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VIRCON, 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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ViroCon, INC.

February 28, 1992

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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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Sincerely,

VIROCON, INC.

Paul P. Apprill

Paul P. Apprill, P.E.

PPA:sse

TABLE OF CONTENTS

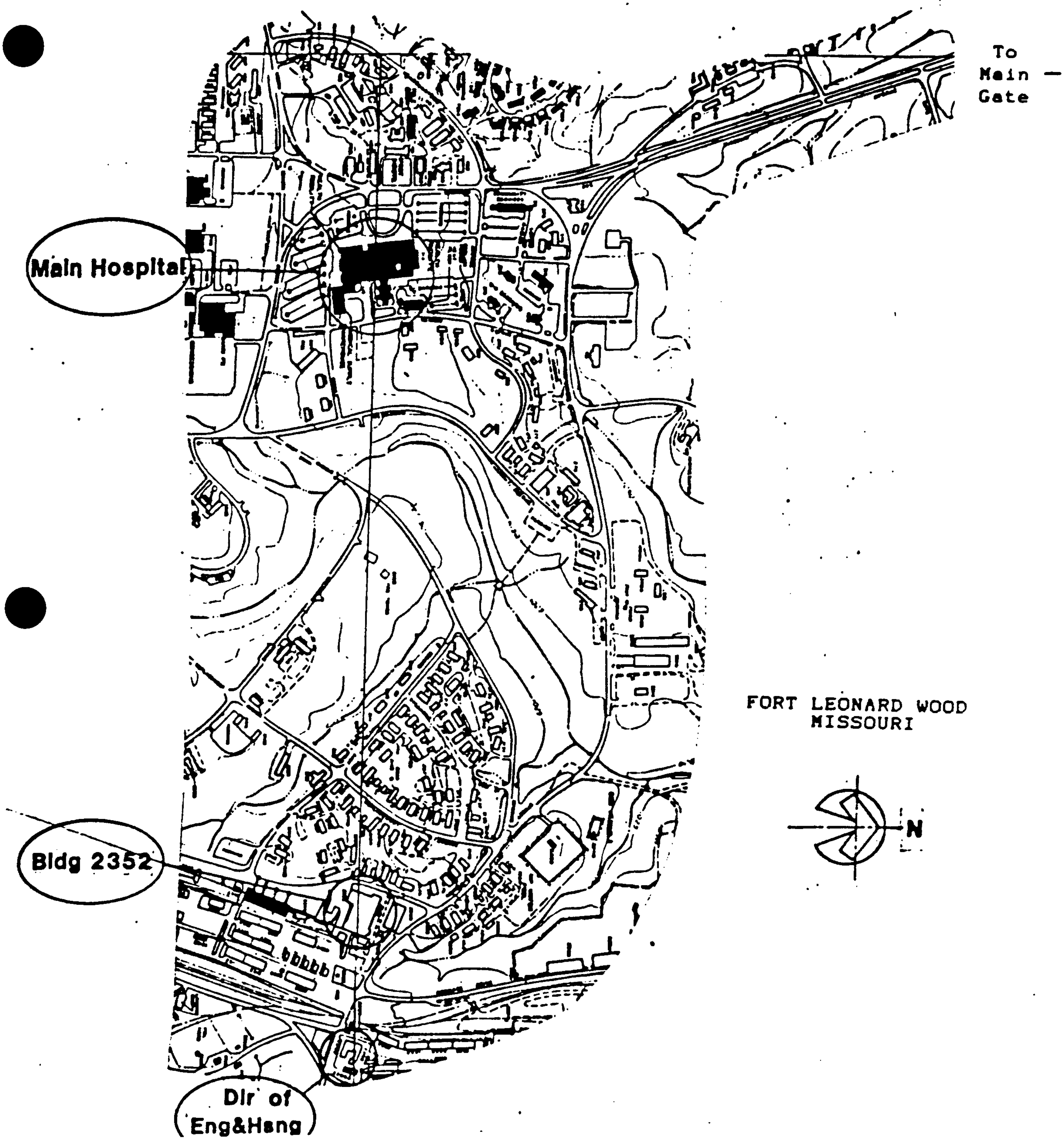
I PROJECT OVERVIEW

A FACILITY DESCRIPTION

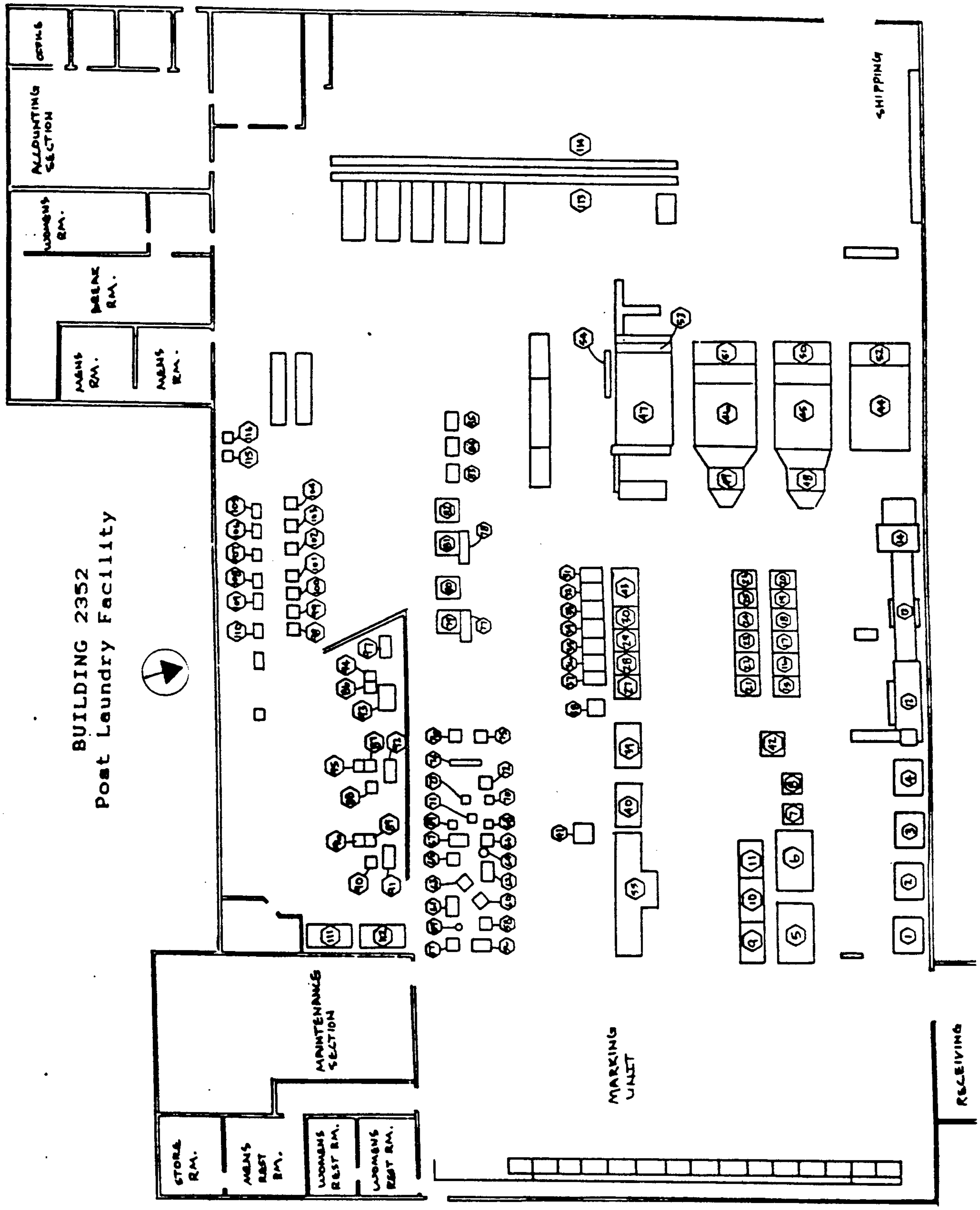
The Fort Leonard Wood Laundry Plant is located in Building 2352 which is situated in the Northeast portion of Main Post. Building 2352 has approximately 48,000 square feet of floor space which contains various types of laundry and dry cleaning process equipment. The facility provides service to the Post 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

