310 | 294 | 504 | 163 | 5014 |
| PILLOW | 75 | 61 | 40 | 35 | 50 | 12 | 7 | 34 | 29 | 17 | 12 | 79 | 451 |
| SHEEP SKIN | | 12 | 17 | | | 24 | | | | | 7 | 11 | 71 |
| CART DR./ORTH | | 5 | | | | 30 | | | | | | | 35 |
| SMOCK | 82 | 107 | 51 | 91 | | | | | 135 | 97 | | | 563 |
| DRESS HOSP. | 56 | 50 | 50 | 35 | 65 | 55 | 44 | 60 | 120 | 60 | 86 | 50 | 731 |
| SALVAGE HOSP DYED | | | 139 | | | | 158 | | 276 | | 207 | 115 | 891 |
| DYED NEW ITEMS | 2097 | | | | | | | | | | | 379 | 2476 |
| SHEET FITTED | 4569 | 4226 | 3362 | 3245 | 3778 | 3133 | 2193 | 2542 | 2907 | 2834 | 1528 | 2504 | 12[illegible]1 |
| ORGANIZATIONAL 72 HR. | | | | | | | | | | | | | |
| APRON FOOD H | 33 | 1 | 45 | 28 | 19 | 31 | 50 | 10 | 11 | 5 | | 10 | 270 |
| CLOTH WASH | 4628 | 6296 | 4929 | 5182 | 6573 | 7202 | 6326 | 9647 | 9664 | 11371 | 12658 | 18912 | 97393 |
| NAPKIN | 1699 | 2178 | 3417 | 2297 | 4345 | 3990 | 3729 | 2749 | 5146 | 4460 | 3769 | 4915 | [illegible] |
| PILLOWCASE | 35579 | 18392 | 30993 | 26217 | 23472 | 26635 | 20942 | 23338 | 39633 | 43190 | 47015 | 27480 | [illegible] |
| SALVAGE DYED-ORANGE | 3140 | 26 | | | | 1982 | 24 | 8 | | 1789 | | 369 | 11[illegible] |
| SHEET COTTON | 68221 | 59053 | 43978 | 50161 | 44090 | 49522 | 38061 | 42889 | 78338 | 84092 | 90392 | 64721 | 7[illegible]517 |
| TABLECLOTH ALL | 2572 | 2397 | 3328 | 2473 | 2812 | 3887 | 2814 | 2770 | 2980 | 2811 | 2380 | 3030 | 83 414 |
| UNIFORM.FROCK F.H | | | | | | | | | | | | 123 | 123 |
| SMOCK | 364 | 53 | 324 | 285 | 253 | 292 | 227 | 150 | 250 | | 2292 ~~2265~~ | 2709 | 2048 |
| MISC. SMALL | | | 1 | | | 3 | 3 | | | | | 2178 | 390 |
| MED. | | | | | | | | 1 | | | 19 | 317 | 51 |
| LARGE | | | | | | | | | | | 8 | | 8 |

LOT#3

| 72 HR. | OCT. 87 | NOV. 87 | DEC. 87 | JAN. 88 | FEB | MAR. 88 | APR. 88 | MAY 88 | JUN. 88 | JUL. 88 | AUG. 88 | SEP. 88 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BAG SLEEPING | 4491 | 4084 | 4403 | 2644 | 3819 | 3477 | 2601 | 2288 | 3511 | 4195 | 6259 | 4526 [illegible] |
| BLANKETS | 11475 | 10336 | 7295 | 9160 | 7675 | 9972 | 9736 | 8423 | 9904 | 9467 | 13207 | 11199 [illegible] |
| TROUSER SWEAT | 3472 | 3151 | 2748 | 2373 | 2215 | 2411 | 2306 | 1850 | 1839 | 2620 | 5062 | 3155 3306 |
| TOWEL BATH | 8851 | 8872 | 6318 | 7275 | 9198 | 10066 | 10768 | 12959 | 15583 | 17521 | 19601 | 17807 [illegible] |
| SHIRT GYM | 2789 | 3250 | 3041 | 2167 | 2501 | 2027 | 1825 | 1730 | 2193 | 2923 | 3102 | 3263 3211 |
| COVERALL/OVERALLS | 42 | 37 | 175 | 171 | 163 | 171 | 219 | 84 | 346 | 100 | 142 | 84 179 |
| PAD MATTRESS | 394 | 543 | 340 | 370 | 335 | 467 | 368 | 364 | | 376 | 456 | 827 8281 |
| SPREAD BED | 124 | 100 | 171 | 88 | 123 | 115 | 153 | 95 | 213 | 152 | 242 | 211 177 |
| SHIRT TEE. SHIRT. JERSEY | 7678 | 7006 | 7019 | 4233 | 6682 | 5427 | 3991 | 3940 | 5180 | 5532 | 11178 | 7362 [illegible] |
| BAG LAUNDRY, DUFFEL | 3666 | 3799 | 3423 | 2531 | 2985 | 2425 | 2701 | 2022 | 1824 | 3227 | 6664 | [illegible] |
| CAP BDU | 333 | | | 500 | 321 | 150 | 301 | 14 | 554 | 265 | | 212 [illegible] |
| COVER AMMO | 511 | 184 | [illegible] | | 50 | 98 | 126 | 22 | | 200 | | 310 1299 |
| COVER MATTRESS | 4305 | 4001 | [illegible] | [illegible] | 3365 | 3699 | 3833 | 4361 | 3515 | [illegible] | [illegible] | 4692 4926 |
| COVER CANTEEN | 466 | 465 | 170 | | 84 | 135 | 256 | 88 | 49 | 240 | 1230 | 1262 [illegible] |
| COVER HELMET | 83 | | 98 | 60 | | 77 | | 138 | | 165 | 1717 | 2338 |
| DRAWERS, COTTON, WOOL | 461 | | 1008 | 532 | 1239 | 623 | 464 | 117 | 758 | 636 | 4718 | 935 [illegible] |
| GLOVE, CHEM. T FINGER | | | 22 | 17 | 74 | 25 | 19 | 8 | | 5 | 29 | 11 293 |
| JACKET FIELD. NBC | 160 | 514 | 493 | 396 | 381 | 425 | 448 | 637 | 334 | 377 | 437 | 1116 6768 |
| LINER FIELD JACKET | 506 | 966 | 454 | 1511 | 2587 | 1996 | 1376 | 32 | 365 | 87 | 156 | 222 10258 |
| LINER PARKA | | | | | | | | | | | | |
| MOP HEAD | 11 | 6 | 7 | 8 | 9 | 5 | 7 | 6 | 14 | 8 | 10 | 15 136 |
| NECK BAND HELMET | 2300 | 1900 | 1350 | 1450 | 1444 | 1150 | 850 | 700 | 20 | | | 126 [illegible] |
| PACK FIELD ALL | 645 | 52 | 334 | 195 | 117 | 291 | 81 | 57 | 127 | 235 | 319 | 24 13 |
| PILLOWS | 5076 | 3889 | 3817 | 3257 | 3215 | 3162 | 3091 | 4599 | 4068 | 3786 | 6455 | 4772 [illegible] |
| RUG SQ. FT. | | | | | | | | | | | | |
| RAGS LB. | 4553 | 2391 | 2881 | 3089 | 3041 | 2961 | 2622 | 2426 | 3010 | 2371 | 1668 | 3344 3457 |
| SHELTER HALVE | 4415 | 3902 | 3347 | 2020 | 2506 | 2894 | 2202 | 2009 | 1943 | 3474 | 6383 | 3069 3824 |
| SHOE TENNIS | | | 48 | | 30 | 48 | 46 | | | | | 37 209 |
| SOCKS | 479 | 522 | 550 | 342 | 796 | 52 | 244 | 223 | 1305 | 403 | 1205 | 734 6855 |
| TROUSER FIELD, NBC | 959 | 258 | 203 | 758 | 2159 | 959 | 852 | 788 | 696 | 237 | 1154 | 876 10515 |
| UNDERSHIRT, WOOL | 117 | | 406 | 25 | 118 | | 552 | 123 | 213 | 266 | | 95 2575 |
| WEBBING HELMET/PACK | 5445 | 4052 | 3313 | 3313 | 3037 | 3417 | 2450 | 1994 | 460 | 583 | 1356 | 350 [illegible] |
| MISC. SMALL | 1843 | 2887 | 2028 | 2022 | 1809 | 1523 | 2208 | 2433 | 2783 | 2948 | 4016 | 2657 [illegible] |
| MED | 6 | 8 | 9 | | 1 | 3 | 6 | 8 | 447 | 10 | 249 | 36 498 |
| LARGE | | | | | | | | | | | 262 | 842 |
| SHIRT UTILITY/BDU | 378 | 210 | 411 | 575 | 324 | 408 | 651 | 353 | 2058 | 439 | 722 | 1171 8097 |
| TROUSER UTILITY/BDU | 316 | 256 | 529 | 464 | 456 | 539 | 640 | 715 | 1580 | 160 | 1006 | 5437 7204 |
| LOT III 3. LAUNDRY ORGANIZATIONAL 48 HR | | | | | | | | | | | | |
| COAT FOOD H/MED. | 438 | 395 | 361 | 331 | 388 | 457 | 355 | 359 | 355 | 622 | 340 | 494 4835 |
| TROUSER FOOD H./MED | 425 | 380 | 362 | 301 | 296 | 422 | 324 | 315 | 353 | 434 | 312 | 280 4204 |
| DRESS FOOD H/MED | 56 | 44 | 49 | 42 | 46 | 48 | 44 | 34 | 67 | 71 | 49 | 22 572 |
| APRON | 12 | 9 | 14 | 27 | 21 | 8 | 14 | 21 | 13 | 20 | 31 | 18 208 |
| LOT #4 IPR 72 HOUR | | | | 16 | | | | | | | | |
| BLOUSE | 9 | 6 | 28 | | 8 | 7 | 77 | 61 | 45 | [illegible] | 55 | 40 406 |
| CURTAINS/DRAPES | 15 | 14 | | | | | | | | | | 59 |
| JACKET FIELD | [illegible] | [illegible] | [illegible] | | | | [illegible] | [illegible] | | | | [illegible] |

A - B

| | OCT. 87 | NOV. 87 | DEC. 87 | JAN 88 | FE. | MAR. 88 | APR. 88 | MAY 88 | JUN. 88 | JUL. 88 | A[illegible] 88 | SEP. 88 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SHIRT EXCEPT BDU | 192 | 141 | 118 | 101 | 77 | 103 | 127 | 120 | 152 | 116 | 128 | 119 1568 |
| SHIRT BDU | 364 | 325 | 329 | 325 | 339 | 424 | 369 | 413 | 484 | 437 | 399 | 315 4525 |
| SKIRT MIL/CIV. | 37 | 7 | 22 | 10 | 6 | 15 | 31 | 19 | 22 | 22 | 12 | 2 205 |
| TROUSER EXCEPT BDU | 285 | 196 | 163 | 105 | 116 | 128 | 222 | 223 | 214 | 230 | 171 | 223 2273 |
| TROUSER BDU | 388 | 338 | 338 | 320 | 321 | 441 | 368 | 392 | 458 | 443 | 400 | 393 4537 |
| MISC. SMALL | 14 | 23 | 8 | 8 | | 7 | 4 | 7 | 11 | 22 | 10 | 22 136 |
| MED. | 112 | 6 | 24 | 1 | 10 | 9 | 4 | 23 | 18 | 14 | 8 | 11 240 |
| LARGE | 3 | 7 | 6 | | 5 | 3 | 4 | 4 | 5 | 13 | 7 | 30 87 |
| COVERALL | 2 | 4 | | 3 | | | | 1 | | 1 | | 11 |
| HANKERCHIEF | 6 | 4 | 4 | 3 | 5 | 9 | 4 | 5 | 7 | 6 | 3 | 2 59 |
| NAPKIN | | | 7 | | | | | | 1 | | | 8 |
| PILLOW CASE | 1 | | | | 2 | | 7 | 4 | 2 | | 1 | 17 |
| SHEET CONTURE | | | | | | | | | | | | 0 |
| SHEET RESURAL | | | 1 | | 2 | 2 | 5 | 4 | 4 | | 2 | 12 32 |
| TABLECLOTH | | | 2 | | | 1 | 4 | | 8 | | 3 | 18 |
| BAG LAUNDRY | 11 | 5 | 5 | 20 | 5 | 36 | 6 | 4 | 7 | 23 | 10 | 132 |
| BAG SLEEPING | | | | | | | | | | | | 0 |
| CAP | | | | | | | | | | | | 0 |
| CLOTH WASH | 6 | 3 | 1 | [illegible] | | 8 | 4 | 2 | 5 | 3 | 4 | 9 47 |
| DRAWERS | 182 | 3 | 28 | [illegible] | 29 | 58 | 6 | 15 | 28 | 70 | 23 | 19 506 |
| PAD BED | | | | | | | | | | | | 0 |
| QUILT | | | | | | | | | | | | 0 |
| RUG. SQ. FT. | | | | | | | | | | | | 0 |
| SHIRT TEE | 55 | 27 | 45 | 38 | 32 | 47 | 24 | 25 | 45 | 87 | 45 | 23 493 |
| SHORTS ATHLETIC | 2 | 2 | | | | 1 | 5 | 3 | 17 | 22 | 6 | 57 |
| SOCKS | 65 | 14 | 52 | 53 | 19 | 66 | 6 | 13 | 26 | 81 | 32 | 27 454 |
| SPREAD BED | | | 1 | | 1 | | 1 | 1 | 3 | | 1 | 8 |
| TOWEL BATH | 43 | 16 | 17 | 13 | 22 | 44 | 11 | 18 | 12 | 19 | 11 | 12 258 |
| TOWEL BEACH | | | | | | | | | | | | 0 |
| MISC. SMALL | | | | | | | | | | | | 0 |
| MED. | | | | | | | | | | | | 0 |
| LARGE | | | | | | | | | | | | 0 |
| LOT #5 24 HR IPB | | | | | | | | | | | | |
| BLOUSE | 6 | 1 | 5 | 3 | 2 | 9 | 14 | 6 | 22 | 10 | 6 | 5 80 |
| COAT/JACKET ALL | 8 | 18 | 9 | 14 | 15 | 20 | 4 | 12 | 1 | 5 | 7 | 3 120 |
| SHIRT EXCEPT BDU | 30 | 8 | 47 | 48 | 17 | 64 | 74 | 63 | 83 | 31 | 53 | 48 536 |
| SHIRT BDU | 123 | 117 | 107 | 115 | 138 | 178 | 144 | 418 | 539 | 290 | 437 | 18 3229 |
| SKIRT | 2 | | 3 | 2 | 3 | 3 | 4 | 9 | 6 | 3 | 16 | 3 44 |
| TROUSER EXCEPT BDU | 142 | 82 | 123 | 59 | 79 | 94 | 110 | 92 | 86 | 59 | 78 | 121 1125 |
| TROUSER BDU | 126 | 127 | 111 | 126 | 124 | 191 | 147 | 403 | 528 | 296 | 492 | 164 2835 |
| MISC. SMALL | 6 | | 1 | | | 2 | 5 | | 22 | 40 | 1 | 1 77 |
| MED | 3 | 6 | 1 | 2 | 3 | 1 | 4 | | 2 | 3 | 2 | 12 39 |
| LARGE | 6 | 4 | 2 | | 1 | 1 | 2 | | 1 | 3 | | 3 23 |
| CLOTH WASH | 1 | | | | | | | | 9 | 14 | 18 | 42 |
| DRAWERS | 1 | | | | | 3 | | | 38 | 89 | 23 | 219 |

| | OCT. 87 | NOV. 87 | DEC 87 | JAN 88 | FEB. 88 | MAR. 88 | APR 88 | MAY 88 | JUN 88 | JUL 88 | AUG 88 | SEPT. 88 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AUG. SQ FT. | | | | | | | | | 52 | 1 | | | 53 |
| SHIRT TEE | | | | | | | | | 43 | 93 | 38 | | 216 |
| SOCKS | | | | | | 12 | | | 40 | 111 | 74 | | 237 |
| TOWEL BATH | | | | | | | | | 9 | 32 | 23 | | 64 |
| LAUNDRY BAG | 2 | | | | | | | | 7 | | | | 9 |
| MISC. SMALL | | | | | | | | | 5 | 32 | | | 37 |
| MED | | | | | | | | | | | | | 0 |
| LARGE | | | | | | | | | | | | | 0 |
| HANKERCHIEF | 1 | | | | | 1 | | | 6 | 12 | 14 | | 39 |
| PILLOWCASE | | | | | | | | | 2 | | | | 2 |
| SHEET | 10 | | | | | | | | 4 | 4 | | | 18 |
| **LOT #6 PAYROLL DEDUCTION** | | | | | | | | | | | | | |
| 1 BUNDLE PER. WEEK | 4730 | 4602 | 2481 | 2205 | 21923 | 13461 | 1750 | 741 | 3168 | 4953 | 3312 | 2328 | [illegible] |
| 2 BUNDLE PER WEEK | 49646 | 45127 | 29472 | 27683 | 28736 | 13841 | 615[illegible] | 7768 | 35665 | 58925 | 44640 | 24763 | [illegible] |
| | 1136 | 1173 | 1103 | 1133 | 1032 | 1530 | 1430 | 1293 | 1490 | 13676 | 1402 | 1344 | 687 |
| PERMANENT PARTY | 10724 | 10669 | 10288 | 10744 | 11845 | 14825 | 13414 | 1388 | 14278 | 14572 | 13372 | 12747 | 360 |
| **LOT #8 ORGANIZATIONAL DRYCLEANING** | | | | | | | | | | | | | |
| ALB | 3 | | | 3 | 5 | | 2 | | | | | | 13 |
| AMICE | | | | | | | | | | | | | 0 |
| COAT SHORT | 68 | 63 | 43 | 227 | 179 | 236 | 66 | 69 | 225 | 32 | 39 | 136 | 3376 |
| COAT LONG LINED | | 37 | 5 | 166 | 2 | 96 | 41 | | 5 | 1 | 397 | | 691 |
| CORPORAL | | | | | | | | | | | | | 0 |
| CURTAIN/DRAPES | 152 | 316 | 45 | | 259 | 362 | 284 | 51 | 49 | 501 | 448 | 23 | 2090 |
| HOOD WINTER LINED | | 87 | | 564 | 139 | | | | | | | | 790 |
| JACKET ALL | | | | | | | | | | 11 | 2 | | 13 |
| ALTAR CLOTH ALL | 8 | | | 4 | 2 | | 5 | 1 | | | | | 20 |
| PARKA | 19 | 40 | | | | 43 | | | 5 | 27 | 4 | | 138 |
| PURIFICATOR | 3 | | | | | | 13 | | | | | | 16 |
| SHIRT | 112 | 89 | 115 | 114 | 289 | 404 | 19 | 166 | 15 | 9 | 260 | 130 | [illegible]321 |
| SCRAF ALL | 15 | 33 | 46 | 118 | | | | 16 | | 10 | | | 238 |
| TOWEL FINGER | 2 | | | | 6 | 4 | 5 | 5 | | | | | 22 |
| TROUSER ALL | 217 | 93 | 200 | 272 | 257 | 235 | 86 | 303 | 365 | 35 | 403 | 136 | 2719 |
| TABLECLOTH ALL | 19 | 32 | 14 | 26 | 30 | 13 | 52 | 14 | 29 | 22 | 88 | 30 | 369 |
| ROBE/GOWN ALL | 40 | | | | | 6 | 5 | 7 | | | 42 | 9 | 109 |
| MISC. SMALL | 153 | 679 | 413 | 230 | 42 | 550 | 4 | 152 | 359 | 18 | 6 | 3 | 2609 |
| MED. | 8 | 25 | 94 | | 18 | 3 | 64 | 4 | 5 | 11 | 37 | 24 | 293 |
| LARGE | | | 33 | 121 | | | | 4 | | 13 | 19 | 2 | 192 |
| GLOVES/MITTEN | 14 | 20 | | 15 | 18 | 299 | 27 | | 6 | 79 | | 23 | 501 |
| HAT DI HAND PROCESS | | | | | | | | | | | | | 0 |
| TAPESTRY/FLAG | 6 | 6 | 4 | 12 | 7 | 26 | 70 | 3 | 14 | 233 | 9 | | 421 |
| MISC. SMALL | | 31 | | | | | | | | 4 | | | 35 |
| MED. | | | | | | | | | | 1 | | | 1 |
| LARGE | | | | | | | | | | | | | 6 |
| CAP PILE | | 16 | 4 | 38 | 210 | 625 | 239 | 253 | 95 | 2 | | | 1488 |
| CAP GARRISON | | | 123 | | | | 165 | | | 133 | 39 | | 620 |
| COVERALL/OVERALL | 227 | 176 | 141 | 53 | 39 | 36 | 23 | 22 | 23 | 10 | 27 | 12 | 789 |
| SCRAF WOOL | | 22 | | | | | | | | 10 | | | 81 |
| DRESS | | | | | | | | | | | | | 180 |