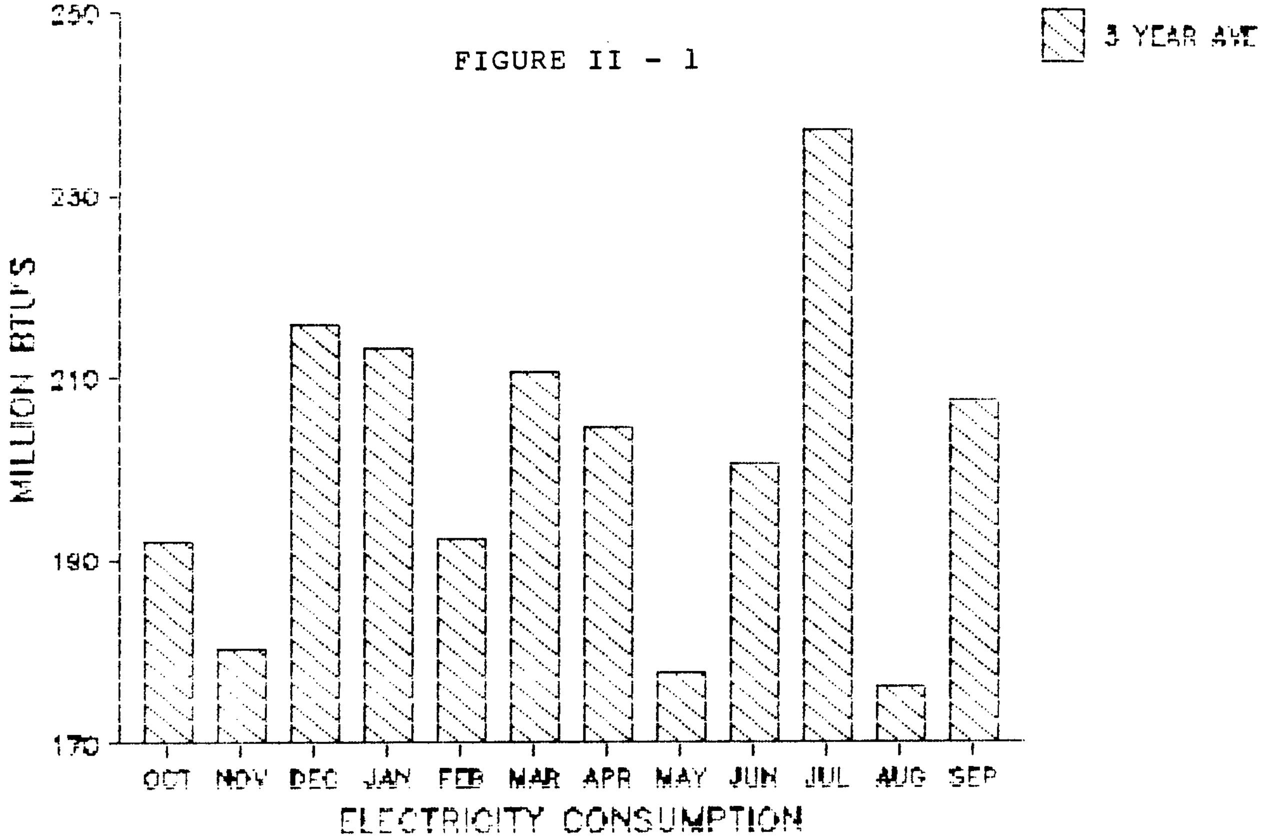
TABLE II-2
BUILDING 2352 - FORT LEONARD WOOD, MO.
UTILITY DATA - 3 YEAR AVERAGE

	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

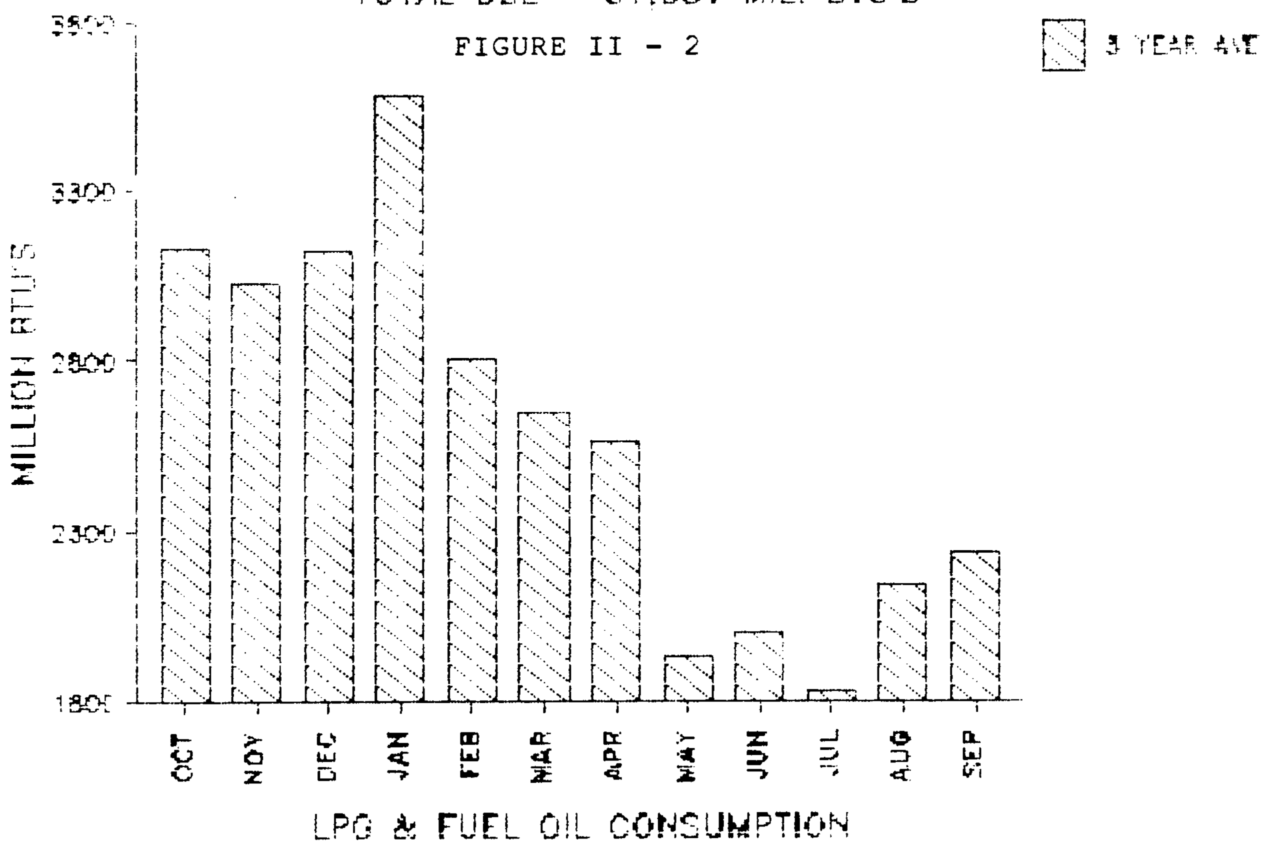
BLDG 2352 – FT. WOOD, MO.

TOTAL USE – 2408 MIL. BTU'S



BLDG 2352 – FT. WOOD, MO.