| | OCT. 87 | NOV 87 | DEC 87 | JAN. 88 | FEB | MAR. 88 | APR 88 | MAY 88 | JUN 88 | JUL 88 | AUG | SEP. 88 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **LOT # 8** | | | | | | | | | | | | | |
| SHIRT WOOL | 8 | 114 | | 283 | 269 | 600 | | 122 | - | 7 | | | 1403 |
| TROUSER WOOL | 69 | 45 | 47 | 74 | 38 | 117 | | | | | | | 394 |
| **LOT #9 ORGANIZATIONAL DRY CLEANING 48 HR.** | | | | | | | | | | | | | |
| COAT AG. PHASE II | 2740 | 2178 | 3148 | 197 | 1204 | 1368 | 818 | 937 | 1516 | 3193 | 3918 | 2053 | 25491 |
| TROUSER AG. PHASE II | 3386 | 3287 | 3729 | 1239 | 1939 | 1893 | 1232 | 1351 | 2168 | 2196 | 5499 | 3195 | 3294 |
| SHIRT | 2711 | 2103 | 2784 | 191 | 1194 | 1303 | 787 | 1899 | 1509 | 3193 | 3933 | 2031 | 22638 |
| **LOT #10 IPR DRYCLEANING 72 HR.** | | | | | | | | | | | | | |
| BLOUSE | 44 | 59 | 62 | 49 | 43 | 56 | 68 | 92 | 71 | 91 | 87 | 82 | 804 |
| COAT FUR TRIMMED | 2 | | | | | | | | | 21 | 1 | 1 | 25 |
| COAT SPORT/UNIFORM | 94 | 78 | 83 | 202 | 47 | 83 | 85 | 85 | 68 | 45 | 56 | 98 | 1016 |
| COAT LONG LINED MIL/CIV | 2 | 6 | 1 | 3 | 39 | 2 | 40 | 1 | 20 | - | 4 | 12 | 121 |
| COAT LONG LINED MIL/LINER | 42 | 40 | 41 | 37 | 46 | 48 | | 38 | | 4 | 3 | 17 | 315 |
| CURTAIN/DRAPES | 82 | 37 | 20 | 24 | | 78 | 43 | 75 | 231 | 14 | 6 | 4 | 68 |
| DRESS EXCEPT EVENING | 39 | 26 | 36 | 29 | 40 | 48 | 57 | 42 | 60 | 42 | 47 | 73 | 547 |
| DRESS EVENING | 4 | 1 | | | 1 | | | | | | 2 | 13 | 21 |
| RUG SQ. FT. | 65 | 53 | 49 | | 60 | | | 87 | 37 | 4 | 1 | 3 | 81 |
| SKIRT W/O PLEATS | 33 | 54 | 56 | 52 | 58 | 72 | 89 | 55 | 66 | 57 | 32 | 58 | 792 |
| SKIRT W/ PLEATS | 1 | 4 | 4 | 5 | | 1 | | | 3 | 12 | 3 | 5 | 38 |
| SHIRT ALL MIL/CIV | 58 | 62 | 63 | 373 | 57 | 54 | 73 | 80 | 85 | 46 | 58 | 110 | 1119 |
| SHIRT W/MILITARY CREASES | 3 | 2 | 1 | 8 | 2 | 6 | 4 | 2 | | 0 | 4 | 9 | 32 |
| SUIT CIV. 2 or 3 PC | 65 | 75 | 79 | 65 | 40 | 57 | 79 | 88 | 52 | 31 | 70 | 75 | 746 |
| SWEATER | 75 | 92 | 106 | 108 | 109 | 70 | 73 | 72 | 39 | 19 | 14 | 51 | 828 |
| TABLECLOTH H-PROCESS | 1 | | | | 1 | | | | | 1 | | | 3 |
| NECKTIE | 13 | 14 | 14 | 13 | 7 | 4 | 15 | 14 | 16 | | 3 | | 126 |
| TROUSER ALL | 26 | 285 | 225 | 583 | 266 | 252 | 297 | 328 | 314 | 302 | 248 | 300 | 3410 |
| UNIFORM MILITARY | 10 | 11 | 10 | 11 | 11 | 9 | 11 | 13 | 8 | 4 | 6 | 10 | 114 |
| MISC. SMALL | 16 | 9 | 9 | 162 | 7 | 10 | 11 | 29 | 20 | 18 | 20 | 39 | 350 |
| MED | 7 | 10 | 7 | 4 | 3 | 11 | 6 | 13 | 3 | 4 | 12 | 1 | 81 |
| LARGE | 5 | 4 | | 6 | 2 | 5 | 11 | 11 | 7 | 8 | 24 | 13 | 96 |
| **LOT #11 IPR DRY CLEANING (SAME DAY)** | | | | | | | | | | | | | |
| BLOUSE | 11 | 10 | 4 | 8 | 3 | 9 | 10 | 8 | 9 | 15 | 5 | 39 | 131 |
| COAT FUR TRIMMED | | | | | | 1 | | | | 4 | | 1 | 6 |
| COAT SPORT/UNIFORM | 35 | 45 | 61 | 36 | 19 | 34 | 29 | 33 | 28 | 12 | 13 | 55 | 400 |
| COAT LONG W/[illegible] | 1 | 10 | 2 | 3 | 1 | 2 | 10 | 2 | 6 | 2 | 1 | 4 | 44 |
| COAT LONG W/[illegible] | 6 | 17 | 30 | 30 | 29 | 16 | | 4 | | | 2 | 7 | 14 |
| SHIRT W/MIL CREASES | | | | | 1 | | | | | 12 | 3 | | 16 |
| CURTAINS SQ. YDS. | | | 6 | | | 22 | 29 | | | 10 | 1 | | 68 |
| DRESS EXCEPT EVENING | 11 | 3 | 10 | 8 | 12 | 12 | 14 | 14 | 15 | 14 | 16 | 27 | 150 |
| RUG SQ. FT. | | | | | | | | | | 5 | | | 5 |
| SKIRT W/O PLEATS | 19 | 13 | 25 | 16 | 8 | 29 | 10 | 10 | 11 | 16 | 13 | 29 | 199 |
| SHIRT ALL MIL/CIV | 69 | 36 | 55 | 44 | 56 | 62 | 52 | 51 | 152 | 55 | 75 | 73 | 780 |
| SUIT CIV. 2 or 3 PIECE | 21 | 18 | 30 | 24 | 15 | 13 | 18 | 20 | 29 | 19 | 5 | 28 | 240 |
| TROUSER ALL | 113 | 147 | 152 | | 95 | 178 | 197 | 46 | 234 | 31 | 139 | 215 | 1624 |
| UNIFORM MILITARY | 18 | 23 | 14 | 7 | 12 | 14 | 7 | 17 | 8 | 3 | 6 | 2 | 133 |
| SWEATER | 19 | 28 | 49 | 39 | 37 | 21 | 16 | 13 | | 4 | 2 | 11 | 238 |

| | OCT 87 | NOV 87 | DEC 87 | JAN 88 | FEB | MAR 88 | APR 88 | MAY 88 | JUN 88 | JUL 88 | AU[illegible] | SEPT. 88 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MISC SMALL | 4 | 6 | 4 | 1 | 3 | 4 | 2 | 3 | 28 | 7 | 32 | 22 | 16 |
| MED | 2 | | | 3 | | 1 | 5 | 1 | 4 | 1 | 3 | 3 | 23 |
| LARGE | 2 | 4 | 3 | | 1 | 1 | 2 | | | 3 | 1 | 4 | 21 |
| NECKTIE | 1 | 4 | 4 | 5 | 14 | 6 | 4 | 4 | 11 | | 8 | | 61 |
| LOT # 12 HOSPITAL DRY CLEANING | | | | | | | | | | | | | |
| COVER ALL | | 1 | 1 | | 3 | | | 1 | 1 | | | | 7 |
| COAT DR. | | | | | 7 | | 121 | | | | | | 128 |
| PAD FOAM RUBBER | | | | | | | | | | | | | 0 |
| TROUSER | | | | 3 | | | 154 | | | | | | 157 |
| SMOCK-PANTSUIT TOP DRAPES | 392 | 229 | 120 | 325 | 315 | 1423 | 354 | 346 | 123 | | 203 | 305 | 3135 |
| MISC. SMALL | | | 103 | | | 2 | 100 | | | | | | 205 |
| MED | | 2 | | | | | 2 | | | | 10 | | 14 |
| LARGE | | | 8 | | | | | | | | | | 8 |
| CURTAINS/DRAPES | 46 | 264 | 892 | 143 | | 4 | | 24 | 36 | | | 720 | 2229 |

# APPENDIX "B"

# ANALYSIS OF PRODUCTION RECORDS

LAUNDRY PRODUCTION DATA

| LOT # | ITEM DESCRIPTION | UNIT WEIGHT LBS | FY 87 # OF ITEMS LAUNDERED | FY 87 TOT LBS | FY 88 # OF ITEMS LAUNDERED | FY 88 TOT LBS |
|---|---|---|---|---|---|---|
| LOT #1 - HOSPITAL LAUNDRY | | | | | | |
| | MISC-SMALL | .18 | 728 | 131.04 | 793 | 142.74 |
| | MISC-MED | 1.25 | 222 | 277.50 | 474 | 592.5 |
| | MISC-LARGE | 2.50 | 1 | 2.50 | 16 | 40 |
| | PILLOW CASES | .30 | 64223 | 19266.90 | 56045 | 16813.5 |
| | SHEET COTTON | 1.25 | 102951 | 128688.75 | 94295 | 117868.75 |
| | TABLE CLOTH | .94 | 19572 | 18397.68 | 17007 | 15986.58 |
| | TOWEL HAND | .18 | 104337 | 18780.66 | 96407 | 17353.26 |
| | LAUNDRY LARGE BAG | 1.50 | 8543 | 12814.50 | 9271 | 13906.5 |
| | BABY ITEMS- PER LB | 1.00 | 7275 | 7275.00 | 7025 | 7025 |
| | BATHROBE | 1.50 | 22953 | 34429.50 | 19273 | 28909.5 |
| | BLANKET COTTEN | 4.00 | 28437 | 113748.00 | 27358 | 109432 |
| | BLANKET WOOL | 4.70 | 34 | 159.80 | 5362 | 25201.4 |
| | CLOTH WASH | .04 | 66697 | 2667.88 | 62801 | 2512.04 |
| | COAT CONVALESCENT | .35 | 445 | 155.75 | 393 | 137.55 |
| | COAT OPERATING/SCRUB | .35 | 27266 | 9543.10 | 27106 | 9487.1 |
| | GOWN OPERATING/XRAY | .35 | 41898 | 14664.30 | 39147 | 13701.45 |
| | GYM SHORTS | .25 | 2839 | 709.75 | 2156 | 539 |
| | PAJAMA COAT | .35 | 35446 | 12406.10 | 32987 | 11545.45 |
| | PAJAMA TROUSERS | .50 | 34804 | 17402.00 | 32628 | 16314 |
| | PAD FLOOR 3 X 5 | 1.35 | 1493 | 2015.55 | 1171 | 1580.85 |
| | PANTS CONVALESCENT/SCRUB | .50 | 26506 | 13253.00 | 22681 | 11340.5 |
| | TOWEL BATH | .57 | 118712 | 67665.84 | 122515 | 69833.55 |
| | WRAPPER | .60 | 68422 | 41053.20 | 56800 | 34080 |
| | COVER HAMPER | 2.00 | 3858 | 7716.00 | 5014 | 10028 |
| | PILLOW | .80 | 631 | 504.80 | 452 | 361.6 |
| | SHEEPSKIN | .80 | 22 | 17.60 | 71 | 56.8 |
| | COAT DR/ORTHO/FOOD H | .50 | 201 | 100.50 | 35 | 17.5 |
| | SMOCK | .60 | 614 | 368.40 | 563 | 337.8 |
| | DRESS HOSP | .90 | 1557 | 1401.30 | 731 | 657.9 |
| | SALVAGE HOSP DYED | 1.00 | 353 | 353.00 | 891 | 891 |
| | DYE NEW ITEMS | 1.00 | 3717 | 3717.00 | 2478 | 2478 |
| | SHEETS FITTED | 1.25 | 35852 | 44815.00 | 125241 | 156551.25 |
| | | | --------- | --------- | --------- | --------- |
| | | | 830619 | 594501.9 | 865186 | 6957[illegible].77 |

LAUNDRY PRODUCTION DATA

| LOT # | ITEM DESCRIPTION | UNIT WEIGHT LBS | FY 87 # OF ITEMS LAUNDERED | FY 87 TOT LBS | FY 88 # OF ITEMS LAUNDERED | FY 88 TOT LBS |
|---|---|---|---|---|---|---|
| LOT #2 - ORGANIZATIONAL 72 HR | | | | | | |
| | APRON FOOD H | .25 | 672 | 168.00 | 210 | 52.5 |
| | CLOTH WASH | .04 | 109281 | 4371.24 | 97293 | 3891.72 |
| | NAPKIN | .17 | 47369 | 8052.73 | 42694 | 7257.98 |
| | PILLOW CASE | .30 | 425955 | 127786.50 | 362843 | 108852.9 |
| | SALVAGE DYE SHOP TOWEL | .18 | 3553 | 639.54 | 11196 | 2015.28 |
| | SHEET COTTON | 1.25 | 825499 | 1031872.50 | 713517 | 891896.25 |
| | TABLE COTH | .94 | 31665 | 29765.10 | 33414 | 31409.16 |
| | UNIFORM FROCK FOOD H | .90 | 16 | 14.40 | 123 | 110.7 |
| | SMOCK | .80 | 3184 | 2547.20 | 2048 | 1638.4 |
| | MISC SMALL | .18 | 822 | 147.96 | 4890 | 880.2 |
| | SLEEPING BAG | 1.25 | 56976 | 71220.00 | 48489 | 60611.25 |
| | BLANKET | 2.50 | 130711 | 326777.50 | 114848 | 287120 |
| | TROUSERS SWEAT | 1.20 | 38099 | 45718.80 | 33308 | 39969.6 |
| | TOWEL BATH | .57 | 137576 | 78418.32 | 141805 | 80828.85 |
| | SHORTS GYM | .25 | 44706 | 11176.50 | 32811 | 8202.75 |
| | COVERALLS/OVERALLS | 4.00 | 2028 | 8112.00 | 1734 | 6936 |
| | PAD MATRESS | 2.80 | 5722 | 16021.60 | 12281 | 34386.8 |
| | SPREAD BED | 4.70 | 1892 | 8892.40 | 1717 | 8069.9 |
| | SHIRT TEE- SWEAT | .25 | 78849 | 19712.25 | 74248 | 18562 |
| | BAG LAUNDRY-DUFFEL | .75 | 40842 | 30631.50 | 39621 | 29715.75 |
| | CAP BDU | .12 | 965 | 115.80 | 2654 | 318.48 |
| | COVER AMMO | .15 | 1304 | 195.60 | 1279 | 191.85 |
| | COVER MATTRESS | .62 | 57358 | 35561.96 | 49226 | 30520.12 |
| | COVER CANTEEN | .15 | 3506 | 525.90 | 5154 | 773.1 |
| | COVER HELMET | .11 | 625 | 68.75 | 2338 | 257.18 |
| | DRAWERS COTTON/WOOL | .18 | 704 | 126.72 | 7391 | 1330.38 |
| | GLOVE/CHEMICAL/TFINGER | .09 | 6989 | 629.01 | 213 | 19.17 |
| | JACKET FIELD NBC | 3.00 | 10863 | 32589.00 | 6268 | 18804 |
| | LINER FIELD JACKET | .40 | 6719 | 2687.60 | 10258 | 4103.2 |
| | LINER PARKA | .65 | 0 | .00 | 0 | 0 |
| | MOP | 1.50 | 258 | 387.00 | 106 | 159 |
| | NECK BAND HELMET | .07 | 23040 | 1612.80 | 11490 | 804.3 |
| | PACK FIELD ALL | .65 | 2097 | 1363.05 | 2413 | 1568.45 |
| | PILLOWS | .80 | 53099 | 42479.20 | 48887 | 39109.6 |
| | RUG SQ FT | 1.35 | 0 | .00 | 0 | 0 |
| | RAGS | .18 | 46320 | 8337.60 | 34357 | 6184.26 |
| | SHELTER HALFS | 3.75 | 47098 | 176617.50 | 38264 | 143490 |
| | SHOE-TENNIS | .65 | 832 | 540.80 | 209 | 135.85 |
| | SOCKS | .15 | 1379 | 206.85 | 6855 | 1028.25 |
| | TROUSER/FIELD/NBC | 2.20 | 16399 | 36077.80 | 10515 | 23133 |
| | UNDER SHIRT WOOL | 1.20 | 1315 | 1578.00 | 2515 | 3018 |
| | WEBBING HELMET/PAD | .19 | 49491 | 9403.29 | 29770 | 5656.3 |
| | MISC-SMALL | .18 | 15637 | 2814.66 | 29158 | 5248.44 |
| | MISC-MED | 1.25 | 1380 | 1725.00 | 498 | 622.5 |
| | MISC-LARGE | 2.50 | 44 | 110.00 | 242 | 605 |
| | SHIRT UTILITY/BDU | 2.15 | 5738 | 12336.70 | 8097 | 17408.55 |
| | TROUSERS UTILITY/BDU | 3.20 | 7207 | 23062.40 | 7204 | 23052.8 |
| | | | 2345783 | 2213199.03 | 2084494 | 1949956.57 |

LAUNDRY PRODUCTION DATA

| LOT # | ITEM DESCRIPTION | UNIT WEIGHT LBS | FY 87 # OF ITEMS LAUNDERED | FY 87 TOT LBS | FY 88 # OF ITEMS LAUNDERED | FY 88 TOT LBS |
|---|---|---|---|---|---|---|
| LOT #3 - LAUNDRY ORIGANIZATIONAL 48 HR | | | | | | |
| | COAT FOOD H/MED | .50 | 5040 | 2520.00 | 4835 | 2417.5 |
| | TROUSERS FOODH/MED | 1.20 | 4672 | 5606.40 | 4204 | 5044.8 |
| | DRESS FOODH/MED | .91 | 691 | 628.81 | 578 | 525.98 |
| | APRON | .25 | 114 | 28.50 | 205 | 5[illegible] |
| | | | 10517 | 8783.71 | 9815 | 8034.88 |
| LOT #4 - IPR 72 HOUR | | | | | | |
| | BLOUSE | .47 | 101 | 47.47 | 400 | 188 |
| | CURTAINS/DRAPES | 2.50 | 73 | 182.50 | 59 | 147.5 |
| | JACKET, FIELD | 3.00 | 203 | 609.00 | 275 | 825 |
| | SHIRT EXCEPT BDU | .47 | 1466 | 689.02 | 1568 | 736.96 |
| | SHIRT BDU | 2.15 | 4159 | 8941.85 | 4525 | 9728.75 |
| | SKIRT MIL/CIV | .75 | 29 | 21.75 | 205 | 153.75 |
| | TROUSER EXCEPT BDU | 1.20 | 1773 | 2127.60 | 2273 | 2727.6 |
| | TROUSER BDU | 3.20 | 3873 | 12393.60 | 4597 | 14710.4 |
| | MISC-SMALL | .18 | 128 | 23.04 | 136 | 24.48 |
| | MISC-MED | 1.25 | 86 | 107.50 | 240 | 300 |
| | MISC-LARGE | 2.50 | 110 | 275.00 | 87 | 217.5 |
| | COVERALL | 4.00 | 14 | 56.00 | 11 | 44 |
| | HANKERCHIEF | .17 | 71 | 12.07 | 59 | 10.03 |
| | NAPKIN | .17 | 0 | .00 | 8 | 1.36 |
| | PILLOWCASE | .30 | 44 | 13.20 | 17 | 5.1 |
| | SHEET | 1.25 | 0 | .00 | 0 | [illegible] |
| | SHEET REG | 1.25 | 26 | 32.50 | 32 | 40 |
| | TABLE CLOTH | .94 | 22 | 20.68 | 18 | 16.92 |
| | BAG LAUNDRY | .75 | 162 | 121.50 | 132 | 99 |
| | BAG SLEEPING | 1.25 | 0 | .00 | 0 | 0 |
| | CAP | .12 | 0 | .00 | 0 | 0 |
| | WASH CLOTH | .04 | 50 | 2.00 | 47 | 1.88 |
| | DRAWERS | .18 | 439 | 79.02 | 506 | 91.08 |
| | PAD BED | 2.80 | 1 | 2.80 | 0 | [illegible] |
| | QUILT | 4.70 | 0 | .00 | 0 | [illegible] |
| | RUGS | 1.35 | 0 | .00 | 0 | [illegible] |
| | SHIRT TEE | .25 | 595 | 148.75 | 493 | 123.25 |
| | SHORT ATHLETIC | .25 | 22 | 5.50 | 59 | 14.75 |
| | SOCKS | .15 | 482 | 72.30 | 454 | 68.1 |
| | BEDSPREAD | 4.70 | 0 | .00 | 8 | 37.6 |
| | TOWEL BATH | .57 | 319 | 181.83 | 238 | 135.66 |
| | TOWEL BEACH | .70 | 0 | .00 | 0 | 0 |
| | MISC. SMALL | .18 | 0 | .00 | 0 | 0 |
| | MISC. MED. | 1.25 | 0 | .00 | 0 | 0 |
| | MISC. LARGE | 2.50 | 0 | .00 | 0 | 0 |
| | | | 14248 | 28156.48 | 16447 | 30448.57 |