TOTAL USE – 31,031 MIL. BTU'S



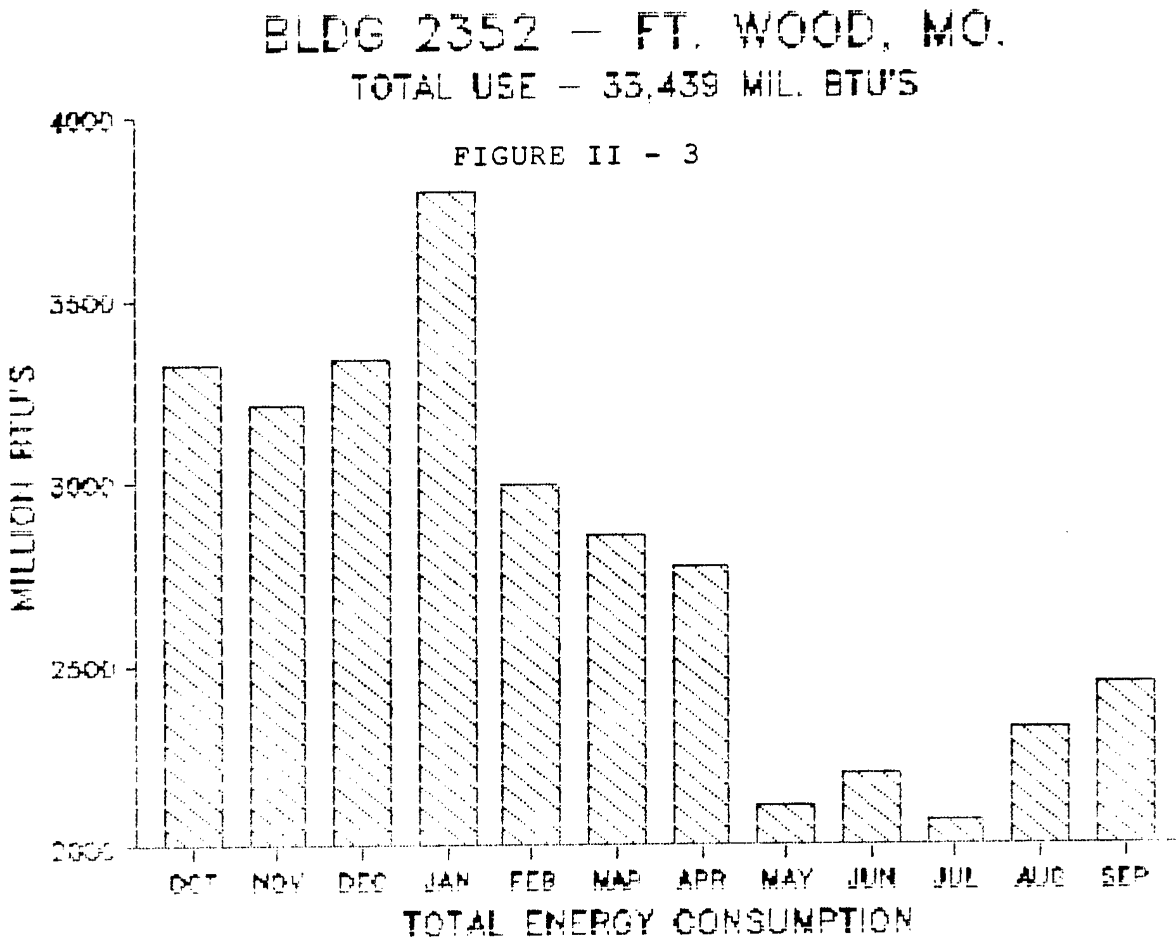

BLDG 2352 – FT. WOOD, MO.
TOTAL USE – 33,439 MIL. BTU'S
4000
3500
3000
2500
2000
MILLION BTU'S
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
TOTAL ENERGY CONSUMPTION

FIGURE II - 3

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-B	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-B	31	350	378.00				1000	700	263.38			
DRYER-B	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-

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.

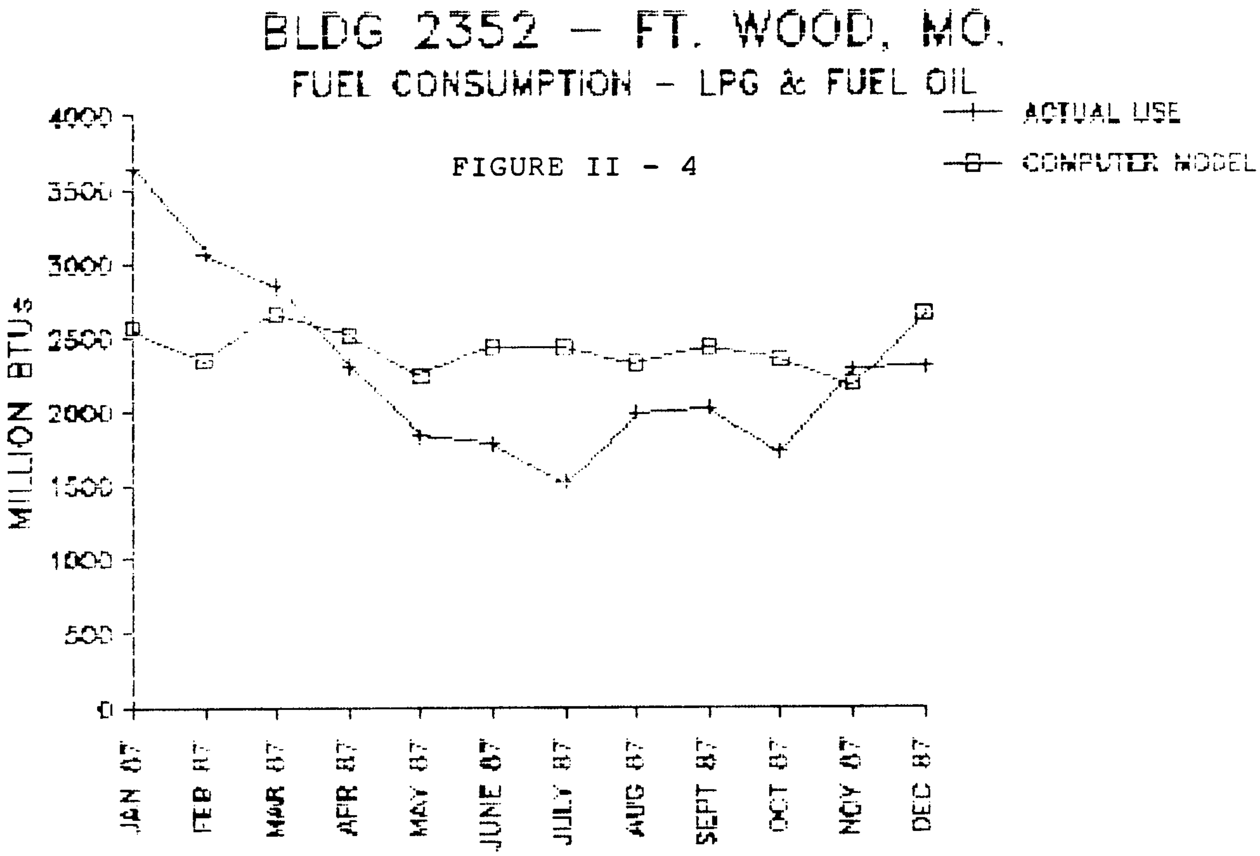
Figure II-5 shows a fairly accurate simulation on monthly consumption trends for electricity. This graph shows a substantial drop in actual electricity use between July and August. This dramatic change i consumption can probably be attributed to the period between meter readings during the summer months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