LAUNDRY PRODUCTION DATA

| LOT # | ITEM DESCRIPTION | UNIT WEIGHT LBS | FY 87 # OF ITEMS LAUNDERED | FY 87 TOT LBS | FY 88 # OF ITEMS LAUNDERED | FY 88 TOT LBS |
|---|---|---|---|---|---|---|
| LOT #5 - IPR 24 HOUR | | | | | | |
| | BLOUSE | .47 | 85 | 39.95 | 89 | 41.83 |
| | COAT/JACKET | 1.40 | 97 | 135.80 | 120 | 168 |
| | SHIRT EXCEPT BDU | .47 | 625 | 293.75 | 596 | 280.12 |
| | SHIRT BDU | 2.15 | 2890 | 6213.50 | 2839 | 6103.85 |
| | SKIRT | .75 | 21 | 15.75 | 54 | 40.5 |
| | TROUSER EXCEPT BDU | 1.20 | 1031 | 1237.20 | 1125 | 1350 |
| | TROUSER BDU | 3.20 | 2956 | 9459.20 | 2835 | 9072 |
| | MISC-SMALL | .18 | 65 | 11.70 | 77 | 13.86 |
| | MISC-MED | 1.25 | 45 | 56.25 | 39 | 48.75 |
| | MISC-LARGE | 2.50 | 22 | 55.00 | 23 | 57.5 |
| | CLOTH WASH | .04 | 19 | .76 | 42 | 1.68 |
| | DRAWERS | .18 | 135 | 24.30 | 219 | 39.42 |
| | RUG SQ FT | 1.35 | 120 | 162.00 | 53 | 71.55 |
| | SHIRT TEE | .25 | 205 | 51.25 | 216 | 54 |
| | SOCKS | .15 | 165 | 24.75 | 237 | 35.55 |
| | TOWEL BATH | .57 | 46 | 26.22 | 64 | 36.48 |
| | LAUNDRY BAG | .75 | 0 | .00 | 9 | 6.75 |
| | MISC-SMALL | .18 | 11 | 1.98 | 37 | 6.66 |
| | MISC-MED | 1.25 | 0 | .00 | 0 | 0 |
| | MISC-LARGE | 2.50 | 0 | .00 | 0 | 0 |
| | HANKERCHIEF | .17 | 36 | 6.12 | 39 | 6.63 |
| | PILLOW CASE | .30 | 3 | .90 | 2 | .6 |
| | SHEET | 1.25 | 4 | 5.00 | 18 | 22.5 |
| | | | --------- | --------- | --------- | --------- |
| | | | 8581 | 17831.38 | 8733 | 17459.23 |
| LOT #6 - PAYROLL DEDUCTION | | | | | | |
| | 1 BUNDLE PER WEEK | 12.00 | 87313 | 1047756.00 | 33700 | 404400 |
| | 2 BUNDLES PER WEEK | 12.00 | 20618 | 247416.00 | 15687 | 188244 |
| | PERMENANT PARTY 1B | | | | | 0 |
| | PERMENANT PARTY 2B | | | | | 0 |
| | | | --------- | --------- | --------- | --------- |
| | | | 107931 | 1295172.00 | 49387 | 592644 |

LAUNDRY PRODUCTION DATA

| LOT # | ITEM DESCRIPTION | UNIT WEIGHT LBS | FY 87 # OF ITEMS LAUNDERED | FY 87 TOT LBS | FY 88 # OF ITEMS LAUNDERED | FY 88 TOT LBS |
|---|---|---|---|---|---|---|
| LOT #8 - ORGANIZATIONAL DRY CLEANING | | | | | | |
| | ALB | 1.00 | 12 | 12.00 | 13 | 13 |
| | AMICE | 1.00 | 0 | .00 | 0 | 0 |
| | COAT SHORT | 1.50 | 1212 | 1818.00 | 1376 | 2064 |
| | COAT LONG LINED | 2.60 | 782 | 2033.20 | 691 | 1796.6 |
| | CORPORAL | 1.00 | 2 | 2.00 | 0 | 0 |
| | CURTAINDRAPES | 2.50 | 3613 | 9032.50 | 2790 | 6975 |
| | HOODWINTER - LINED | 1.35 | 598 | 807.30 | 790 | 1066.5 |
| | JACKET ALL | 1.40 | 16 | 22.40 | 13 | 18.2 |
| | ALTAR CLOTH ALL | 3.00 | 67 | 201.00 | 20 | 60 |
| | PARKA | 2.80 | 287 | 803.60 | 138 | 386.4 |
| | PURIFICATOR | 1.00 | 43 | 43.00 | 16 | 16 |
| | SHIRT | .47 | 1263 | 593.61 | 2321 | 1090.87 |
| | SCARF ALL | .19 | 298 | 56.62 | 238 | 45.22 |
| | TOWEL FINGER | .18 | 26 | 4.68 | 22 | 3.96 |
| | TROUSER ALL | 1.20 | 2022 | 2426.40 | 2719 | 3262.8 |
| | TABLECLOTH | .94 | 107 | 100.58 | 369 | 346.86 |
| | ROBE/GOWN ALL | 1.50 | 189 | 283.50 | 109 | 163.5 |
| | MISC-SMALL | .18 | 1410 | 253.80 | 2609 | 469.62 |
| | MISC-MED | 1.25 | 184 | 230.00 | 293 | 366.25 |
| | MISC-LARGE | 2.50 | 0 | .00 | 19[illegible] | 48 |
| | GLOVES/MITTEN | .09 | 237 | 21.33 | 501 | 45.09 |
| | HAT DI | 1.10 | 9 | 9.90 | 0 | 0 |
| | TAPESTRY/FLAG | .94 | 123 | 115.62 | 421 | 395.74 |
| | MISC-SMALL | .18 | 7 | 1.26 | 35 | 6.3 |
| | MISC-MED | 1.25 | 2 | 2.50 | 1 | 1.25 |
| | MISC-LARGE | 2.50 | 0 | .00 | 0 | 0 |
| | CAP PILE | .18 | 415 | 74.70 | 1488 | 267.84 |
| | CAP GARRISON | .12 | 0 | .00 | 620 | 74.4 |
| | COVERALL/OVERALLS | 4.00 | 1998 | 7992.00 | 789 | 3156 |
| | SCARF WOOL | .30 | 223 | 66.90 | 81 | 24.3 |
| | DRESS | .91 | 417 | 379.47 | 180 | 163.8 |
| | SHIRT WOOL | .60 | 563 | 337.80 | 1403 | 641.8 |
| | TROUSER WOOL | 1.60 | 165 | 264.00 | 390 | 624 |
| | | | 16290 | 27985.67 | 20635 | 24225.3 |
| LOT #9 - ORGANIZATIONAL DRY CLEANING 48 HR | | | | | | |
| | COAT AG | 1.80 | 28691 | 51643.80 | 23469 | 42244.2 |
| | TROUSER AG | 2.20 | 39757 | 87465.40 | 32984 | 72564.8 |
| | SHIRT | .47 | 27277 | 12820.19 | 22638 | 10639.86 |
| | | | 95725 | 151929.39 | 79091 | 125448.86 |

LAUNDRY PRODUCTION DATA

| LOT # | ITEM DESCRIPTION | UNIT WEIGHT LBS | FY 87 # OF ITEMS LAUNDERED | FY 87 TOT LBS | FY 88 # OF ITEMS LAUNDERED | FY 88 TOT LBS |
|---|---|---|---|---|---|---|
| LOT #10 - IPR DRY CLEANING 72 HR | | | | | | |
| | BLOUSE | .47 | 484 | 227.48 | 804 | 377.88 |
| | COAT FUR TRIMMED | 3.00 | 5 | 15.00 | 25 | 75 |
| | COAT SPORTS | 1.40 | 787 | 1101.80 | 1016 | 1422.4 |
| | COAT LONG LINED | 2.60 | 99 | 257.40 | 121 | 314.6 |
| | COAT LONG WO LINER | 2.10 | 268 | 562.80 | 315 | 661.5 |
| | CURTAIN | 1.10 | 553 | 608.30 | 618 | 679.8 |
| | DRESS | .91 | 366 | 333.06 | 547 | 497.77 |
| | DRESS EVENING | 2.80 | 17 | 47.60 | 21 | 58.8 |
| | RUG | 1.35 | 782 | 1055.70 | 361 | 487.35 |
| | SKIRT W/O PLEATS | .90 | 532 | 478.80 | 702 | 631.8 |
| | SKIRT W/PLEATS | 1.15 | 7 | 8.05 | 38 | 43.7 |
| | SHIRT ALL MIL/CIV | .47 | 1192 | 560.24 | 1119 | 525.93 |
| | SHIRT W/MIL CREASE | .47 | 54 | 25.38 | 32 | 15.04 |
| | SUIT CIV | 2.90 | 600 | 1740.00 | 796 | 2306.4 |
| | SWEATER | 1.00 | 761 | 761.00 | 828 | 828 |
| | TABLE CLOTH | .94 | 22 | 20.68 | 3 | 2.82 |
| | NECKTIE | .04 | 119 | 4.76 | 126 | 5.04 |
| | TROUSER ALL | 1.20 | 2990 | 3588.00 | 3440 | 4128 |
| | UNIFORM MIL | 2.90 | 684 | 1983.60 | 114 | 330.6 |
| | MISC. SMALL | .18 | 157 | 28.26 | 350 | 63 |
| | MISC MED | 1.25 | 102 | 127.50 | 81 | 101.25 |
| | MISC. LARGE | 2.50 | 55 | 137.50 | 96 | 240 |
| | | | --------- | --------- | --------- | --------- |
| | | | 10638 | 13673.91 | 11553 | 13798.68 |
| LOT #11 - IPR DRY CLEANING (SAME DAY) | | | | | | |
| | BLOUSE | .47 | 199 | 93.53 | 131 | 61.57 |
| | COAT FUR TRIMMED | 3.00 | 0 | .00 | 6 | 18 |
| | COAT SPORTS/UNIFORM | 1.50 | 509 | 763.50 | 400 | 600 |
| | COAT LONG W.LINER | 2.60 | 30 | 78.00 | 44 | 114.4 |
| | COAT LONG WO LINER | 2.20 | 139 | 305.80 | 141 | 310.2 |
| | CURTAINS | 1.10 | 115 | 126.50 | 68 | 74.8 |
| | DRESS EXCEPT EVENING | .91 | 161 | 146.51 | 156 | 141.96 |
| | RUG | 1.35 | 68 | 91.80 | 5 | 6.75 |
| | SKIRT W/O PLEATS | .90 | 285 | 256.50 | 193 | 173.7 |
| | SHIRT ALL | .47 | 1207 | 567.29 | 780 | 366.6 |
| | SHIRT W/MIL CREASES | .47 | 23 | 10.81 | 16 | 7.52 |
| | SUIT CIV | 2.90 | 231 | 669.90 | 240 | 696 |
| | TROUSERS ALL | 1.20 | 2044 | 2452.80 | 1647 | 1976.4 |
| | UNIFORM MIL | 2.90 | 504 | 1461.60 | 133 | 385.7 |
| | SWEATER | 1.00 | 314 | 314.00 | 238 | 238 |
| | MISC. SMALL | .18 | 121 | 21.78 | 116 | 20.88 |
| | MISC MED | 1.25 | 38 | 47.50 | 23 | 28.75 |
| | MISC. LARGE | 2.50 | 20 | 50.00 | 21 | 52.5 |
| | NECKTIE | .04 | 114 | 4.56 | 61 | 2.44 |
| | | | --------- | --------- | --------- | --------- |
| | | | 6122 | 7462.38 | 4425 | 5281.57 |

LAUNDRY PRODUCTION DATA

| LOT # | ITEM DESCRIPTION | UNIT WEIGHT LBS | FY 87 # OF ITEMS LAUNDERED | FY 87 TOT LBS | FY 88 # OF ITEMS LAUNDERED | FY 88 TOT LBS |
|---|---|---|---|---|---|---|
| LOT #12 - HOSPITAL DRY CLEANING | | | | | | |
| | COVERALL | 4.00 | 1 | 4.00 | 7 | 28 |
| | COAT DR. | 1.40 | 7 | 9.8 | 128 | 179.2 |
| | PAD FOAM RUBBER | 2.80 | 93 | 260.40 | 0 | 0 |
| | TROUSERS | 1.20 | 7 | 8.40 | 157 | 188.4 |
| | SMOCK/PANT SUIT | 1.30 | 3719 | 4834.70 | 3135 | 4075.5 |
| | MISC. SMALL | .18 | 258 | 46.44 | 205 | 36.9 |
| | MISC MED | 1.25 | 181 | 226.25 | 14 | 17.5 |
| | MISC. LARGE | 2.50 | 0 | .00 | 8 | 20 |
| | CURTAINS/DRESS | 1.10 | 1947 | 2141.70 | 2229 | 2451.9 |
| | | | 6213 | 7531.69 | 5883 | 6997.4 |
| | TOTAL PRODUCTION ALL ITEMS | | 3452655 | 4364230.54 | 3159646 | 3470014.57 |
| | TOTAL PRODUCTION DRY CLEANING | | 134986 | 208586.04 | 121580 | 175751.81 |
| | TOTAL PRODUCTION LAUNDERED ITEMS | | 3317669 | 4155644.50 | 3038066 | 3294263.16 |

APPENDIX "C"

PRODUCTION ANALYSIS  JULY-SEP FY 88

LAUNDRY PRODUCTION DATA

| LOT # | ITEM DESCRIPTION | UNIT WEIGHT LBS | JUL 88 # OF ITEMS LAUNDERED | AUG 88 # OF ITEMS LAUNDERED | SEP 88 # OF ITEMS LAUNDERED | JUL 88 # OF LBS LAUNDERED | AUG 88 # OF LBS LAUNDERED | SEP 88 # OF LBS LAUNDERED |
|---|---|---|---|---|---|---|---|---|
| LOT #1 - HOSPITAL LAUNDRY | | | | | | | | |
| | MISC-SMALL | .18 | 27 | 47 | 15 | 4.86 | 8.46 | 2.7 |
| | MISC-MED | 1.25 | 11 | 234 | 29 | 13.75 | 292.5 | 36.25 |
| | MISC-LARGE | 2.50 | 0 | 11 | 5 | 0 | 27.5 | 12.5 |
| | PILLOW CASES | .30 | 3771 | 4887 | 3984 | 1131.3 | 1466.1 | 1195.2 |
| | SHEET COTTON | 1.25 | 5613 | 8831 | 6283 | 7016.25 | 11038.75 | 7853.75 |
| | TABLE CLOTH | .94 | 1181 | 1250 | 1162 | 1110.14 | 1175 | 1092.28 |
| | TOWEL HAND | .18 | 5687 | 4441 | 8102 | 1023.66 | 799.38 | 1458.36 |
| | LAUNDRY LARGE BAG | 1.50 | 584 | 937 | 720 | 876 | 1405.5 | 1080 |
| | BABY ITEMS- PER LB | 1.00 | 498 | 1466 | 652 | 498 | 1466 | 652 |
| | BATHROBE | 1.50 | 1316 | 1267 | 850 | 1974 | 1900.5 | 1275 |
| | BLANKET COTTEN | 4.00 | 1513 | 1726 | 1879 | 6052 | 6904 | 7516 |
| | BLANKET WOOL | 4.70 | 0 | 0 | 5321 | 0 | 0 | 25008.7 |
| | CLOTH WASH | .04 | 4322 | 5202 | 0 | 172.88 | 208.08 | 0 |
| | COAT CONVALESCENT | .35 | 35 | 32 | 60 | 12.25 | 11.2 | 21 |
| | COAT OPERATING/SCRUB | .35 | 1993 | 2430 | 2081 | 697.55 | 850.5 | 728.35 |
| | GOWN OPERATING/XRAY | .35 | 3401 | 4049 | 3861 | 1190.35 | 1417.15 | 1351.35 |
| | GYM SHORTS | .25 | 181 | 180 | 204 | 45.25 | 45 | 51 |
| | PAJAMA COAT | .35 | 2112 | 2475 | 1647 | 739.2 | 866.25 | 576.45 |
| | PAJAMA TROUSERS | .50 | 2111 | 2313 | 1756 | 1055.5 | 1156.5 | 878 |
| | PAD FLOOR 3 X 5 | 1.35 | 148 | 29 | 128 | 199.8 | 39.15 | 172.8 |
| | PANTS CONVALESCENT/SCRUB | .50 | 1581 | 1995 | 1616 | 790.5 | 997.5 | 808 |
| | TOWEL BATH | .57 | 8265 | 10196 | 8310 | 4711.05 | 5811.72 | 4736.7 |
| | WRAPPER | .60 | 4637 | 4859 | 4300 | 2782.2 | 2915.4 | 2580 |
| | COVER HAMPER | 2.00 | 294 | 504 | 163 | 588 | 1008 | 326 |
| | PILLOW | .80 | 17 | 12 | 79 | 13.6 | 9.6 | 63.2 |
| | SHEEPSKIN | .80 | 0 | 7 | 11 | 0 | 5.6 | 8.8 |
| | COAT DR/ORTHO/FOOD H | .50 | 0 | 0 | 0 | 0 | 0 | 0 |
| | SMOCK | .60 | 97 | 0 | 0 | 58.2 | 0 | 0 |
| | DRESS HOSE | .90 | 60 | 86 | 50 | 54 | 77.4 | 45 |
| | SALVAGE HOSP DYED | 1.00 | 0 | 207 | 115 | 0 | 207 | 115 |
| | DYE NEW ITEMS | 1.00 | 0 | 0 | 379 | 0 | 0 | 379 |
| | SHEETS FITTED | 1.25 | 2804 | 1528 | 2504 | 3505 | 1910 | 3130 |
| | | | --------- | --------- | --------- | --------- | --------- | --------- |
| | | | 52259 | 61[illegible] | 56266 | 38315.[illegible] | 44[illegible] | 63051.[illegible] |

LAUNDRY PRODUCTION DATA

| LOT # | ITEM DESCRIPTION | UNIT WEIGHT LBS | JUL 88 # OF ITEMS LAUNDERED | AUG 88 # OF ITEMS LAUNDERED | SEP 88 # OF ITEMS LAUNDERED | JUL 88 # OF LBS LAUNDERED | AUG 88 # OF LBS LAUNDERED | SEP 88 # OF LBS LAUNDERED |
|---|---|---|---|---|---|---|---|---|
| LOT #2 - ORGANIZATIONAL 72 HR | | | | | | | | |
| | APRON FOOD H | .25 | 5 | 0 | 10 | 1.25 | 0 | 2.5 |
| | CLOTH WASH | .04 | 11371 | 12658 | 10912 | 454.84 | 506.32 | 436.48 |
| | NAPKIN | .17 | 4460 | 3769 | 4915 | 758.2 | 640.73 | 835.55 |
| | PILLOW CASE | .30 | 43190 | 47015 | 27480 | 12957 | 14104.5 | 8244 |
| | SALVAGE DYE SHOP TOWEL | .18 | 1789 | 0 | 3627 | 322.02 | 0 | 652.86 |
| | SHEET COTTON | 1.25 | 84092 | 90391 | 64731 | 105115 | 112988.75 | 80913.75 |
| | TABLE CLOTH | .94 | 2811 | 2380 | 3030 | 2642.34 | 2237.2 | 2848.2 |
| | UNIFORM FROCK FOOD H | .90 | 0 | 0 | 123 | 0 | 0 | 110.7 |
| | SMOCK | .80 | 0 | 0 | 0 | 0 | 0 | 0 |
| | MISC SMALL | .18 | 0 | 2232 | 2209 | 0 | 401.76 | 397.62 |
| | SLEEPING BAG | 1.25 | 4196 | 6259 | 4526 | 5245 | 7823.75 | 5657.5 |
| | BLANKET | 2.50 | 9467 | 13207 | 11199 | 23667.5 | 33017.5 | 27997.5 |
| | TROUSERS SWEAT | 1.20 | 2620 | 5068 | 3155 | 3144 | 6081.6 | 3786 |
| | TOWEL BATH | .57 | 17521 | 19601 | 14807 | 9986.97 | 11172.57 | 8439.99 |
| | SHORTS GYM | .25 | 2923 | 5102 | 3263 | 730.75 | 1275.5 | 815.75 |
| | COVERALLS/OVERALLS | 4.00 | 100 | 142 | 84 | 400 | 568 | 336 |
| | PAD MATTRESS | 2.80 | 376 | 456 | 8278 | 1052.8 | 1276.8 | 23178.4 |
| | SPREAD BED | 4.70 | 152 | 242 | 211 | 714.4 | 1137.4 | 991.7 |
| | SHIRT TEE- SWEAT | .25 | 5552 | 11178 | 7362 | 1388 | 2794.5 | 1840.5 |
| | BAG LAUNDRY-DUFFEL | .75 | 3325 | 6664 | 4052 | 2493 | 4998 | 3039.75 |
| | CAP BDU | .12 | 265 | 0 | 212 | 31.8 | 0 | 25.44 |
| | COVER AMMO | .15 | 200 | 0 | 310 | 30 | 0 | 46.5 |
| | COVER MATTRESS | .62 | 3782 | 6205 | 4693 | 2344.84 | 3847.1 | 2909.66 |
| | COVER CANTEEN | .15 | 280 | 1939 | 1262 | 42 | 290.85 | 189.3 |
| | COVER HELMET | .11 | 165 | 1717 | 0 | 18.15 | 188.87 | 0 |
| | DRAWERS COTTON/WOOL | .18 | 636 | 718 | 835 | 114.48 | 129.24 | 150.3 |
| | GLOVE/CHEMICAL/TRIGGER | .09 | 8 | 29 | 11 | .72 | 2.61 | .99 |
| | JACKET FIELD NEC | 3.00 | 377 | 687 | 1116 | 1131 | 2061 | 3348 |
| | LINER FIELD JACKET | .40 | 87 | 156 | 222 | 34.8 | 62.4 | 88.8 |
| | LINER PARKA | .65 | 0 | 0 | 0 | 0 | 0 | 0 |
| | MOP | 1.50 | 8 | 10 | 15 | 12 | 15 | 22.5 |
| | NECK BAND HELMET | .07 | 0 | 0 | 126 | 0 | 0 | 8.82 |
| | PACK FIELD ALL | .65 | 235 | 319 | 0 | 152.75 | 207.35 | 0 |
| | PILLOWS | .80 | 3986 | 6455 | 4771 | 3188.8 | 5164 | 3816.8 |
| | RUG SQ FT | 1.35 | | 0 | 0 | 0 | 0 | 0 |
| | RAGS | .18 | 2371 | 1668 | 3344 | 426.78 | 300.24 | 601.92 |
| | SHELTER HALFS | 3.75 | 3474 | 6383 | 3069 | 13027.5 | 23936.25 | 11508.75 |
| | SHOE-TENNIS | .65 | 0 | 0 | 37 | 0 | 0 | 24.05 |
| | SOCKS | .15 | 403 | 1205 | 734 | 60.45 | 180.75 | 110.1 |
| | TROUSER/FIELD/NEC | 2.20 | 837 | 1154 | 896 | 1841.4 | 2538.8 | 1971.2 |
| | UNDER SHIRT WOOL | 1.20 | 866 | 0 | 95 | 1039.2 | 0 | 114 |
| | WEBBING HELMET/PAD | .19 | 583 | 1356 | 351 | 110.77 | 257.64 | 66.5 |
| | MISC-SMALL | .18 | 2948 | 4016 | 2658 | 530.64 | 722.88 | 478.44 |
| | MISC-MED | 1.25 | 10 | 249 | 36 | 12.5 | 311.25 | 45 |
| | MISC-LARGE | 2.50 | 0 | 242 | 0 | 0 | 605 | 0 |
| | SHIRT UTILITY/BDU | 2.15 | 439 | 722 | 1170 | 943.85 | 1552.3 | 2515.50 |
| | TROUSERS UTILITY/BDU | 3.20 | 160 | 1006 | 543 | 512 | 3219.2 | 1737.6 |
| | | | --------- | --------- | --------- | --------- | --------- | --------- |
| | | | 216073 | 262600 | 200471 | 196683.5 | 245817.61 | 202234.75 |

LAUNDRY PRODUCTION DATA

| LOT # | ITEM DESCRIPTION | UNIT WEIGHT LBS | JUL 88 # OF ITEMS LAUNDERED | AUG 88 # OF ITEMS LAUNDERED | SEP 88 # OF ITEMS LAUNDERED | JUL 88 # OF LBS LAUNDERED | AUG 88 # OF LBS LAUNDERED | SEP 88 # OF LBS LAUNDERED |
|---|---|---|---|---|---|---|---|---|
| LOT #3 - LAUNDRY ORIGANIZATIONAL 48 HR | | | | | | | | |
| | COAT FOOD H/MED | .50 | 622 | 340 | 494 | 311 | 170 | 247 |
| | TROUSERS FOODH/MED | 1.20 | 434 | 313 | 280 | 520.8 | 374.4 | 336 |
| | DRESS FOODH/MED | .91 | 71 | 49 | 22 | 64.61 | 44.59 | 20.02 |
| | APRON | .25 | 20 | 31 | 18 | 5 | 7.75 | 4.5 |
| | | | 1147 | 733 | 814 | 901.41 | 596.74 | 607.52 |
| LOT #4 - IPR 72 HOUR | | | | | | | | |
| | BLOUSE | .47 | 64 | 55 | 40 | 30.08 | 25.85 | 18.8 |
| | CURTAINS/DRAPES | 2.50 | 23 | 0 | 0 | 57.5 | 0 | 0 |
| | JACKET, FIELD | 3.00 | 19 | 6 | 3 | 57 | 18 | 9 |
| | SHIRT EXCEPT BDU | .47 | 118 | 128 | 189 | 55.46 | 60.16 | 88.83 |
| | SHIRT BDU | 2.15 | 439 | 399 | 315 | 943.85 | 857.85 | 677.25 |
| | SHIRT MIL/CIV | .75 | 22 | 12 | 2 | 16.5 | 9 | 1.5 |
| | TROUSER EXCEPT BDU | 1.20 | 230 | 171 | 223 | 276 | 205.2 | 267.6 |
| | TROUSER BDU | 3.20 | 443 | 400 | 393 | 1417.6 | 1280 | 1257.6 |
| | MISC-SMALL | .18 | 22 | 10 | 22 | 3.96 | 1.8 | 3.96 |
| | MISC-MED | 1.25 | 14 | 8 | 11 | 17.5 | 10 | 13.75 |
| | MISC-LARGE | 2.50 | 13 | 7 | 30 | 32.5 | 17.5 | 75 |
| | COVERALL | 4.00 | 1 | 0 | 0 | 4 | 0 | 0 |
| | HANKERCHIEF | .17 | 6 | 3 | 2 | 1.02 | .51 | .34 |
| | NAPKIN | .17 | 0 | 0 | 0 | 0 | 0 | 0 |
| | PILLOWCASE | .30 | 0 | 1 | 0 | 0 | .3 | 0 |
| | SHEET | 1.25 | 0 | 0 | 0 | 0 | 0 | 0 |
| | SHEET BED | 1.25 | 0 | 2 | 12 | 0 | 2.5 | 15 |
| | TABLE CLOTH | .94 | 0 | 3 | 0 | 0 | 2.82 | 0 |
| | BAG LAUNDRY | .75 | 23 | 10 | 0 | 17.25 | 7.5 | 0 |
| | BAG SLEEPING | 1.25 | 0 | 0 | 0 | 0 | 0 | 0 |
| | CAP | .12 | 0 | 0 | 0 | 0 | 0 | 0 |
| | WASH CLOTH | .04 | 8 | 4 | 9 | .32 | .16 | .36 |
| | DRAWERS | .18 | 70 | 38 | 19 | 12.6 | 6.84 | 3.42 |
| | PAD BED | 2.80 | 0 | 0 | 0 | 0 | 0 | 0 |
| | QUILT | 4.70 | 0 | 0 | 0 | 0 | 0 | 0 |
| | RUGS | 1.25 | 0 | 0 | 0 | 0 | 0 | 0 |
| | SHIRT TEE | .25 | 87 | 45 | 23 | 21.75 | 11.25 | 5.75 |
| | SHORT ATHLETIC | .25 | 23 | 6 | 0 | 5.75 | 1.5 | 0 |
| | SOCKS | .15 | 81 | 30 | 27 | 12.15 | 4.5 | 4.05 |
| | BEDSPREAD | 4.70 | 0 | 1 | 0 | 0 | 4.7 | 0 |
| | TOWEL BATH | .57 | 19 | 11 | 12 | 10.83 | 6.27 | 6.84 |
| | TOWEL BEACH | .70 | 0 | 0 | 0 | 0 | 0 | 0 |
| | MISC. SMALL | .18 | 0 | 0 | 0 | 0 | 0 | 0 |
| | MISC. MED. | 1.25 | 0 | 0 | 0 | 0 | 0 | 0 |
| | MISC. LARGE | 2.50 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 1725 | 1358 | 1332 | 2993.62 | 2534.51 | 2443.75 |

LAUNDRY PRODUCTION DATA

| LOT # | ITEM DESCRIPTION | UNIT WEIGHT LBS | JUL 88 # OF ITEMS LAUNDERED | AUG 88 # OF ITEMS LAUNDERED | SEP 88 # OF ITEMS LAUNDERED | JUL 88 # OF LBS LAUNDERED | AUG 88 # OF LBS LAUNDERED | SEP 88 # OF LBS LAUNDERED |
|---|---|---|---|---|---|---|---|---|
| LOT #5 - IPR 24 HOUR | | | | | | | | |
| | BLOUSE | .47 | 10 | 6 | 5 | 4.7 | 2.82 | 2.35 |
| | COAT/JACKET | 1.40 | 5 | 7 | 3 | 7 | 9.8 | 4.2 |
| | SHIRT EXCEPT BDU | .47 | 31 | 53 | 48 | 14.57 | 24.91 | 22.56 |
| | SHIRT BDU | 2.15 | 290 | 497 | 183 | 623.5 | 1068.55 | 393.45 |
| | SKIRT | .75 | 3 | 16 | 3 | 2.25 | 12 | 2.25 |
| | TROUSER EXCEPT BDU | 1.20 | 59 | 78 | 121 | 70.8 | 93.6 | 145.2 |
| | TROUSER BDU | 3.20 | 296 | 492 | 164 | 947.2 | 1574.4 | 524.8 |
| | MISC-SMALL | .18 | 40 | 1 | 1 | 7.2 | .18 | .18 |
| | MISC-MED | 1.25 | 3 | 2 | 12 | 3.75 | 2.5 | 15 |
| | MISC-LARGE | 2.50 | 3 | 0 | 3 | 7.5 | 0 | 7.5 |
| | CLOTH WASH | .04 | 14 | 18 | 0 | .56 | .72 | 0 |
| | DRAWERS | .18 | 89 | 88 | 0 | 16.02 | 15.84 | 0 |
| | RUG SQ FT | 1.35 | 1 | 0 | 0 | 1.35 | 0 | 0 |
| | SHIRT TEE | .25 | 93 | 80 | 0 | 23.25 | 20 | 0 |
| | SOCKS | .15 | 111 | 74 | 0 | 16.65 | 11.1 | 0 |
| | TOWEL BATH | .57 | 32 | 23 | 0 | 18.24 | 13.11 | 0 |
| | LAUNDRY BAG | .75 | 0 | 0 | 0 | 0 | 0 | 0 |
| | MISC-SMALL | .18 | 32 | 0 | 0 | 5.76 | 0 | 0 |
| | MISC-MED | 1.25 | 0 | 0 | 0 | 0 | 0 | 0 |
| | MISC-LARGE | 2.50 | 0 | 0 | 0 | 0 | 0 | 0 |
| | HANKERCHIEF | .17 | 18 | 14 | 0 | 3.06 | 2.38 | 0 |
| | PILLOW CASE | .30 | 0 | 0 | 0 | 0 | 0 | 0 |
| | SHEET | 1.25 | 4 | 0 | 0 | 5 | 0 | 0 |
| | | | --------- | --------- | --------- | --------- | --------- | --------- |
| | | | 1134 | 1445 | 543 | 1778.36 | 2851.91 | 1117.49 |
| LOT #6 - PAYROLL DEDUCTION | | | | | | | | |
| | 1 BUNDLE PER WEEK | 12.00 | 4953 | 3312 | 2328 | 59436 | 39744 | 27936 |
| | 2 BUNDLES PER WEEK | 12.00 | 1457 | 1402 | 1344 | 17484 | 16824 | 16128 |
| | PERMENANT PARTY 1B | | | | | 0 | 0 | 0 |
| | PERMENANT PARTY 2B | | | | | 0 | 0 | 0 |
| | | | --------- | --------- | --------- | --------- | --------- | --------- |
| | | | 6410 | 4714 | 3672 | 76920 | 56568 | 44064 |

LAUNDRY PRODUCTION DATA

| LOT # | ITEM DESCRIPTION | UNIT WEIGHT LBS | JUL 88 # OF ITEMS LAUNDERED | AUG 88 # OF ITEMS LAUNDERED | SEP 88 # OF ITEMS LAUNDERED | JUL 88 # OF LBS LAUNDERED | AUG 88 # OF LBS LAUNDERED | SEP 88 # OF LBS LAUNDERED |
|---|---|---|---|---|---|---|---|---|
| LOT #8 - ORGANIZATIONAL DRY CLEANING | | | | | | | | |
| | ALB | 1.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| | AMICE | 1.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| | COAT SHORT | 1.50 | 25 | 39 | 136 | 37.5 | 58.5 | 204 |
| | COAT LONG LINED | 2.60 | 1 | 397 | 0 | 2.6 | 1032.2 | 0 |
| | CORPORAL | 1.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| | CURTAINDRAPES | 2.50 | 801 | 448 | 23 | 2002.5 | 1120 | 57.5 |
| | HOODWINTER - LINED | 1.35 | 0 | 0 | 0 | 0 | 0 | 0 |
| | JACKET ALL | 1.40 | 11 | 2 | 0 | 15.4 | 2.8 | 0 |
| | ALTAR CLOTH ALL | 3.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| | PARKA | 2.80 | 27 | 4 | 0 | 75.6 | 11.2 | 0 |
| | PURIFICATOR | 1.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| | SHIRT | .47 | 8 | 860 | 130 | 3.76 | 404.2 | 61.1 |
| | SCARF ALL | .19 | 10 | 0 | 0 | 1.9 | 0 | 0 |
| | TOWEL FINGER | .18 | 0 | 0 | 0 | 0 | 0 | 0 |
| | TROUSER ALL | 1.20 | 62 | 493 | 136 | 74.4 | 591.6 | 163.2 |
| | TABLECLOTH | .94 | 22 | 88 | 30 | 20.68 | 82.72 | 28.2 |
| | ROBE/GOWN ALL | 1.50 | 0 | 42 | 9 | 0 | 63 | 13.5 |
| | MISC-SMALL | .18 | 18 | 6 | 3 | 3.24 | 1.08 | .54 |
| | MISC-MED | 1.25 | 11 | 37 | 24 | 13.75 | 46.25 | 30 |
| | MISC-LARGE | 2.50 | 13 | 19 | 2 | 32.5 | 47.5 | 5 |
| | GLOVES/MITTEN | .09 | 79 | 0 | 23 | 7.11 | 0 | 2.07 |
| | HAT DI | 1.10 | 0 | 0 | 0 | 0 | 0 | 0 |
| | TAPESTRY/FLAG | .94 | 255 | 9 | 0 | 239.7 | 8.46 | 0 |
| | MISC-SMALL | .18 | 4 | 0 | 0 | .72 | 0 | 0 |
| | MISC-MED | 1.25 | 1 | 0 | 0 | 1.25 | 0 | 0 |
| | MISC-LARGE | 2.50 | 0 | 0 | 0 | 0 | 0 | 0 |
| | CAP PILE | .18 | 8 | 0 | 0 | 1.44 | 0 | 0 |
| | CAP GARRISON | .12 | 193 | 139 | 0 | 23.16 | 16.68 | 0 |
| | COVERALL/OVERALLS | 4.00 | 10 | 27 | 12 | 40 | 108 | 48 |
| | SCARF WOOL | .3 | 19 | 0 | 0 | 5.7 | 0 | 0 |
| | DRESS | .91 | 0 | 17 | 0 | 0 | 15.47 | 0 |
| | SHIRT WOOL | .60 | 7 | 0 | 0 | 4.2 | 0 | 0 |
| | TROUSER WOOL | 1.60 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 1585 | 2627 | 528 | 2607.11 | 3609.66 | 613.11 |
| LOT #9 - ORGANIZATIONAL DRY CLEANING AG HR | | | | | | | | |
| | COAT AG | 1.80 | 3193 | 3918 | 2053 | 5747.4 | 7052.4 | 3695.4 |
| | TROUSER AG | 2.20 | 3996 | 5479 | 3195 | 8791.2 | 12053.8 | 7029 |
| | SHIRT | .47 | 3193 | 3933 | 2031 | 1500.71 | 1846.51 | 954.57 |
| | | | 10382 | 13330 | 7279 | 16039.31 | 20954.71 | 11675.57 |