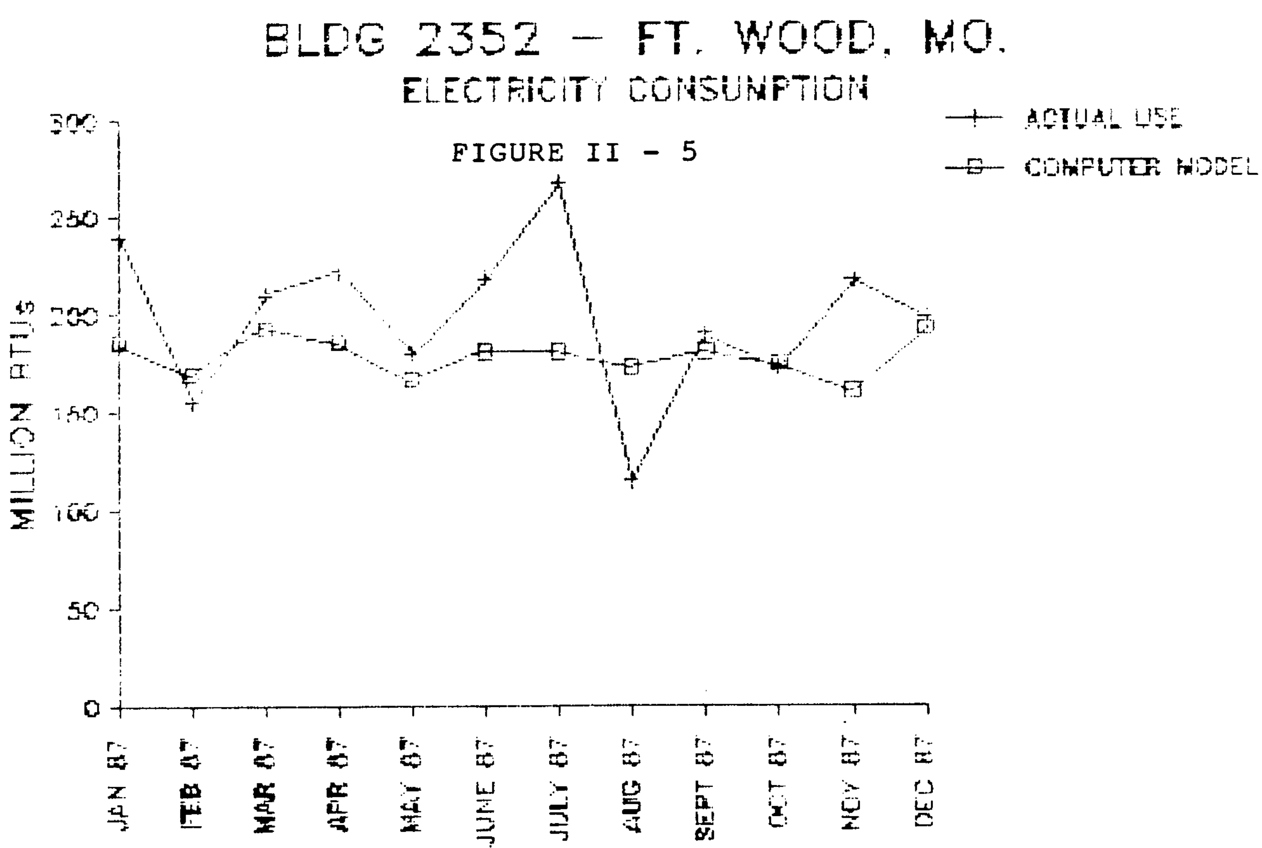
Figure II-A shows that monthly fuel consumption trends are not accurately predicted by the computer model when compared with utility records. The computer shows a fairly consistent fuel usage from month to month. Utility records show a wide fluctuation. The difference between the computer simulation 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