LAUNDRY PRODUCTION DATA

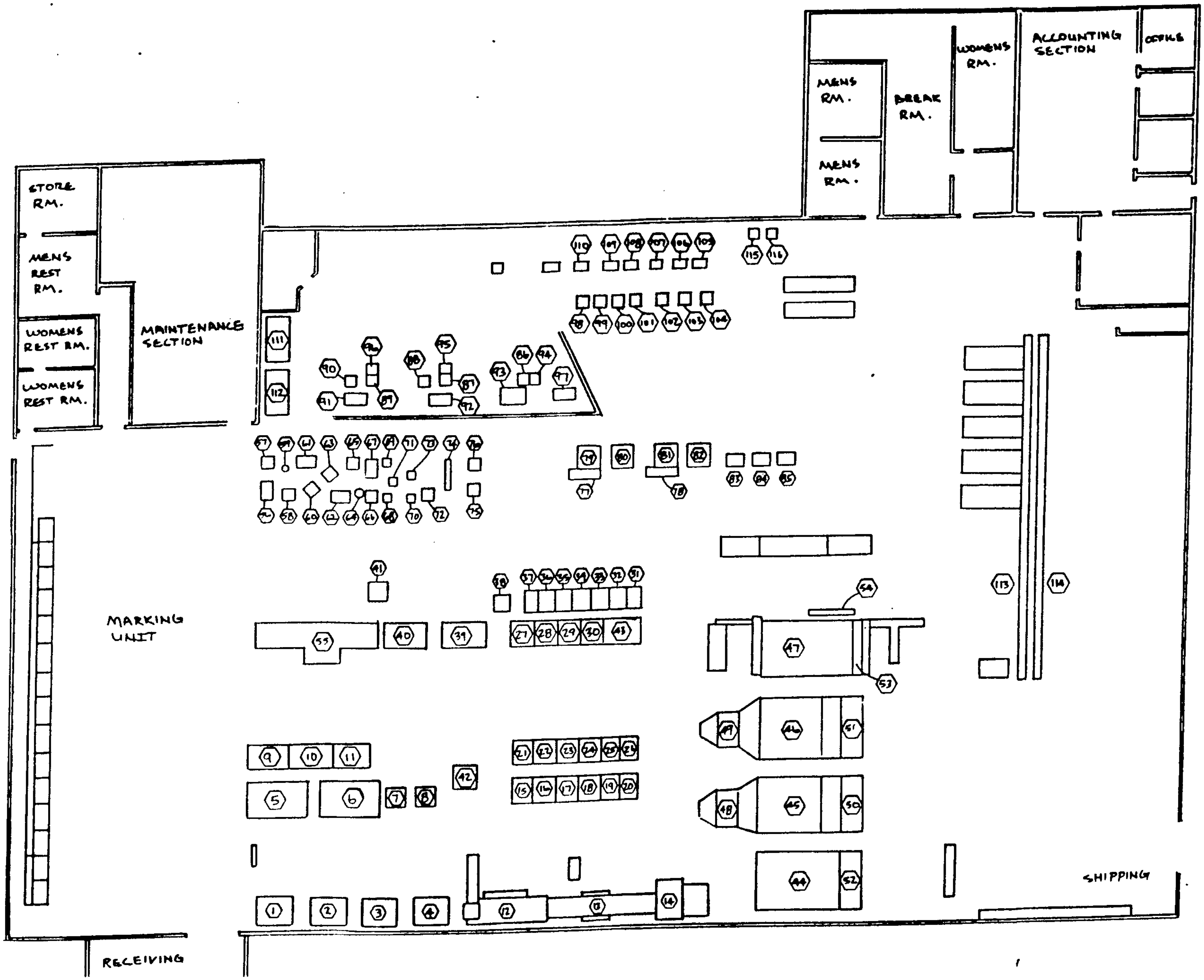
| LOT # | ITEM DESCRIPTION | UNIT WEIGHT LBS | JUL 88 # OF ITEMS LAUNDERED | AUG 88 # OF ITEMS LAUNDERED | SEP 88 # OF ITEMS LAUNDERED | JUL 88 # OF LBS LAUNDERED | AUG 88 # OF LBS LAUNDERED | SEP 88 # OF LBS LAUNDERED |
|---|---|---|---|---|---|---|---|---|
| LOT #10 - IPR DRY CLEANING 72 HR | | | | | | | | |
| | BLOUSE | .47 | 91 | 87 | 82 | 42.77 | 40.89 | 38.54 |
| | COAT FUR TRIMMED | 3.00 | 21 | 1 | 1 | 63 | 3 | 3 |
| | COAT SPORTS | 1.40 | 45 | 56 | 98 | 63 | 78.4 | 137.2 |
| | COAT LONG LINED | 2.60 | 3 | 4 | 12 | 7.8 | 10.4 | 31.2 |
| | COAT LONG WO LINER | 2.10 | 4 | 3 | 17 | 8.4 | 6.3 | 35.7 |
| | CURTAIN | 1.10 | 14 | 6 | 8 | 15.4 | 6.6 | 8.8 |
| | DRESS | .91 | 48 | 47 | 73 | 43.68 | 42.77 | 66.43 |
| | DRESS EVENING | 2.80 | 0 | 2 | 13 | 0 | 5.6 | 36.4 |
| | RUG | 1.35 | 4 | 1 | 3 | 5.4 | 1.35 | 4.05 |
| | SKIRT W/O PLEATS | .90 | 57 | 52 | 58 | 51.3 | 46.8 | 52.2 |
| | SKIRT W/PLEATS | 1.15 | 12 | 3 | 5 | 13.8 | 3.45 | 5.75 |
| | SHIRT ALL MIL/CIV | .47 | 46 | 58 | 110 | 21.62 | 27.26 | 51.7 |
| | SHIRT W/MIL CREASE | .47 | 6 | 4 | 9 | 2.82 | 1.88 | 4.23 |
| | SUIT CIV | 2.90 | 51 | 70 | 75 | 147.9 | 203 | 217.5 |
| | SWEATER | 1.00 | 19 | 14 | 51 | 19 | 14 | 51 |
| | TABLE CLOTH | .94 | 1 | 0 | 0 | .94 | 0 | 0 |
| | NECKTIE | .04 | 0 | 3 | 0 | 0 | .12 | 0 |
| | TROUSER ALL | 1.20 | 302 | 248 | 300 | 362.4 | 297.6 | 360 |
| | UNIFORM MIL | 2.9. | 4 | 6 | 10 | 11.6 | 17.4 | 29 |
| | MISC. SMALL | .18 | 18 | 20 | 39 | 3.24 | 3.6 | 7.02 |
| | MISC MED | 1.25 | 4 | 12 | 1 | 5 | 15 | 1.25 |
| | MISC. LARGE | 2.50 | 8 | 24 | 13 | 20 | 60 | 32.5 |
| | | | 758 | 721 | 978 | 909.07 | 685.43 | 1173.47 |
| LOT #11 - IPR DRY CLEANING (SAME DAY) | | | | | | | | |
| | BLOUSE | .47 | 15 | 5 | 39 | 7.05 | 2.35 | 18.33 |
| | COAT FUR TRIMMED | 3.00 | 4 | 0 | 1 | 12 | 0 | 3 |
| | COAT SPORTS/UNIFORM | 1.50 | 12 | 13 | 55 | 18 | 19.5 | 82.5 |
| | COAT LONG W. LINER | 2.60 | 2 | 1 | 4 | 5.2 | 2.6 | 10.4 |
| | COAT LONG WO LINER | 2.20 | 0 | 2 | 7 | 0 | 4.4 | 15.4 |
| | CURTAINS | 1.10 | 12 | 3 | 0 | 13.2 | 3.3 | 0 |
| | DRESS EXCEPT EVENING | .91 | 10 | 1 | 0 | 9.1 | .91 | 0 |
| | RUG | 1.35 | 14 | 16 | 27 | 18.9 | 21.6 | 36.45 |
| | SKIRT W/O PLEATS | .90 | 5 | 0 | 0 | 4.5 | 0 | 0 |
| | SHIRT ALL | .47 | 16 | 13 | 29 | 7.52 | 6.11 | 13.63 |
| | SHIRT W/MIL CREASES | .47 | 55 | 75 | 73 | 25.85 | 35.25 | 34.31 |
| | SUIT CIV | 2.90 | 19 | 5 | 28 | 55.1 | 14.5 | 81.2 |
| | TROUSERS ALL | 1.20 | 131 | 139 | 215 | 157.2 | 166.8 | 258 |
| | UNIFORM MIL | 2.90 | 3 | 6 | 2 | 6.7 | 17.4 | 5.8 |
| | SWEATER | 1.00 | 4 | 2 | 11 | 4 | 2 | 11 |
| | MISC. SMALL | .18 | 7 | 32 | 22 | 1.26 | 5.76 | 3.96 |
| | MISC MED | 1.25 | 1 | 3 | 3 | 1.25 | 3.75 | 3.75 |
| | MISC. LARGE | 2.50 | 3 | 1 | 4 | 7.5 | 2.5 | 10 |
| | NECKTIE | .04 | 0 | 8 | 0 | 0 | .32 | 0 |
| | | | 313 | 325 | 520 | 356.33 | 309.05 | 587.73 |

LAUNDRY PRODUCTION DATA

| LOT # | ITEM DESCRIPTION | UNIT WEIGHT LBS | JUL 88 # OF ITEMS LAUNDERED | AUG 88 # OF ITEMS LAUNDERED | SEP 88 # OF ITEMS LAUNDERED | JUL 88 # OF LBS LAUNDERED | AUG 88 # OF LBS LAUNDERED | SEP 88 # OF LBS LAUNDERED |
|---|---|---|---|---|---|---|---|---|
| LOT #12 - HOSPITAL DRY CLEANING | | | | | | | | |
| | COVERALL | 4.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| | COAT DR. | 1.40 | 0 | 0 | 0 | 0 | 0 | |
| | PAD FOAM RUBBER | 2.80 | 0 | 0 | 0 | 0 | 0 | 0 |
| | TROUSERS | 1.20 | 0 | 0 | 0 | 0 | 0 | 0 |
| | SMOCK/PANT SUIT | 1.30 | 0 | 203 | 305 | 0 | 263.9 | 396.5 |
| | MISC. SMALL | .18 | 0 | 0 | 0 | 0 | 0 | 0 |
| | MISC MED | 1.25 | 0 | 10 | 0 | 0 | 12.5 | 0 |
| | MISC. LARGE | 2.50 | 0 | 0 | 0 | 0 | 0 | 0 |
| | CURTAINS/DRESS | 1.10 | 0 | 0 | 92 | 0 | | 101.2 |
| | | | 0 | 213 | 1225 | 0 | 275.4 | 14[illegible]3.5 |
| | TOTAL PRODUCTION ALL ITEMS | | 291782 | 349264 | 273533 | 335503 | 379223.75 | 327146.33 |
| | TOTAL PRODUCTION DRY CLEANING | | 13038 | 17212 | 10530 | 19911.62 | 26035.24 | 15481.78 |
| | TOTAL PRODUCTION LAUNDERED ITEMS | | 278748 | 332048 | 263056 | 315591.12 | 353188.51 | 311664.5 |
| | TOTAL WATER USE (GALLONS) | | | | | 809900 | 972500 | 811300 |
| | MINUS BOILER FEEDWATER | | | | | 9020 | 9620 | 4630 |
| | MINUS DOMESTIC WATER | | | | | 4000 | 4000 | 4000 |
| | NET PROCESS WATER USE | | | | | 796880 | 958880 | 802670 |
| | WATER USE PER LB LAUNDRY | | | | | 2.52 | 2.71 | 2.58 |
| | WATER USE PER LB LAUNDRY 3 MONTH AVERAGE | | | | | 2.61 | | |

# APPENDIX "D"

## PLANT LAYOUT & INVENTORY FORMS



STORE RM.
MENS REST RM.
WOMENS REST RM.
WOMENS REST RM.
MAINTENANCE SECTION
MENS RM.
MENS RM.
BREAK RM.
WOMENS RM.
ACCOUNTING SECTION
OFFICE
MARKING UNIT
SHIPPING
RECEIVING


D - 1

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

| | | |
|---|---|---|
| FLOOR PLAN EQUIPMENT NO. | - | 1 2 3 4 |
| TYPE OF EQUIPMENT | - | WASHER - EXTRACTOR |
| EQUIPMENT CAPACITY | - | |
| MAKE/MODEL NUMBER | - | G.A. BRAUN / NTD 600 |

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | WASH | EXTRACTOR | |
| H.P. | 7-1/2 | 12.5-25 | |
| VOLTS | 208-230-460 | 230 | |
| F.L.A. | 24.8-21.6-10.8 | 40-46.4 | |
| RPM | 1740 | 850-1700 | |
| ACTUAL AMP | 13.5 | 27.5 | |
| ACTUAL VOLT | 238-238-235 | | |

MISCELLANEOUS EQUIPMENT INFORMATION

| | | |
|---|---|---|
| SPEED | - | WASH - 31.7 EXTRACT - 277 |
| STEAM LINE SIZE | - | 1-1/2" |
| STEAM VALVE RATING | - | 14 PSI |
| COLD WATER LINE SIZE | - | 4" |
| HOT WATER LINE SIZE | - | 4" |

145 F WASH WATER
110 F EXTRACT WATER
SERIAL NOS. NTD60071167-70

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

| | | |
|---|---|---|
| FLOOR PLAN EQUIPMENT NO. | - | 5 6 |
| TYPE OF EQUIPMENT | - | WASHER - EXTRACTOR |
| EQUIPMENT CAPACITY | - | 800 POUND |
| MAKE/MODEL NUMBER | - | G.A. BRAUN / NTD 800 |

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | WASH | EXTRACTOR | |
| H.P. | 10 | 15-30 | |
| VOLTS | 230-460 | 230 | |
| F.L.A. | 28-14 | 55-74 | |
| RPM | 1745 | 830-1670 | |
| ACTUAL AMP | 22 | | |
| ACTUAL VOLT | | | |

MISCELLANEOUS EQUIPMENT INFORMATION

| | | |
|---|---|---|
| SPEED | - | WASH - 31.7 EXTRACT - 277 |
| STEAM LINE SIZE | - | 1-1/2" |
| STEAM VALVE RATING | - | 14 PSI |
| COLD WATER LINE SIZE | - | 4" |
| HOT WATER LINE SIZE | - | 4" |

SERIAL NOS. NTD80076176

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

FLOOR PLAN EQUIPMENT NO. - 7 8

TYPE OF EQUIPMENT - WASHER - EXTRACTOR

EQUIPMENT CAPACITY - 200 POUND (MAX CAPACITY 230 LB.)

MAKE/MODEL NUMBER - G.A. BRAUN / 200 NSP

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | WASH | EXTRACTOR | EXTRACTOR |
| H.P. | 3 | 10 | 3 |
| VOLTS | 200-230-460 | 230-460 | 230-460 |
| F.L.A. | 9.9-13.6-6.8 | 28-14 | 9.0-4.5 |
| RPM | 1700 | 1650 | 1750 |

ACTUAL AMP
ACTUAL VOLT

MISCELLANEOUS EQUIPMENT INFORMATION

SPEED - WASH - 31.3 EXTRACT - 310/620

STEAM LINE SIZE - 3/4"
STEAM VALVE RATING -

COLD WATER LINE SIZE - 2"
HOT WATER LINE SIZE - 2"

SERIAL NOS. NSP2007871138

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

| | | |
|---|---|---|
| FLOOR PLAN EQUIPMENT NO. | - | 9 10 11 |
| TYPE OF EQUIPMENT | - | WASHERS |
| EQUIPMENT CAPACITY | - | 100 LB |
| MAKE/MODEL NUMBER | - | MODEL 44-22-100 |

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | WASH | WASH | |
| H.P. | 2 | 5-2.5 | |
| VOLTS | 208-230-460 | 230 | |
| F.L.A. | 6.4-6.0-3.0 | 14-13 | |
| RPM | 1725 | 1665-1880 | |
| ACTUAL AMP | | | |
| ACTUAL VOLT | | | |

MISCELLANEOUS EQUIPMENT INFORMATION

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

FLOOR PLAN EQUIPMENT NO. - 12

TYPE OF EQUIPMENT - SHEET WASH

EQUIPMENT CAPACITY -

MAKE/MODEL NUMBER - TROY LAUNDRY MACHINE/2E1

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | WASH | CONVEYOR | CONVEYOR |
| H.P. | 15 | 3/4 | 3/4 |
| VOLTS | 230-460 | 230-460 | 230-460 |
| F.L.A. | 46-23 | 36-1.8 | 36-1.8 |
| RPM | | | |

ACTUAL AMP
ACTUAL VOLT

MISCELLANEOUS EQUIPMENT INFORMATION

SPEED -

STEAM LINE SIZE - 3/4"
STEAM VALVE RATING -

COLD WATER LINE SIZE - 1-1/2"
HOT WATER LINE SIZE - 1-1/2"

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

| | | |
|---|---|---|
| FLOOR PLAN EQUIPMENT NO. | - | 13 |
| TYPE OF EQUIPMENT | - | SHAPER, PRESS, AND CONVEYOR |
| EQUIPMENT CAPACITY | - | |
| MAKE/MODEL NUMBER | - | TROY LAUNDRY MACHINE/2E1 |

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | SHAPER | PRESS | CONVEYOR |
| H.P. | 11 K.W. | 11 K.W. | 2 |
| VOLTS | 220 | 220 | 230-460 |
| F.L.A. | 36 | 40 | 7.0-3.5 |
| RPM | 3480 | | |
| | COS =90 | COS = 83 | |
| ACTUAL AMP | | | |
| ACTUAL VOLT | | | |

MISCELLANEOUS EQUIPMENT INFORMATION

| | |
|---|---|
| SPEED | - |
| STEAM LINE SIZE | - |
| STEAM VALVE RATING | - |
| COLD WATER LINE SIZE | - |
| HOT WATER LINE SIZE | - |

# FT. LEONARD WOOD LAUNDRY PLANT STUDY
## EQUIPMENT SURVEY

| | | |
|---|---|---|
| FLOOR PLAN EQUIPMENT NO. | - | 14 |
| TYPE OF EQUIPMENT | - | DRYER - TUMBLER |
| EQUIPMENT CAPACITY | - | 400 POUND |
| MAKE/MODEL NUMBER | - | CHALLENGE DRY FLO LAUNDRY/DFG-S |

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | TUMBLER | TUMBLER | CONVEYOR |
| H.P. | 20 | 5 | 2 |
| VOLTS | 230-460 | 230-460 | 230-460 |
| F.L.A. | 48.7-24.4 | 7.9-15.8 | 7.0-3.5 |
| RPM | 3500 | | |
| ACTUAL AMP | | | |
| ACTUAL VOLT | | | |

| MOTOR DATA | MOTOR #4 | MOTOR #5 |
|---|---|---|
| SERVICE | CONVEYOR | BURNER |
| H.P. | 1 | 2 |
| VOLTS | 230-460 | 230-460 |
| F.L.A. | 5.2-2.6 | 6.0-3.0 |
| RPM | | |

### MISCELLANEOUS EQUIPMENT INFORMATION

| | | |
|---|---|---|
| PROPANE LINE SIZE | - | 2-1/2" |
| GAS VALVE RATING | - | 15 PSI |
| FIRE RATE | - | 3,350,000 BTU<br>2,750,000 BTU<br>8000 CFM AIRFLOW THRU DRYER |
| GAS INPUT | - | 3 MILLION BTU<br>80 LB COMPRESSED AIR<br>40 LB MINIMUM WATER PRESSURE |
| BURNER SIZE | - | 15-S01 CHICAGO BLOWER |
| STEAM | - | 1200 LB/HR AT 100-125 PSI |
| AIR | - | 4 CFM FREE AIR AT 80 PSIG |
| WATER | - | 40 GPM AT 40 PSI<br>(APPROX. 1-1/2 GAL./LB LAUNDRY) |

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

| | | |
|---|---|---|
| FLOOR PLAN EQUIPMENT NO. | - | 15 20 |
| TYPE OF EQUIPMENT | - | DRYER |
| EQUIPMENT CAPACITY | - | |
| MAKE/MODEL NUMBER | - | TROY MINUTEMAN / 42 X 42 |

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | | | |
| H.P. | 1-1/2" | | |
| VOLTS | 208-220-440 | | |
| F.L.A. | 4.6-2.3 | | |
| RPM | | | |
| ACTUAL AMP | | | |
| ACTUAL VOLT | | | |

MISCELLANEOUS EQUIPMENT INFORMATION

| | |
|---|---|
| SPEED | - |
| STEAM LINE SIZE | - |
| STEAM VALVE RATING | - |
| COLD WATER LINE SIZE | - |
| HOT WATER LINE SIZE | - |

125 LBS MAXIMUM STEAM PRESSURE

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

FLOOR PLAN EQUIPMENT NO. - 19 17

TYPE OF EQUIPMENT - DRYER

EQUIPMENT CAPACITY -

MAKE/MODEL NUMBER - THERMATIC AMERICAN / MODEL 121
42 X 42

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | TUMBLER | FAN | |
| H.P. | 3/4 | 3 | |
| VOLTS | 208-230-460 | 208-230-460 | |
| F.L.A. | 3.6-3.0-1.4-1.5 | 7.6-8.8-3.8-4.4 | |
| RPM | 1725-1425 | 3450-2850 | |

ACTUAL AMP
ACTUAL VOLT

MISCELLANEOUS EQUIPMENT INFORMATION

SPEED -

STEAM LINE SIZE -
STEAM VALVE RATING -

125 MAX STEAM PRESSURE
11 BOILER HP

*** 1BHP=38.6 LB/HR STEAM

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| FLOOR PLAN EQUIPMENT NO. | - | 18 | 16 | 31 | 31 | 33 | 34 | 35 |
| TYPE OF EQUIPMENT | - | DRYER | | | | | | |
| EQUIPMENT CAPACITY | - | 110 LB. DRY WEIGHT | | | | | | |
| MAKE/MODEL NUMBER | - | AMERICAN ZONE AIR / 44 X 42<br>FED STOCK NO. FSN-3510-141-8197 | | | | | | |

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | TUMBLER | FAN | |
| H.P. | 1/2 | 1 | |
| VOLTS | 220-440 | | |
| F.L.A. | 1.8-9.5 | | |
| RPM | 1750 | | |

ACTUAL AMP
ACTUAL VOLT

MISCELLANEOUS EQUIPMENT INFORMATION

| | | |
|---|---|---|
| SPEED | - | 36 RPM |
| STEAM LINE SIZE | - | 1" |
| STEAM VALVE RATING | - | |

312 LB/HR STEAM CONSUMPTION
25 MINUTE DRYING TIME

*** 1BHP=38.6 LB/HR STEAM

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

| | | |
|---|---|---|
| FLOOR PLAN EQUIPMENT NO. | - | 28 29 27 30 |
| TYPE OF EQUIPMENT | - | GAS DRYER |
| EQUIPMENT CAPACITY | - | |
| MAKE/MODEL NUMBER | - | CISSEL / 44CD426 |

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | TUMBLER | FAN | |
| H.P. | 1 | 1-1/2 | |
| VOLTS | 208-240-480 | 200-230-460 | |
| F.L.A. | 3.3-3.7-1.9 | 6.0-6.0-3.0 | |
| RPM | 1725 | 1725 | |
| ACTUAL AMP | | | |
| ACTUAL VOLT | | | |

MISCELLANEOUS EQUIPMENT INFORMATION

250,000 BTU/HR INPUT (PROPANE)
11" MANIFOLD PRESSURE

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

| | | |
|---|---|---|
| FLOOR PLAN EQUIPMENT NO. | - | 37 25 26 23 22 24 21 36 |
| TYPE OF EQUIPMENT | - | DRYER |
| EQUIPMENT CAPACITY | - | ? 210-240 LB/HR |
| MAKE/MODEL NUMBER | - | CISSEL / L4242 |

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | TUMBLER | FAN | |
| H.P. | 3/4 | 1-1/2 | |
| VOLTS | 230-460 | 208-220 | |
| F.L.A. | 2.8-1.4 | 6-3/5-2.5 | |
| RPM | | 1440/1730 | |

ACTUAL AMP
ACTUAL VOLT

MISCELLANEOUS EQUIPMENT INFORMATION

SPEED -

STEAM LINE SIZE -
STEAM VALVE RATING -

7.3 BHP AT 125 LB STEAM
EQUIVALENT FOR GAS FIRED 300,000 BTU INPUT

*** 1BHP=38.6 LB/HR STEAM

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

FLOOR PLAN EQUIPMENT NO. - 38

TYPE OF EQUIPMENT - STEAM DRYER

EQUIPMENT CAPACITY - 40 POUND DRY WEIGHT

MAKE/MODEL NUMBER - HUEBSCH MFG - MILWAUKEE

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | TUMBLER | FAN | |
| H.P. | 1/4 | 1-1/2 | |
| VOLTS | 208-220 | 208-220-440 | |
| F.L.A. | 1.1 | 4.9-4.8-2.4 | |
| RPM | | 1725 | |
| ACTUAL AMP | | | |
| ACTUAL VOLT | | | |

MISCELLANEOUS EQUIPMENT INFORMATION

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

| | | |
|---|---|---|
| FLOOR PLAN EQUIPMENT NO. | - | 39 40 |
| TYPE OF EQUIPMENT | - | GAS DRYER |
| EQUIPMENT CAPACITY | - | 400 POUND |
| MAKE/MODEL NUMBER | - | NORMAN / 171 |

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | TUMBLER | BURNER | HYD PUMP |
| H.P. | 5 | 25 | 2 |
| VOLTS | 230-460 | 230-460 | 208-220-440 |
| F.L.A. | 15-7.5 | 64-32 | /2.7 |
| RPM | | 1750 | |

ACTUAL AMP
ACTUAL VOLT

** FAN MOTOR IS INACCESIBLE

MISCELLANEOUS EQUIPMENT INFORMATION

| | | |
|---|---|---|
| GAS LINE SIZE | - | 2" |
| BURNER CAPACITY | - | 3,000,000 BTU AT 7-20" W.C. (APPROX 50 CFM) |

DRYING TEMP. 205-215 F
EXHAUST TEMP. 180 F

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

FLOOR PLAN EQUIPMENT NO. - 41

TYPE OF EQUIPMENT - GAS DRYER

EQUIPMENT CAPACITY - 400 POUND

MAKE/MODEL NUMBER - AMERICAN DRYER CORP. / 7321

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | TUMBLER | FAN | BURNER |
| H.P. | 7.5 | 10 | 1/2 |
| VOLTS | 208-230-460 | 208-220-440 | 208-230-460 |
| F.L.A. | 22-21-10.5 | 28-25-12.5 | 2.0-1.0 |
| RPM | | | |

ACTUAL AMP
ACTUAL VOLT

MISCELLANEOUS EQUIPMENT INFORMATION

BURNER MINIMUM CAPACITY 840,000 BTUH (NATURAL GAS)
MAXIMUM CAPACITY 2,000,000 BTUH

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

| | | |
|---|---|---|
| FLOOR PLAN EQUIPMENT NO. | - | 42 |
| TYPE OF EQUIPMENT | - | LINT TRAP |
| EQUIPMENT CAPACITY | - | |
| MAKE/MODEL NUMBER | - | CINCINNATI FAN / WAF-42-15 |

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | FAN | PUMP | |
| H.P. | 15 | 1 | |
| VOLTS | 230-460 | 208-220-440 | |
| F.L.A. | 39.8-19.9 | 3.2-1.6 | |
| RPM | | 3450-2850 | |
| ACTUAL AMP | | | |
| ACTUAL VOLT | | | |

MISCELLANEOUS EQUIPMENT INFORMATION

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

FLOOR PLAN EQUIPMENT NO. - 43

TYPE OF EQUIPMENT - LINT TRAP

EQUIPMENT CAPACITY -

MAKE/MODEL NUMBER - CINCINNATI FAN / WAF-42-10

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | FAN | PUMP | |
| H.P. | 10 | 1 | |
| VOLTS | 230-460 | 208-220-440 | |
| F.L.A. | 26.8-13.4 | 3.2-1.6 | |
| RPM | | 3450-2850 | |
| ACTUAL AMP | | | |
| ACTUAL VOLT | | | |

MISCELLANEOUS EQUIPMENT INFORMATION

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

| | | |
|---|---|---|
| FLOOR PLAN EQUIPMENT NO. | - | 44 45 46 47 |
| TYPE OF EQUIPMENT | - | SHEET PRESS |
| EQUIPMENT CAPACITY | - | SIZE 120 |
| MAKE/MODEL NUMBER | - | AMERICAN LAUNDRY MACHINE |

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | DRIVE | | |
| H.P. | 7-1/2 | | |
| VOLTS | 208-220-440 | | |
| F.L.A. | 23.4-22-11 | | |
| RPM | | | |
| ACTUAL AMP | | | |
| ACTUAL VOLT | | | |

MISCELLANEOUS EQUIPMENT INFORMATION

| | | |
|---|---|---|
| SPEED | - | |
| STEAM LINE SIZE | - | 4" REDUCE TO 2" |
| STEAM VALVE RATING | - | |
| COLD WATER LINE SIZE | - | |
| HOT WATER LINE SIZE | - | |

DESIGNED FOR 100 LB STEAM

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

FLOOR PLAN EQUIPMENT NO. - 49 48

TYPE OF EQUIPMENT - SHEET SPREADER - FEEDER

EQUIPMENT CAPACITY -

MAKE/MODEL NUMBER - McCABE - LUBBOC, TX

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | DRIVE | FAN | POSITIONER |
| H.P. | 1-1/2 | 1/4 | 1/4 |
| VOLTS | 230-460 | 115-230 | 115-230 |
| F.L.A. | 54.-2.7 | 4.4-2.2 | 5.2-2.6 |
| RPM | 1755 | | |

ACTUAL AMP
ACTUAL VOLT

MISCELLANEOUS EQUIPMENT INFORMATION

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

FLOOR PLAN EQUIPMENT NO. - 51 50

TYPE OF EQUIPMENT - SHEET FOLDER

EQUIPMENT CAPACITY -

MAKE/MODEL NUMBER - TROY / STOCK #FSN-3510-293-4333

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
| --- | --- | --- | --- |
| SERVICE | | | |
| H.P. | 1 | 1/3 | 1/3 |
| VOLTS | 230-460 | 208-220-440 | 208-220-440 |
| F.L.A. | 3.2-1.6 | 1.4-0.7 | 1.4-0.7 |
| RPM | | | |

ACTUAL AMP
ACTUAL VOLT

MISCELLANEOUS EQUIPMENT INFORMATION
-----------------------------------

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

| | | |
|---|---|---|
| FLOOR PLAN EQUIPMENT NO. | - | 52 |
| TYPE OF EQUIPMENT | - | SHEET FOLDER |
| EQUIPMENT CAPACITY | - | 120 INCH |
| MAKE/MODEL NUMBER | - | AMERICAN LAUNDRY |

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | | | |
| H.P. | | | |
| VOLTS | | | |
| F.L.A. | | | |
| RPM | | | |
| ACTUAL AMP | | | |
| ACTUAL VOLT | | | |

MISCELLANEOUS EQUIPMENT INFORMATION

## FT. LEONARD WOOD LAUNDRY PLANT STUDY
## EQUIPMENT SURVEY

| | | |
|---|---|---|
| FLOOR PLAN EQUIPMENT NO. | - | 53 |
| TYPE OF EQUIPMENT | - | SHEET FOLDER |
| EQUIPMENT CAPACITY | - | |
| MAKE/MODEL NUMBER | - | JENSEN , AMERICAN STACKRITE |

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | | | |
| H.P. | 1/2 | | |
| VOLTS | 230-460 | | |
| F.L.A. | 2.7-1.35 | | |
| RPM | | | |
| ACTUAL AMP | | | |
| ACTUAL VOLT | | | |

MISCELLANEOUS EQUIPMENT INFORMATION

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

| | | |
|---|---|---|
| FLOOR PLAN EQUIPMENT NO. | - | 54 |
| TYPE OF EQUIPMENT | - | TOWEL FOLDER |
| EQUIPMENT CAPACITY | - | |
| MAKE/MODEL NUMBER | - | TEAM INDUSTRIES L.A. |

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | | | |
| H.P. | 1 | | |
| VOLTS | 230-460 | | |
| F.L.A. | 3.8-1.9 | | |
| RPM | | | |
| ACTUAL AMP | | | |
| ACTUAL VOLT | | | |

MISCELLANEOUS EQUIPMENT INFORMATION
-----------------------------------

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

FLOOR PLAN EQUIPMENT NO. - 55

TYPE OF EQUIPMENT - WATER & CONDITIONER DISTRIBUTION

EQUIPMENT CAPACITY -

MAKE/MODEL NUMBER -

| MOTOR DATA | MOTOR #1 | *4 EACH<br>MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | MIXER | PUMP | |
| H.P. | 1/3 | 1/4 | |
| VOLTS | 115-230 | 115-230 | |
| F.L.A. | 4.4-2.2 | 5.2-2.6 | |
| RPM | | | |

ACTUAL AMP
ACTUAL VOLT

MISCELLANEOUS EQUIPMENT INFORMATION
-----------------------------------

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

| | | |
|---|---|---|
| FLOOR PLAN EQUIPMENT NO. | - | 78 77 |
| TYPE OF EQUIPMENT | - | PANTS DRYER CABINET |
| EQUIPMENT CAPACITY | - | |
| MAKE/MODEL NUMBER | - | COLMAC |

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | EX. FAN | BLOWER | CONVEYER |
| H.P. | 1/2 | 1/2 | 1/16 |
| VOLTS | 115-230 | 115-230 | 115 |
| F.L.A. | 7.8-3.9 | | 3.6 |
| RPM | | | |
| ACTUAL AMP | | | |
| ACTUAL VOLT | | | |

MISCELLANEOUS EQUIPMENT INFORMATION

## FT. LEONARD WOOD LAUNDRY PLANT STUDY
## EQUIPMENT SURVEY

| | | |
|---|---|---|
| FLOOR PLAN EQUIPMENT NO. | - | 79 78 82 81 |
| TYPE OF EQUIPMENT | - | PANTS PRESS |
| EQUIPMENT CAPACITY | - | |
| MAKE/MODEL NUMBER | - | COLMAC |

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | FAN | | |
| H.P. | 1-1/2 | | |
| VOLTS | 208-220-440 | | |
| F.L.A. | 4.7-2.35 | | |
| RPM | | | |
| ACTUAL AMP | | | |
| ACTUAL VOLT | | | |

MISCELLANEOUS EQUIPMENT INFORMATION

3 HP STEAM
80 POUNDS AIR

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

| | | |
|---|---|---|
| FLOOR PLAN EQUIPMENT NO. | - | 86 |
| TYPE OF EQUIPMENT | - | DRYER - DRY CLEAN AREA |
| EQUIPMENT CAPACITY | - | |
| MAKE/MODEL NUMBER | - | |

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | TUMBLER | BLOWER | |
| H.P. | 1/2 | 3/4 | |
| VOLTS | 230-460 | | |
| F.L.A. | 2.6-1.3 | | |
| RPM | 1140 | | |
| ACTUAL AMP | | | |
| ACTUAL VOLT | | | |

MISCELLANEOUS EQUIPMENT INFORMATION

## FT. LEONARD WOOD LAUNDRY PLANT STUDY
## EQUIPMENT SURVEY

FLOOR PLAN EQUIPMENT NO. - 87 88 89 90

TYPE OF EQUIPMENT - DRYER - DRY CLEAN AREA

EQUIPMENT CAPACITY -

MAKE/MODEL NUMBER -

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | TUMBLER | BLOWER | |
| H.P. | 1/3 | 1/3 | |
| VOLTS | 220 | 220 | |
| F.L.A. | 1.6 | 1.6 | |
| RPM | | | |
| | | | |
| ACTUAL AMP | | | |
| ACTUAL VOLT | | | |

MISCELLANEOUS EQUIPMENT INFORMATION
-----------------------------------

## FT. LEONARD WOOD LAUNDRY PLANT STUDY
## EQUIPMENT SURVEY

FLOOR PLAN EQUIPMENT NO. - 92 91

TYPE OF EQUIPMENT - WASHER - DRY CLEAN AREA

EQUIPMENT CAPACITY - 110 POUNDS

MAKE/MODEL NUMBER - 110 SMS

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | TUMBLER | TUMBLER | PUMP |
| H.P. | 7-1/2 | 3 | 2 |
| VOLTS | 220-440 | 220-440 | 220-440 |
| F.L.A. | 21-10.5 | 11.6-5.8 | 6.8-3.4 |
| RPM | | | |

ACTUAL AMP
ACTUAL VOLT

MISCELLANEOUS EQUIPMENT INFORMATION
-----------------------------------

80-100 PSI AIR
60 PSI WATER
100 PSI STEAM

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

| | | |
|---|---|---|
| FLOOR PLAN EQUIPMENT NO. | - | 93 |
| TYPE OF EQUIPMENT | - | WASHER - DRY CLEAN AREA |
| EQUIPMENT CAPACITY | - | 70 POUND |
| MAKE/MODEL NUMBER | - | |

| MOTOR DATA | MOTOR #1 | MOTOR #2 | MOTOR #3 |
|---|---|---|---|
| SERVICE | TUMBLER | TUMBLER | PUMP |
| H.P. | 5 | 1/2 | 2 |
| VOLTS | 220-440 | 220-440 | 220-440 |
| F.L.A. | 13.5-6.75 | 5.4-2.7 | 9.2-4.6 |
| RPM | | | |
| ACTUAL AMP | | | |
| ACTUAL VOLT | | | |

MISCELLANEOUS EQUIPMENT INFORMATION

80-100 PSI AIR
60 PSI WATER
100 PSI STEAM

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

FLOOR PLAN EQUIPMENT NO. - 94 95 96

TYPE OF EQUIPMENT - DRY CLEAN AREA

EQUIPMENT CAPACITY -

MAKE/MODEL NUMBER - COPELAND

| MOTOR DATA | MOTOR #1 | MOTOR #2 | *2 EACH MOTOR #3 |
|---|---|---|---|
| SERVICE | COMPRESSOR | PUMP | COND. FAN |
| H.P. | | 1/2 | 1/3 |
| VOLTS | 208-230 | 115-230 | |
| F.L.A. | 47.5 | 8.0-4.0 | |
| RPM | | | |

ACTUAL AMP
ACTUAL VOLT

MISCELLANEOUS EQUIPMENT INFORMATION

EXHAUST FAN FOR COMPRESSOR - 1-1/2 HP 230-460 VOLTS 4-2

FT. LEONARD WOOD LAUNDRY PLANT STUDY
EQUIPMENT SURVEY

## MISCELLANEOUS EQUIPMENT LIST

| | | |
|---|---|---|
| PRESSING STATION (2 EACH) | | |
| | FOLDING TABLE | MODEL FF2<br>1 AMP 220 VOLT |
| | SHAPE POST | 1/2" STEAM LINE |
| | SHIRT PRESS | MODEL CRLYA1<br>2.5-2.75 BHP AT 100-140 PSI STEAM<br>0.53 CU. FT. AIR AT 80 PSI |
| | COLLAR PRESS | |
| | BAG SLEEVER | 1.75 BHP AT 100 PSI STEAM<br>0.03 CU. FT. AIR AT 80 PSI<br>0.166 CU. FT. FREE AIR |
| | LONG COAT PRESS | 1.75 BHP AT 100-125 PSI STEAM<br>0.03 CU. FT. AIR AT 80 PSI |
| PRESSING STATION (3 EACH) | | |
| | 3 MISCELLANEOUS PRESS | 95-100 POUND STEAM SUPPLY<br>70-80 POUND COMPRESSED AIR |
| AJAX PRESSING STATION | | |
| HANGER CONVEYOR | | 2 MOTORS<br>1/2 HP 115-208-230 |
| PRESSING STATION | | |
| | 13 INDIVIDUAL PRESSES | 1/2" STEAM LINES<br>1 BOILER HP<br>55 POUND AIR PRESSURE<br>85 POUND STEAM PRESSURE |
| 14 MARKING MACHINES | | COMPRESSED AIR |
| AIR COMPRESSORS | | TWI STAR MOD TA 0265 EC111JJ<br>125 LB 230 VOLT<br>TWI STAR TA225 WW2-125<br>60 HP |

APPENDIX "E"

COMPUTER INPUT

# PC-DOE/DOE-2.1B

B U I L D I N G   E N E R G Y   A N A L Y S I S   P R O G R A M

ORIGINALLY DEVELOPED BY:
LAWRENCE BERKELEY LABORATORY/UNIVERSITY OF CALIFORNIA

MODIFIED AND ENHANCED FOR THE PERSONAL COMPUTER BY:
CA SYSTEMS INTERNATIONAL, INC./LAKEWOOD, COLORADO

**LEGAL NOTICE**

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```
*   1 *  INPUT=LOADS  ..
-I   ULT - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  INPUT-UNITS    = ENGLISH
     T -                                                                  OUTPUT-UNITS   = ENGLISH
```

# L D L   P R O C E S S O R   I N P U T   D A T A

PC-DOE/DOE-2.1B  1/01/80  0:05  LDL RUN  1

```
 ABORT              ERRORS  ..
 DIAGNOSTIC         WARNINGS  ..
 LOADS-REPORT       VERIFICATION=(LV-A,LV-C)
                    SUMMARY=(LS-A)              ..

 TITLE LINE-1   *FORT LEONARD WOOD LAUNDRY PLANT STUDY*   ..

 BUILDING-LOCATION  LATITUDE=37    LONGITUDE=92
                    ALTITUDE=1158  TIME-ZONE=6
                    AZIMUTH=198    HOLIDAY=YES
                    DAYLIGHT-SAVINGS=YES
                    GROSS-AREA=47790              ..