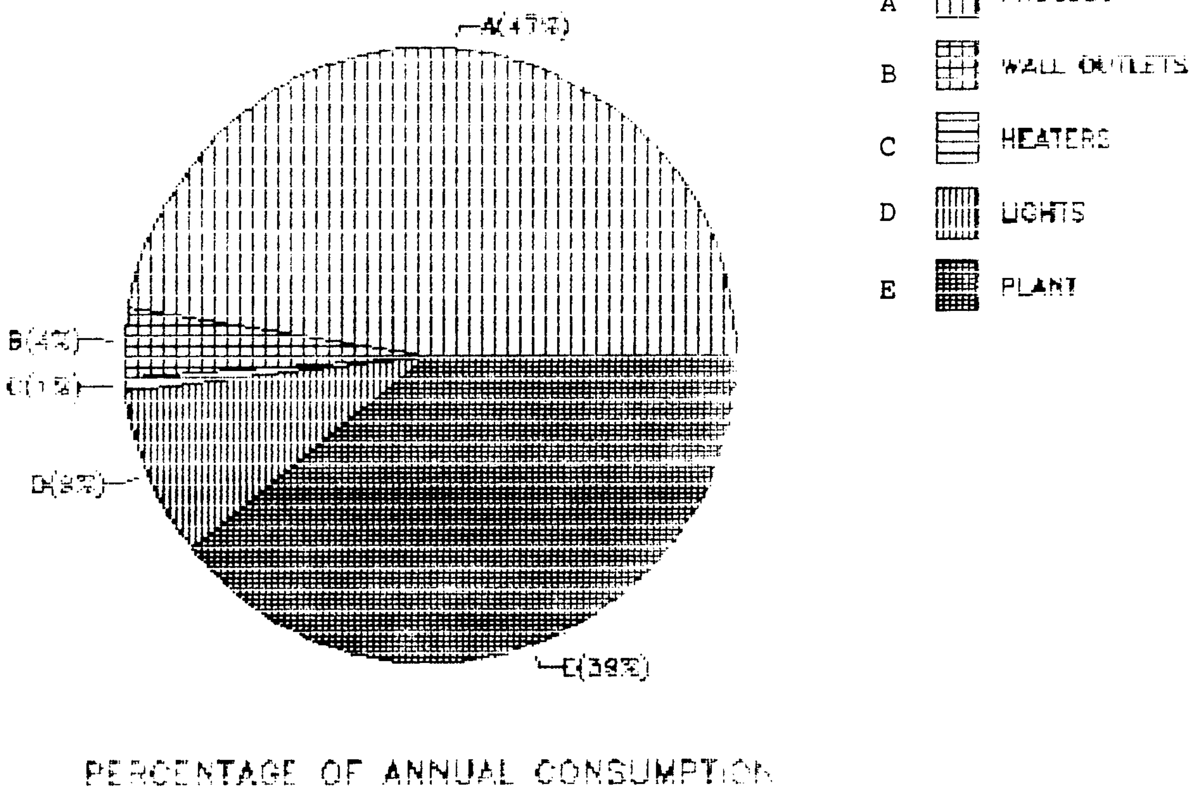
FORT LEONARD WOOD
BUILDING 2352
AUDIT SUMMARY