 RUN-PERIOD         JAN 1 1987 THRU DEC 31 1987  ..


$*******CONSTRUCTION U-VALUES********$

 SIDING=CONSTRUCTION U-VALUE= 0.150  ..
 BU-ROOF=CONSTRUCTION  U-VALUE= 0.163  ..
 SLAB=CONSTRUCTION U-VALUE= 0.41  ..
 DOOR=CONSTRUCTION  U-VALUE= 0.55  ..
 DBPANE=GLASS-TYPE  PANES=2 GLASS-TYPE-CODE= 4   ..

$*********SCHEDULES*********$

 OCCUPY-1=SCHEDULE  THRU DEC 31,  (WD)  (1,6)   (0.0)
                                        (7,8)   (0.2)
                                        (9,15)  (1.0)
                                        (16,24)  (0.0)
                                  (WEH) (1,24)  (0.0)  ..
 EQUIPMENT=SCHEDULE THRU DEC 31,  (WD)  (1,6)   (0.0)
                                        (7,15)  (1.0)
                                        (16,24)  (0.0)
                                  (WEH) (1,24)  (0.0)  ..

$*********BUILDING RESOURCE*********$
 BUILDING-RESOURCE  GAS-SCHEDULE=OCCUPY-1
                    GAS-THERMS=50             ..

$*********SPACE DESCRIPTION*********$

 LAUNDRY=SPACE    X=0 Y=0 Z=0 AZIMUTH=0
                  AREA=47790  VOLUME=846045

                  TEMPERATURE=(72)  ZONE-TYPE=CONDITIONED

                  PEOPLE-SCHEDULE=OCCUPY-1
                  NUMBER-OF-PEOPLE=30
                  PEOPLE-HG-LAT=325
                  PEOPLE-HG-SENS=315

                  LIGHTING-SCHEDULE=EQUIPMENT
```

```
                LIGHTING-TYPE=SUS-FLUOR
                LIGHTING-KW=24

                EQUIP-SCHEDULE=EQUIPMENT
                EQUIPMENT-KW=133

                SOURCE-SCHEDULE=EQUIPMENT
                SOURCE-TYPE=HOT-WATER
                SOURCE-BTU/HR=5000000

                INF-METHOD=AIR-CHANGE
                INF-CFM/SQFT=0.01                 ..

        NORTH-WALL=EXTERIOR-WALL    X=0 Y=0 Z=0
                                    TILT=90  AZIMUTH=180
                                    HEIGHT=77.5  WIDTH=270
                                    CONSTRUCTION=SIDING     ..
                NORTH-WINDOW=WINDOW     HEIGHT=11.125  WIDTH=140
                                        GLASS-TYPE=DBPANE  ..

        EAST-WALL=EXTERIOR-WALL     X=0 Y=189 Z=0
                                    TILT=90  AZIMUTH=270
                                    HEIGHT=17.25  WIDTH=207
                                    CONSTRUCTION=SIDING     ..
                EAST-WINDOW=WINDOW      HEIGHT=6.4     WIDTH=63.9
                                        GLASS-TYPE=DBPANE  ..

        SOUTH-WALL=EXTERIOR-WALL    X=270 Y=189 Z=0
                                    TILT=90  AZIMUTH=0
                                    HEIGHT=14.5  WIDTH=270
                                    CONSTRUCTION=SIDING     ..
                SOUTH-WINDOW=WINDOW     HEIGHT=6.4  WIDTH=123.5
                                        GLASS-TYPE=DBPANE   ..

        WEST-WALL=EXTERIOR-WALL     X=270  Y=0  Z=0
                                    TILT=90  AZIMUTH=90
                                    HEIGHT=17.25  WIDTH=207
                                    CONSTRUCTION=SIDING     ..
                WEST-WINDOW=WINDOW      HEIGHT=6.4  WIDTH=56.25
                                        GLASS-TYPE=DBPANE    ..

        FLOOR=UNDERGROUND-FLOOR     X=0 Y=0 Z=0
                                    TILT=180 AZIMUTH=180
                                    HEIGHT=177  WIDTH=270
                                    CONSTRUCTION=SLAB     ..

        CEILING1=ROOF               X=0 Y=18 Z=14.5
                                    TILT=25  AZIMUTH=180
                                    HEIGHT=180  WIDTH=270
                                    CONSTRUCTION=BU-ROOF  ..
        CEILING2=ROOF               X=15 Y=0 Z=14.5
                                    TILT=7  AZIMUTH=180
                                    HEIGHT=18 WIDTH=45
                                    CONSTRUCTION=BU-ROOF  ..
        CEILING3=ROOF               X=180 Y=180 Z=14.5
                                    TILT=7 AZIMUTH=180
                                    HEIGHT=27  WIDTH=90
                                    CONSTRUCTION=BU-ROOF  ..
END ..
COMPUTE=LOADS ..

INPUT=SYSTEMS ..
```

SDL PROCESSOR INPUT DATA

PC-DOE/DOE-2.1B 1/01/80 0:05 SDL RUN 1

```

      SYSTEMS-REPORT   VERIFICATION=(SV-A)
                       SUMMARY=(SS-D)  ..

      HEAT-1=SCHEDULE  THRU DEC 31, (ALL) (1,24) (70.)  ..

      HEAT-2=ZONE-CONTROL  DESIGN-HEAT-T=70  DESIGN-COOL-T=70
                           THERMOSTAT-TYPE=TWO-POSITION
                           HEAT-TEMP-SCH=HEAT-1          ..

      LAUNDRY=ZONE     ZONE-TYPE=CONDITIONED
                       EXHAUST-CFM=55000
                       EXHAUST-KW=.00034
                       ZONE-CONTROL=HEAT-2    ..

      UNITHEAT=SYSTEM SYSTEM-TYPE=UHT
                      MAX-SUPPLY-T=200  MIN-SUPPLY-T=70
                      ZONE-NAMES=(LAUNDRY)  ..

      PLANT-1=PLANT-ASSIGNMENT  SYSTEM-NAMES=(UNITHEAT)  ..

  END ..
  COMPUTE=SYSTEMS ..

  INPUT=PLANT  ..
```

P D L   P R O C E S S O R   I N P U T   D A T A

PC-DOE/DOE-2.1B  1/01/80  0:05  PDL RUN  1

```
      PLANT-REPORT    VERIFICATION=(PV-A)
                      SUMMARY=(BEPS,PS-A,PS-C,PS-D,PS-G,PS-H)  ..

      PLANT-1=PLANT-ASSIGNMENT ..

      BOILER1=PLANT-EQUIPMENT      TYPE=STM-BOILER  SIZE=17.2
                                   INSTALLED-NUMBER=2
                                   MAX-NUMBER-AVAIL=2    ..
      BOILER2=PLANT-EQUIPMENT      TYPE=STM-BOILER  SIZE=13.39
                                   INSTALLED-NUMBER=2
                                   MAX-NUMBER-AVAIL=2    ..

      PLANT-PARAMETERS             BOILER-FUEL=LPG
                                   STM-PRES=105      ..

      HEAT=LOAD-ASSIGNMENT         TYPE=HEATING
                                   LOAD-RANGE=35
                                   PLANT-EQUIPMENT=BOILER1  NUMBER=2
                                   LOAD-RANGE=60
                                   PLANT-EQUIPMENT=BOILER1  NUMBER=1
                                   PLANT-EQUIPMENT=BOILER2  NUMBER=2  ..

      LOAD-MANAGEMENT              PRED-LOAD-RANGE=999
                                   LOAD-ASSIGNMENT=(HEAT,DEFAULT,DEFAULT)  ..