		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

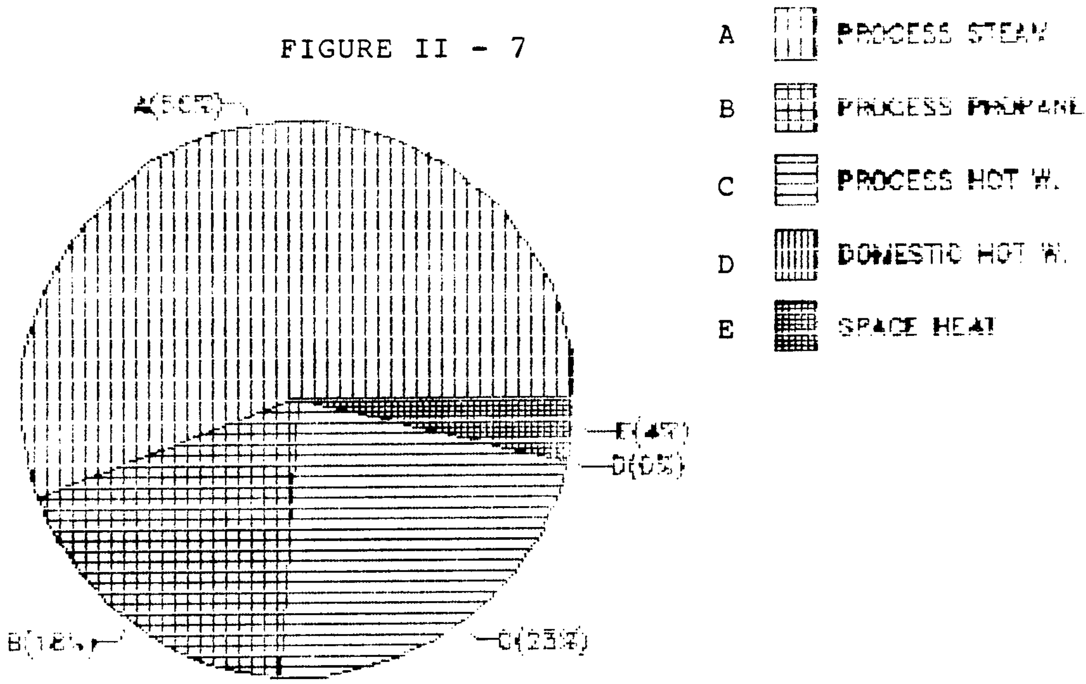
FIGURE II - 6



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

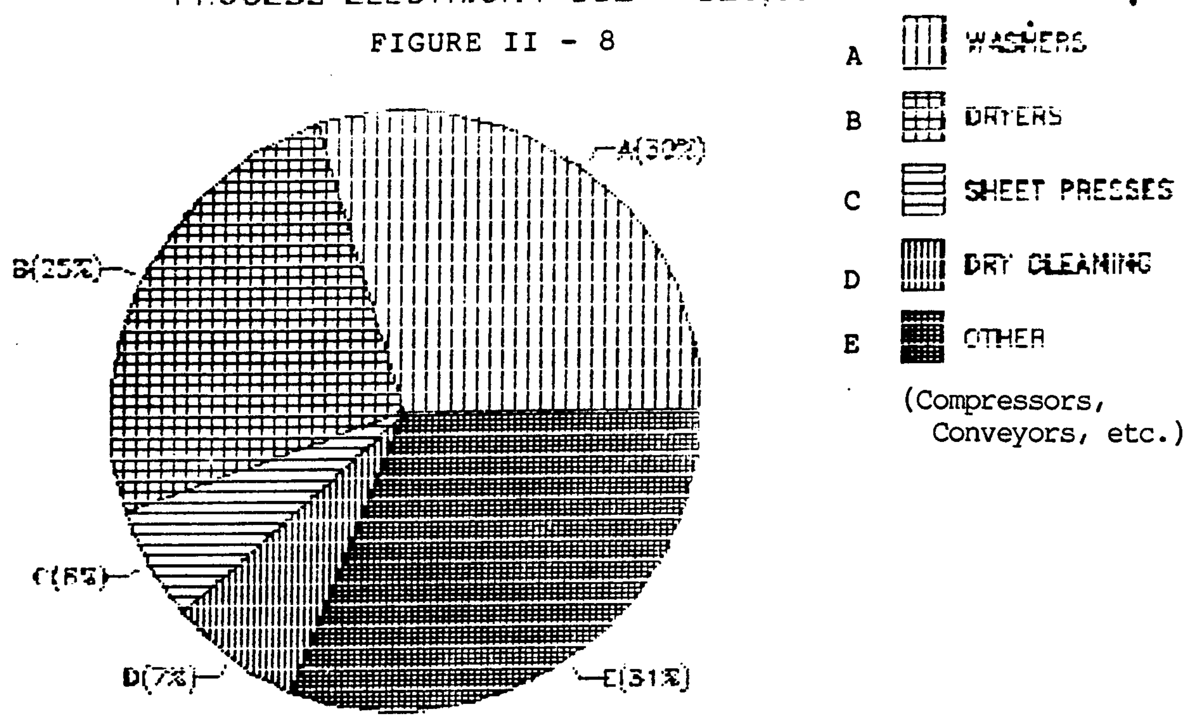
PROCESS ENERGY DISTRIBUTION

		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

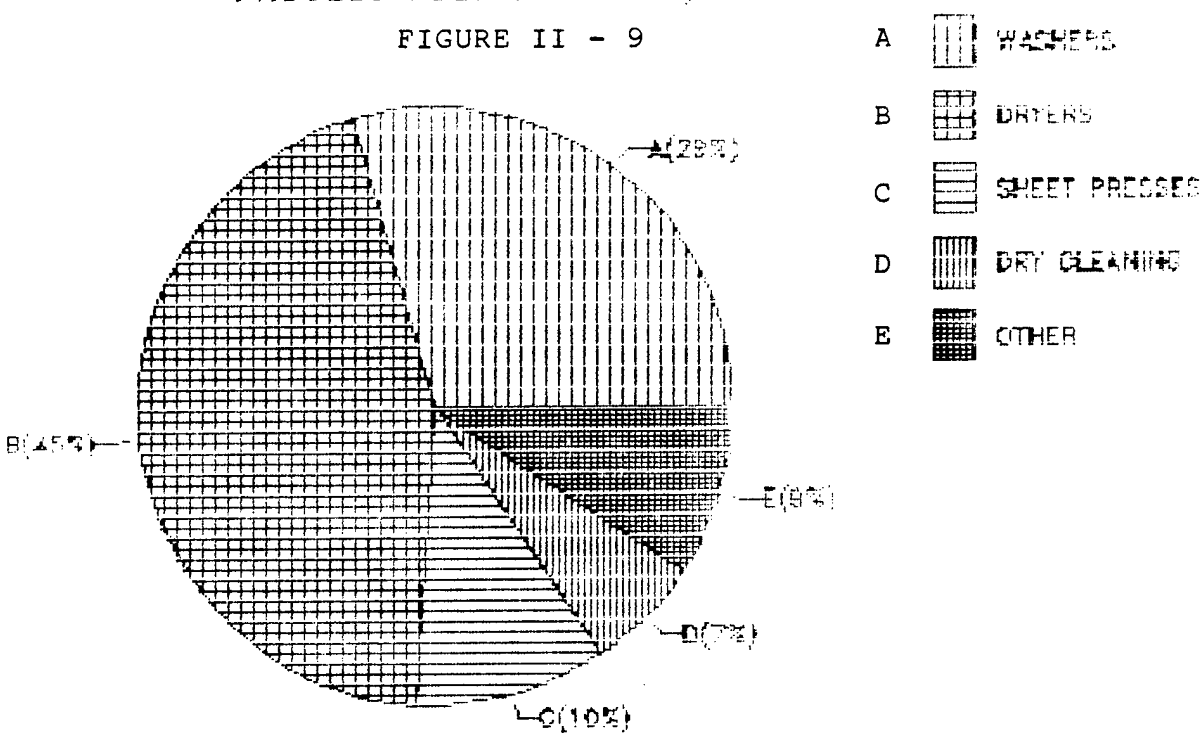
FIGURE II - 8



PERCENTAGE OF ANNUAL CONSUMPTION

BLDG 2352 - FT WOOD, MO
PROCESS FUEL USE - 25,065 MIL. BTU

FIGURE II - 9

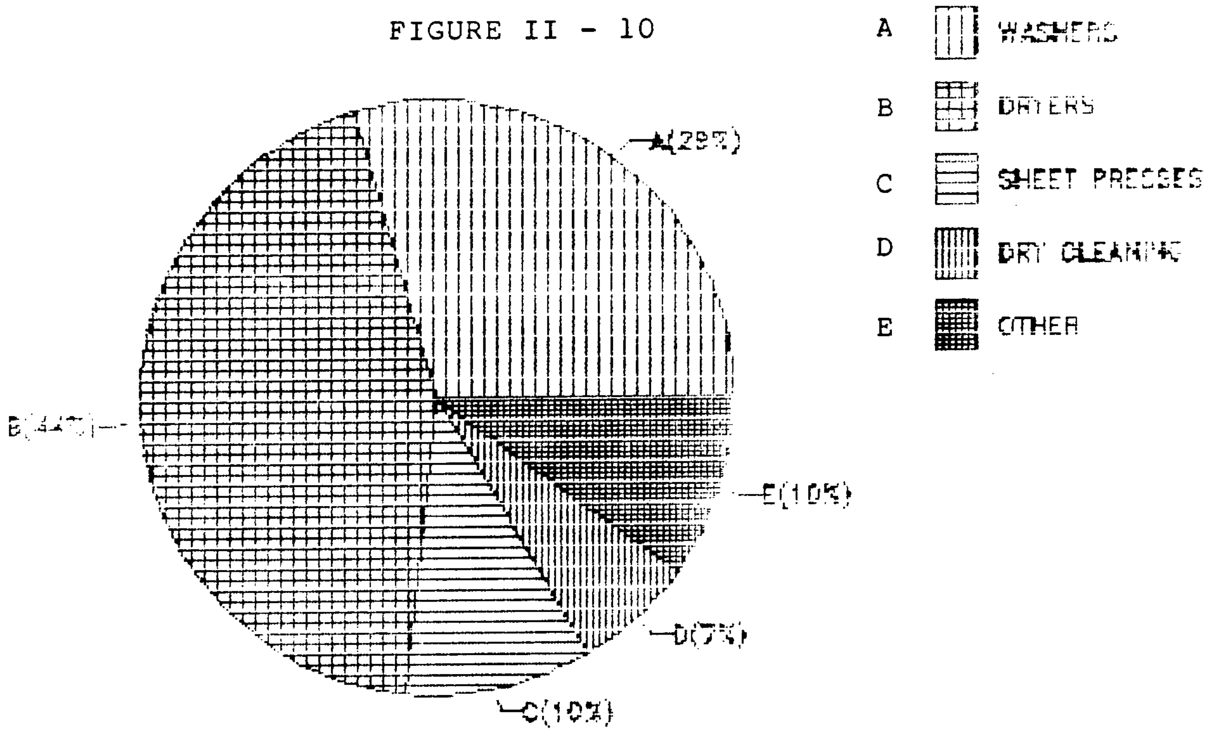


PERCENTAGE OF ANNUAL CONSUMPTION

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	8750	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	34.5	3.45	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	295.65	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	12.49890