END ..
COMPUTE=PLANT  ..
STOP    ..
```

APPENDIX "F"

COMPUTER OUTPUT

B U I L D I N G   E N E R G Y   A N A L Y S I S   P R O G R A M

ORIGINALLY DEVELOPED BY:
LAWRENCE BERKELEY LABORATORY/UNIVERSITY OF CALIFORNIA

MODIFIED AND ENHANCED FOR THE PERSONAL COMPUTER BY:
CA SYSTEMS INTERNATIONAL, INC./LAKEWOOD, COLORADO

**L E G A L   N O T I C E**

REPORT- LV-A GENERAL PROJECT AND BUILDING INPUT

---

PERIOD OF STUDY

| STARTING DATE | ENDING DATE | NUMBER OF DAYS |
|---|---|---|
| 1 JAN 1987 | 31 DEC 1987 | 365 |

SITE CHARACTERISTIC DATA

| STATION NAME | LATITUDE (DEG) | LONGITUDE (DEG) | ALTITUDE (FT) | TIME ZONE | BUILDING AZIMUTH (DEG) |
|---|---|---|---|---|---|
| TMY SPRINGFIELD MO | 37.0 | 93.0 | 1156. | 6 CST | 198.0 |

REPORT- LV-C DETAILS OF SPACE    LAUNDRY

DATA FOR SPACE    LAUNDRY

LOCATION OF ORIGIN IN BUILDING COORDINATES

| XB (FT) | YB (FT) | ZB (FT) | SPACE AZIMUTH (DEG) | SPACE MULTIPLIER | HEIGHT (FT) | AREA (SQFT ) | VOLUME (CUFT ) |
|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 | 1.0 | 17.7 | 47790.0 | 846045.0 |

| TOTAL NUMBER OF SURFACES | NUMBER OF EXTERIOR SURFACES | NUMBER OF INTERIOR SURFACES | NUMBER OF UNDERGROUND SURFACES |
|---|---|---|---|
| 8 | 7 | 0 | 1 |

NUMBER OF SUBSURFACES

| TOTAL | WINDOWS | DOORS |
|---|---|---|
| 4 | 4 | 0 |

| FLOOR WEIGHT (LB/SQFT ) | CALCULATION TEMPERATURE (F ) |
|---|---|
| 70.0 | 72.0 |

INFILTRATION

| SCHEDULE | INFILTRATION CALCULATION METHOD | F.R.PER SQFT | AIR CHANGES PER HOUR | HEIGHT TO NEUTRAL ZONE (FT) |
|---|---|---|---|---|
| | AIR-CHANGE | 0.01 | 0.00 | 0.0 |

PEOPLE

| SCHEDULE | NUMBER | AREA PER PERSON (SQFT ) | PEOPLE ACTIVITY (BTU/HR ) | PEOPLE SENSIBLE (BTU/HR ) | PEOPLE LATENT (BTU/HR ) |
|---|---|---|---|---|---|
| OCCUPY-1 | 30.0 | 1593.0 | 0.0 | 315.0 | 325.0 |

LIGHTING

| SCHEDULE | LIGHTING TYPE | LOAD (WATTS/ SQFT ) | LOAD (KW) | FRACTION OF LOAD TO SPACE |
|---|---|---|---|---|
| EQUIPMENT | SUS-FLUOR | 0.00 | 24. | 1.00 |

ELECTRICAL EQUIPMENT

| SCHEDULE | ELEC LOAD (WATTS/ SQFT ) | ELEC LOAD (KW) | FRACTION OF LOAD TO SPACE | |
|---|---|---|---|---|
| | | | SENSIBLE | LATENT |
| EQUIPMENT | 0.00 | 133. | 1.00 | 0.00 |

OTHER EQUIPMENT

| SCHEDULE | SOURCE TYPE | LOAD (BTU/HR) | FRACTION OF LOAD TO SPACE | |
|---|---|---|---|---|
| | | | SENSIBLE | LATENT |
| EQUIPMENT | HOT-WATER | 500000.0 | 1.00 | 0.00 |

EXTERIOR SURFACES

| SURFACE | MULTIPLIER | AREA (SQFT ) | WIDTH (FT) | HEIGHT (FT) | CONSTRUCTION | U-VALUE (BTU/HR-SQFT-F) | SURFACE TYPE |
|---|---|---|---|---|---|---|---|
| NORTH-WALL | 1.0 | 20925. | 270.00 | 77.50 | SIDING | 0.15 | QUICK |
| EAST-WALL | 1.0 | 3571. | 207.00 | 17.25 | SIDING | 0.15 | QUICK |
| SOUTH-WALL | 1.0 | 3915. | 270.00 | 14.50 | SIDING | 0.15 | QUICK |
| WEST-WALL | 1.0 | 3571. | 207.00 | 17.25 | SIDING | 0.15 | QUICK |
| CEILING1 | 1.0 | 48600. | 270.00 | 180.00 | BU-ROOF | 0.16 | QUICK |
| CEILING2 | 1.0 | 810. | 45.00 | 18.00 | BU-ROOF | 0.16 | QUICK |
| CEILING3 | 1.0 | 2430. | 90.00 | 27.00 | BU-ROOF | 0.16 | QUICK |

| SURFACE | AZIMUTH (DEG) | TILT (DEG) | LOCATION OF ORIGIN IN BUILDING COORDINATES XB (FT) | YB (FT) | ZB (FT) | LOCATION OF ORIGIN IN SPACE COORDINATES X (FT) | Y (FT) | Z (FT) |
|---|---|---|---|---|---|---|---|---|
| NORTH-WALL | 180.0 | 90.0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| EAST-WALL | 270.0 | 90.0 | 0.00 | 189.00 | 0.00 | 0.00 | 189.00 | 0.00 |
| SOUTH-WALL | 0.0 | 90.0 | 270.00 | 189.00 | 0.00 | 270.00 | 185.00 | 0.00 |
| WEST-WALL | 90.0 | 90.0 | 270.00 | 0.00 | 0.00 | 270.00 | 0.00 | 0.00 |
| CEILING1 | 180.0 | 25.0 | 0.00 | 18.00 | 14.50 | 0.00 | 18.00 | 14.50 |
| CEILING2 | 180.0 | 7.0 | 15.00 | 0.00 | 14.50 | 15.00 | 0.00 | 14.50 |
| CEILING3 | 180.0 | 7.0 | 180.00 | 180.00 | 14.50 | 180.00 | 180.00 | 14.50 |

REPORT- LV-C DETAILS OF SPACE LAUNDRY

-------------------------------------------------------------------------------------------(CONTINUED)--------

UNDERGROUND SURFACES

| SURFACE | MULTIPLIER | AREA (SQFT ) | CONSTRUCTION | U-VALUE (BTU/HR-SQFT-F) |
|---|---|---|---|---|
| FLOOR | 1.0 | 47790. | SLAB | 0.41 |

WINDOWS

| WINDOW | MULTIPLIER | AREA (SQFT ) | SHADING COEFF | NUMBER OF PANES | GLASS TYPE INDEX | SET-BACK (FT) | WIDTH (FT) | HEIGHT (FT) | SKY FORM FACTOR | GROUND FORM FACTOR |
|---|---|---|---|---|---|---|---|---|---|---|
| NORTH-WINDOW | 1.0 | 1556. | 1.00 | 2 | 4 | 0.00 | 140.00 | 11.13 | | |
| EAST-WINDOW | 1.0 | 409. | 1.00 | 2 | 4 | 0.00 | 63.90 | 6.40 | | |
| SOUTH-WINDOW | 1.0 | 790. | 1.00 | 2 | 4 | 0.00 | 123.50 | 6.40 | | |
| WEST-WINDOW | 1.0 | 360. | 1.00 | 2 | 4 | 0.00 | 56.25 | 6.40 | | |

| WINDOW | LOCATED IN SURFACE | LOCATION IN ORIGIN IN BUILDING COORDINATES XB (FT) | YB (FT) | ZB (FT) | LOCATION OF ORIGIN IN SURFACE COORDINATES X (FT) | Y (FT) |
|---|---|---|---|---|---|---|
| NORTH-WINDOW | NORTH-WALL | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| EAST-WINDOW | EAST-WALL | 0.00 | 189.00 | 0.00 | 0.00 | 0.00 |
| SOUTH-WINDOW | SOUTH-WALL | 270.00 | 189.00 | 0.00 | 0.00 | 0.00 |
| WEST-WINDOW | WEST-WALL | 270.00 | 0.00 | 0.00 | 0.00 | 0.00 |

REPORT- LS-A SPACE PEAK LOADS SUMMARY

| SPACE NAME | MULTIPLIER SPACE | MULTIPLIER FLOOR | COOLING LOAD (KBTU/HR) | TIME OF PEAK | DRY-BULB | WET-BULB | HEATING LOAD (KBTU/HR) | TIME OF PEAK | DRY-BULB | WET-BULB |
|---|---|---|---|---|---|---|---|---|---|---|
| LAUNDRY | 1. | 1. | 5520.044 | JUL 31 3 PM | 93.F | 77.F | -1345.459 | FEB 2 6 AM | 14.F | 13.F |
| SUM | | | 5520.044 | | | | -1345.459 | | | |
| BUILDING PEAK | | | 5520.044 | JUL 31 3 PM | 93.F | 77.F | -1345.459 | FEB 2 6 AM | 14.F | 13.F |

MESSAGE LIST FROM SYSTEMS     PROGRAM

***ERROR*************************************************************************
ZONE LAUNDRY          IN SYSTEM UNITHEAT          HAS UNUSED EXHAUST SPECIFIED

REPORT- SV-A SYSTEM DESIGN PARAMETERS UNITHEAT

| SYSTEM NAME | ALTITUDE MULTIPLIER |
|---|---|
| UNITHEAT | 1.040 |

| SUPPLY FAN (CFM ) | ELEC (KW) | DELTA-T (F) | RETURN FAN (CFM ) | ELEC (KW) | DELTA-T (F) | OUTSIDE AIR RATIO | COOLING CAPACITY (KBTU/HR) | SENSIBLE (SHR) | HEATING CAPACITY (KBTU/HR) | COOLING EIR (BTU/BTU) | HEATING EIR (BTU/BTU) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 57200. | 0.000 | 0.2 | 0. | 0.000 | 0.0 | 0.000 | 0.000 | 0.000 | 0.000 | 0.00 | 0.00 |

| ZONE NAME | SUPPLY FLOW | EXHAUST FLOW | FAN (KW) | MINIMUM FLOW RATIO | OUTSIDE AIR FLOW | COOLING CAPACITY (KBTU/HR) | SENSIBLE (SHR) | EXTRACTION RATE (KBTU/HR) | HEATING CAPACITY (KBTU/HR) | ADDITION RATE (KBTU/HR) | MULTIPLIER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LAUNDRY | 57200. | 57200. | 22.550 | 1.000 | 0. | 0.00 | 0.00 | 0.00 | -7671.53 | -7683.93 | 1.0 |

REPORT- SS-D PLANT MONTHLY LOADS SUMMARY FOR PLANT-1

| | - - - COOLING - - - | | | | | | - - - HEATING - - - | | | | | | - - - ELEC - - - | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MONTH | COOLING ENERGY (MBTU) | TIME OF MAX DY | HR | DRY-BULB TEMP | WET-BULB TEMP | MAXIMUM COOLING LOAD (KBTU/HR) | HEATING ENERGY (MBTU) | TIME OF MAX DY | HR | DRY-BULB TEMP | WET-BULB TEMP | MAXIMUM HEATING LOAD (KBTU/HR) | ELEC-TRICAL ENERGY (KWH) | MAXIMUM ELEC LOAD (KW) |
| JAN | 0.00000 | | | | | 0.000 | -139.699 | 19 | 6 | 25.F | 25.F | -1064.633 | 29744. | 157.001 |
| FEB | 0.00000 | | | | | 0.000 | -141.005 | 2 | 6 | 14.F | 13.F | -1277.175 | 26918. | 157.001 |
| MAR | 0.00000 | | | | | 0.000 | -130.380 | 15 | 6 | 17.F | 15.F | -1156.213 | 31152. | 157.001 |
| APR | 0.00000 | | | | | 0.000 | -48.357 | 13 | 6 | 29.F | 29.F | -1007.847 | 31111. | 157.001 |
| MAY | 0.00000 | | | | | 0.000 | -20.871 | 11 | 6 | 39.F | 36.F | -763.813 | 28871. | 157.001 |
| JUN | 0.00000 | | | | | 0.000 | -0.068 | 1 | 6 | 65.F | 62.F | -46.969 | 31086. | 157.001 |
| JUL | 0.00000 | | | | | 0.000 | 0.000 | | | | | 0.000 | 31085. | 157.001 |
| [illegible] | 0.00000 | | | | | 0.000 | 0.000 | | | | | 0.000 | 29673. | 157.001 |
| SEP | 0.00000 | | | | | 0.000 | 0.000 | | | | | 0.000 | 31086. | 157.001 |
| OCT | 0.00000 | | | | | 0.000 | -17.166 | 19 | 6 | 35.F | 33.F | -522.181 | 29662. | 157.001 |
| NOV | 0.00000 | | | | | 0.000 | -45.805 | 2 | 6 | 25.F | 21.F | -822.797 | 26870. | 157.001 |
| DEC | 0.00000 | | | | | 0.000 | -131.038 | 27 | 7 | 15.F | 15.F | -1106.509 | 31152. | 157.001 |
| TOTAL | 0.000 | | | | | | -674.393 | | | | | | 357829. | |
| MAX | | | | | | 0.000 | | | | | | -1277.175 | | 157.0 |

REPORT- PV-A EQUIPMENT SIZES

| E Q U I P M E N T | SIZE (MBTU/) | NUMBER INSTD | AVAIL | SIZE (MBTU/) | NUMBER INSTD | AVAIL | SIZE (MBTU/) | NUMBER INSTD | AVAIL | SIZE (MBTU/) | NUMBER INSTD | AVAIL | SIZE (MBTU/) | NUMBER INSTD | AVAIL | SIZE (MBTU/) | NUMBER INSTD | AVAIL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STM-BOILER | 13.390 | 2 | 2 | 17.200 | 2 | 2 | | | | | | | | | | | | |

REPORT- PS-A PLANT ENERGY UTILIZATION SUMMARY

| | SITE ENERGY | | | | | | | | | | | | SOURCE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| MONTH | TOTAL HEAT LOAD | TOTAL COOLING LOAD | TOTAL ELECTR LOAD | RCVRED ENERGY | WASTED RCVRABL ENERGY | HEAT INPUT COOLING | ELEC INPUT COOLING | FUEL INPUT HEATING | ELEC INPUT HEATING | FUEL INPUT ELECT | TOTAL FUEL INPUT | TOTAL SITE ENERGY | TOTAL SOURCE ENERGY |
| JAN | 1087.3 | 0.0 | 185.5<br>54.4E | 0.0 | 0.0 | 0.0 | 0.0<br>0.0E | 1787.0 | 84.0<br>24.6E | 0.0 | 2564.0 | 2749.5 | 3195.1 |
| FEB | 998.3 | 0.0 | 169.2<br>49.6E | 0.0 | 0.0 | 0.0 | 0.0<br>0.0E | 1641.6 | 77.3<br>22.7E | 0.0 | 2344.6 | 2513.8 | 2920.1 |
| MAR | 1122.6 | 0.0 | 192.9<br>56.5E | 0.0 | 0.0 | 0.0 | 0.0<br>0.0E | 1844.2 | 86.6<br>25.4E | 0.0 | 2658.2 | 2851.1 | 3314.4 |
| APR | 1039.8 | 0.0 | 185.5<br>54.3E | 0.0 | 0.0 | 0.0 | 0.0<br>0.0E | 1703.4 | 79.3<br>23.2E | 0.0 | 2517.4 | 2702.9 | 3148.3 |
| MAY | 921.8 | 0.0 | 166.5<br>48.8E | 0.0 | 0.0 | 0.0 | 0.0<br>0.0E | 1508.6 | 70.0<br>20.5E | 0.0 | 2248.6 | 2415.1 | 2815.0 |
| JUN | 95[illegible] | 0.0 | 181.0<br>53.0E | 0.0 | 0.0 | 0.0 | 0.0<br>0.0E | 1619.0 | 74.9<br>22.0E | 0.0 | 2433.0 | 2614.0 | 3048.7 |
| JUL | 99[illegible].0 | 0.0 | 181.0<br>53.0E | 0.0 | 0.0 | 0.0 | 0.0<br>0.0E | 1618.8 | 74.9<br>22.0E | 0.0 | 2432.8 | 2613.8 | 3048.5 |
| AUG | 945.0 | 0.0 | 172.8<br>50.6E | 0.0 | 0.0 | 0.0 | 0.0<br>0.0E | 1545.2 | 71.5<br>21.0E | 0.0 | 2322.2 | 2495.0 | 2910.0 |
| SEP | 991.0 | 0.0 | 181.0<br>53.0E | 0.0 | 0.0 | 0.0 | 0.0<br>0.0E | 1618.8 | 74.9<br>22.0E | 0.0 | 2432.8 | 2613.8 | 3048.5 |
| OCT | 963.0 | 0.0 | 174.4<br>51.1E | 0.0 | 0.0 | 0.0 | 0.0<br>0.0E | 1575.8 | 73.1<br>21.4E | 0.0 | 2352.8 | 2527.2 | 2946.0 |
| NOV | 902.2 | 0.0 | 164.6<br>47.0E | 0.0 | 0.0 | 0.0 | 0.0<br>0.0E | 1478.4 | 68.9<br>20.2E | 0.0 | 2181.4 | 2341.9 | 2727.8 |
| DEC | 1123.3 | 0.0 | 193.0<br>56.5E | 0.0 | 0.0 | 0.0 | 0.0<br>0.0E | 1845.3 | 86.7<br>25.4E | 0.0 | 2659.3 | 2852.3 | 3315.7 |
| | ======= | ======= | ======= | ======= | ======= | ======= | ======= | ======= | ======= | ======= | ======= | ======= | ======= |
| | 12073.3 | 0.0 | 2143.5<br>626.0E | 0.0 | 0.0 | 0.0 | 0.0<br>0.0E | 19786.2 | 922.3<br>270.2E | 0.0 | 29147.2 | 31290.7 | 36437.9 |

NOTE-- ALL ENTRIES ARE IN MBTU EXCEPT
ENTRIES FOLLOWED BY E ARE IN MWH (THOUSANDS OF KWH)

REPORT- PS-C EQUIPMENT PART LOAD OPERATION

| EQUIPMENT | HOURS AT PERCENT PART LOAD RATIO | | | | | | | | | | | TOTAL HOURS | ANNUAL LOAD (MBTU) | FALSE LOAD (MBTU) | ELEC USED (MBTU) | THERMAL USED (MBTU) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 — 10 | -- 20 | — 30 | -- 40 | -- 50 | -- 60 | — 70 | -- 80 | -- 90 | — 100 | - 110+ | | | | | |
| STM-BOILER | 1089 | 0 | 2277 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3366 | 12073.6 | 0.0 | 988.2 | 19788.[illegible] |
| | 3366 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |

HOT LOOP CIRCULATION PUMP ELECTRICAL USE = 0.0 MBTU
COLD LOOP CIRCULATION PUMP ELECTRICAL USE = 0.0 MBTU

NOTES TO TABLE

1) THE FIRST PART LOAD ENTRY FOR EACH PIECE OF EQUIPMENT IS THE HOURLY LOAD DIVIDED BY THE HOURLY OPERATING CAPACITY

2) THE SECOND PART LOAD ENTRY FOR EACH PIECE OF EQUIPMENT IS THE HOURLY LOAD DIVIDED BY THE TOTAL INSTALLED CAPACITY

REPORT- PS-D PLANT LOADS SATISFIED

| HEATING INPUTS | MBTU SUPPLIED | PCT OF TOTAL LOAD |
|---|---|---|
| STM-BOILER | 12073.6 | 100.0 |
| LOAD SATISFIED | 12073.6 | 100.0 |
| TOTAL LOAD ON PLANT | 12073.6 | |

| ELECTRICAL INPUTS | MBTU SUPPLIED | PCT OF TOTAL LOAD |
|---|---|---|
| ELECTRICITY | 2143.5 | 100.0 |
| LOAD SATISFIED | 2143.5 | 100.0 |
| TOTAL LOAD ON PLANT | 2143.5 | |

SUMMARY OF LOADS MET

| TYPE OF LOAD | TOTAL LOAD (MBTU) | LOAD SATISFIED (MBTU) | TOTAL OVERLOAD (MBTU) | PEAK OVERLOAD (MBTU) | HOURS OVERLOADED |
|---|---|---|---|---|---|
| HEATING INPUTS | 12073.6 | 12073.6 | 0.000 | 0.000 | 0 |
| ELECTRICAL INPUTS | 2143.5 | 2143.5 | 0.000 | 0.000 | 0 |

REPORT- PS-6 ELECTRICAL LOAD SCATTER PLOT

TOTAL HOURS AT HOURLY DEMAND AND TIME OF DAY

| | HOUR | 1AM | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1PM | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 551 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 508 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 466 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 424 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 381 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E | 339 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M K | 296 | 0 | 0 | 0 | 0 | 0 | 0 | 253 | 253 | 253 | 253 | 253 | 253 | 253 | 253 | 253 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2277 |
| A W | 254 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N | 212 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| D | 169 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 127 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 84 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 42 | 365 | 365 | 365 | 365 | 365 | 365 | 112 | 112 | 112 | 112 | 112 | 112 | 112 | 112 | 112 | 365 | 365 | 365 | 365 | 365 | 365 | 365 | 365 | 365 | 6483 |
| | PERCENT TOTAL DEMAND | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 10.9 | 10.9 | 10.9 | 10.9 | 10.9 | 10.9 | 10.9 | 10.9 | 10.9 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | |

PEAK ELECTRICAL LOAD BREAKDOWN

| SOURCE | KW | PCT |
|---|---|---|
| SYSTEMS LOAD | 157.002 | 58.6 |
| STM-BOILER | 110.871 | 41.4 |
| TOTAL | 267.873 | |

REPORT- PS-H EQUIPMENT USE STATISTICS

| EQUIPMENT | AVG OPER RATIO | MAX LOAD (MBTU) | MON | DAY | HR | SIZE (MBTU) | OPER HRS | SIZE (MBTU) | OPER HRS | SIZE (MBTU) | OPER HRS | SIZE (MBTU) | OPER HRS | SIZE (MBTU) | OPER HRS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STM-BOILER | 0.205 | 5.000 | 12 | 31 | 15 | 13.390 | 0 | 17.200 | 3366 | | | | | | |

REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE

---

| ENERGY TYPE IN SITE MBTU - | ELECTRICITY | LPG | NATURAL-GAS |
|---|---|---|---|
| CATEGORY OF USE | | | |
| SPACE HEAT | 60.57 | 1169.77 | 0.00 |
| SPACE COOL | 0.00 | 0.00 | 0.00 |
| HVAC AUX | 1.16 | 0.00 | 0.00 |
| DOM HOT WTR | 861.56 | 18616.28 | 0.00 |
| AUX SOLAR | 0.00 | 0.00 | 0.00 |
| LIGHTS | 186.51 | 0.00 | 0.00 |
| VERT TRANS | 0.00 | 0.00 | 0.00 |
| MISC EQUIP | 1033.58 | 0.00 | 9361.14 |
| TOTAL | 2143.38 | 19786.05 | 9361.14 |

TOTAL SITE ENERGY 31290.65 MBTU 654.6 KBTU/SQFT-YR GROSS-AREA 654.6 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 36437.90 MBTU 762.5 KBTU/SQFT-YR GROSS-AREA 762.5 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.0
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0

NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

APPENDIX "G"

CONTRACT DOCUMENTS

24. Equipping dryer exhaust with heat exchanger for preheating incoming air to dryer

25. Verify that supply steam and condensate system is functioning in the most efficient manner.

26. Utilization of high temperature, oil heated processes rather than steam

27. Use of cold water laundering

28. Waste heat recovery

29. Efficiency of compressed air system

30. Thermal storage

31. Shut off steam supply during non use hours

CEMRK-ED-MF Revised 6 September 1988

ANNEX A

ENERGY CONSERVATION OPPORTUNITIES

LAUNDRY STUDY

FORT LEONARD WOOD, MISSOURI

1. Insulation (wall, roof, pipe, duct, etc.)
2. Insulated glass or double glazed windows
3. Weather stripping & Caulking
4. Solar films
5. Vestibules
6. Reduction of glass area
7. Shutdown energy to hot water heaters or modify controls
8. Energy conserving fluorescent lamps and ballasts
9. Reduce lighting levels
10. Replace incandescent lighting
11. Use more efficient lighting source
12. Infrared heaters
13. Heat reclaim from laundry equipment
14. Heat destratification
15. Heat recovery from laundry wash water
16. Booster heaters at major hot water users
17. Lower processing hot water temperature
18. Make HVAC operations more efficient
19. Steam traps (size, operation, type)
20. Optimize laundry facilities operation (space utilization, more efficient equipment-operational procedures)
21. Use air curtains/plastic strips at personnel entrances
22. Dryers equipped with temperature sensor located on discharge duct. Sensor to provide information to stop heating during drying cycle at the most energy efficient point.
23. Recycling of rinse water for a following wash cycle.

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ANNEX B
ENERGY SURVEYS OF LAUNDRY FACILITIES
ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)
FORT LEONARD WOOD, MISSOURI

DETAILED SCOPE OF WORK

1. This project involves the review for information of the previously completed EEAP study and any other studies performed at this installation, reevaluation of selected projects and energy conservation opportunities (ECOs) for economic feasibility based upon revised criteria, evaluation of selected ECOs to determine energy savings potential, a limited site survey of buildings, preparation of new programming documents based upon recommendations, and the preparation of a comprehensive report of work performed with results and recommendations.

2. Authorization. This project is authorized by CEEC-EE (1110) later dated 15 Nov 87, subject: FY 88 Energy Engineer Analysis Program (EEAP) for Kansas City District.

3. Services to be performed by the Contractor. The A-E shall perform and shall assume responsibility for the accuracy of the work and completeness of the following services in connection with the above project in accordance with the General Scope of Work as amended by criteria and instructions listed herein. Quality of work accomplished under this contract will be a determining factor in consideration of the A/E for future work.

(1) POC at Fort Leonard Wood will be Mr. Jack DeShurly (314) 368-2177.

(2) POC at Kansas City District will be David Werner at (816) 426-2782 or 2783.

4. Submittals. Work detailed in paragraph 3, above, will be completed in accordance with the General Scope of Work.

5. Distribution.

a. Twelve (12) sets of each submittal shall be furnished to reviewers in accordance with the following distribution schedule.

Commander
U.S. Army Engineer District, Kansas City
ATTN: CEMRK-ED-MF/David Werner
700 Federal Building
Kansas City, Missouri 64106-2896
2 copies

Commander
Missouri River Division
ATTN: CEMRD-MD-ED
P.O. Box 103, Downtown Station
Omaha, Nebraska 68101-0103
2 copies

Commander
Huntsville Division
ATTN: HNDED-PM/Ganus
P.O. Box 1600, West Station
Huntsville, Alabama 35807-4301 — 2 copies

Commander
HQUSACE, ATTN: CEEC-EE/McCormick
Washington, DC 20314-1000 — 1 copy

Commander
USALEA
ATTN: DALO-LEP/MAJ Heibel
New Cumberland Army Depot
New Cumberland, PA 17070-5007 — 1 copy

Commander
HQ, TRADOC
ATTN: ATEN-FE
Ft. Monroe, VA 23351 — 1 copy

Commander
Ft. Leonard Wood
ATTN: ATZT-CS-EC/DeShurly/
Ft. Leonard Wood, Missouri 65473 — copies

b. Survey forms will be sent to MRKED-MF and Fort Leonard Wood, Missouri only.

6. Data, Information and Services to be Furnished by the Government. The Government will furnish the following data, information, and services:

a. DOD Construction Criteria Manual, DOD 4270.1-M.

b. Energy Conservation Investment Program (ECIP) Guidance, dated 10 Aug 82, and revision dated 4 Mar 85.

c. ETLS 1110-3-254, Use of Electric Power Comfort Space Heating, 1110-3-282, Energy Conservation and 1110-3-294, Interior Design Temperatures.

d. TM 5-785, Engineering Weather Data, TM 5-800-2, General Criteria Preparation of Cost Estimates, TM 5-800-3, Project Development Brochure.

e. AR 415-15, Military Construction Army (MCA) Program Development, AR 415-17, Cost Estimating for Military Programming, AR 415-20, Construction, Project Development and Design Approval, AR 415-28, Department of the Army Facility Classes and Construction Categories, AR 415-35, Construction, Minor Construction, AR 420-10, General Provisions, Organization,, Functions and Personnel, and AR 5-4, Change No. 1, Department of the Army Productivity Improvement Program.

f. Army Facility Energy Plan.

g. An example of a correctly completed programming document for an EC project.

7. Completion Schedule. The A/E shall complete the work and services for each increment as follows:

a. Interim submittal - within one Hundred and Fifty (150) calendar days of Notice to Proceed.

b. Prefinal submittal - within thirty (60) calendar days of interim. submittal.

c. Final submittal-with thirty (30) calendar days of prefinal submittal.

The A/E shall allow a period of approximately forth-five (45) days for review by Government forces for each submission. Presentation of each submission will occur upon completion of the review period for that submission.

8. Method of Payment.

a. Title I Services - Study & Report. Payment for the study & report work and services will be made in accordance with the following procedures:

Partial Payment. The Architect-Engineer shall prepare and submit to the U.S. Army Engineer District, Kansas City, partial payment estimates using ENG Form 93, which shall serve as the request for payment. All partial payments shall be based on work completed as of the 15th day of the report month and shall be submitted to the office of the Contracting Officer by the 18th day of the month. The pay estimate shall be submitted with ENG Form 93 in accordance with the "Instructions for Completion of ENG Form 93 - Payment Estimate," dated 5 January 1983. The U.S. Army Engineer District, Kansas City, will prepare supporting payment documents after obtaining necessary approvals and forward all documents to the U.S. Army Engineer District, Omaha, for issuance of the payment check. All questions regarding payments shall be directed to the U.S. Army Engineer District, Kansas City.

b. Additional Conferences. Payment for furnishing the services of technically qualified representatives to attend conferences other than the review conferences specified above, when so requested in writing by the Contracting Officer, will be made at rate per hour for the discipline involved plus travel expenses computed in accordance with Government Joint Travel Regulations in effect at the time travel is performed and actual cost of transportation. Payment for attending additional conferences shall be made after submittal of an ENG Form 93.

9. Fees. Subject to the provisions of Clause 39 of the Contract Clauses of the contract and paragraph 8 above, except as noted below, payment for work and services performed under the contract will be as follows:

a. Title I.

Study and Report. Upon completion and acceptance of all work and services required, the Architect-Engineer shall be paid the sum of THIRTY-NINE THOUSAND THREE HUNDRED EIGHTY-SEVEN DOLLARS AND NO CENTS ($ 39,387.00), less any partial payments previously made therefor.

b. Additional Conferences. For furnishing the services of technically qualified representatives to attend conferences other than those specified, the Architect-Engineer shall be paid:

1. For professional services, at the following rates which include direct labor, overheads and profits, for actual time spent in connection with the project, computed from time of departure from the Architect-Engineer's office to time of return thereto, but limited to 8 hours per day or fractional part thereof, per person, based on normal workhours.

| | |
|---|---|
| Principal | $67.98 ($28.85 x 114.2% OH x 10% Profit) |
| Project Manager | $51.65 ($21.92 x 114.2% OH x 10% Profit) |
| Engineer I | $39.42 ($16.73 x 114.2% OH x 10% Profit) |
| Engineer II | $31.26 ($13.27 x 114.2% OH x 10% Profit) |
| Technician I | $20.03 ($ 8.50 x 114.2% OH x 10% Profit) |
| Technician II | $14.72 ($ 6.25 x 114.2% OH x 10% Profit) |
| Drafter | $20.03 ($ 8.50 x 114.2% OH x 10% Profit) |
| Clerical | $28.27 ($12.00 x 114.2% OH x 10% Profit) |

2. For travel expenses, at the per diem rate or rates provided in the Government Joint Travel Regulations in effect at the time travel is performed. In addition, the Architect-Engineer will be reimbursed for actual cost of taxi fares or other local transportation from terminal to hotel or duty point on day of arrival at temporary duty station and from hotel or duty point on day of departure from temporary duty station.

3. For transportation, the actual cost thereof by public conveyance (plane and train rates to be supported by transportation receipts), or, when travel is performed by private-owned vehicle, at the rate provided in the Government Joint Travel Regulations in effect at the time travel is performed. Mileage will be based on odometer readings certified by the Architect-Engineer and approved by the Contracting Officer. Payment for attending additional conferences shall be made after submittal of a ENG Form 93.