	3	162	16.2	180	80	8760	215.90	30.63860
	2.5	144	14.4	180	80	8760	180.50	22.76899
	2	18	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	109.70	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:

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
ECO #1													
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.

INVITATION/CONTRACTOR

EFFECTIVE PRICING DATE

DATE PREPARED 6·1·89

PROJECT WINDOW CAULKING

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

DRAWING NO.

SHEET 1 OF 1 SHEETS

LOCATION FORT LEONARD WOOD

ESTIMATOR

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

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

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

INVITATION/CONTRACTOR

EFFECTIVE PRICING DATE

DATE PREPARED: 24 MAY 89

PROJECT: INSTALL GAS HOT WATER HEATER

CODE (Check one) ☐ A ☐ B ☐ C ☐ OTHER

DRAWING NO.

SHEET 1 OF 1 SHEETS

LOCATION: FORT LEONARD WOOD

ESTIMATOR

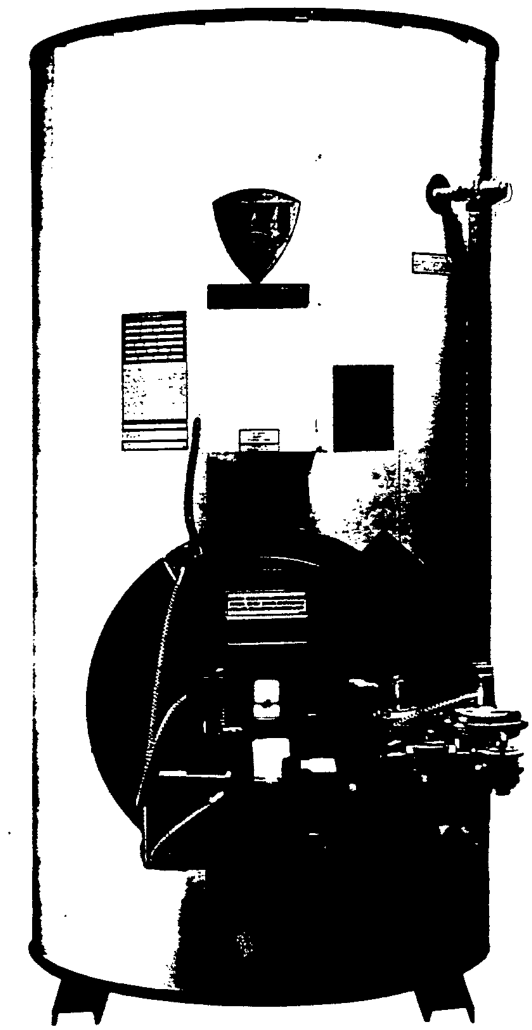
CHECKED BY

TASK DESCRIPTION	QUANTITY		LABOR				EQUIPMENT		MATERIAL		TOTAL	SHIPPING	
ECO #7	NO. OF UNITS	UNIT MEAS	MH UNIT	TOTAL HRS	UNIT PRICE	COST	UNIT PRICE	COST	UNIT PRICE	COST		UNIT WT	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…

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

Check the other side to see if your name is correct.

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 1783 FORT WORTH, TX

POSTAGE WILL BE PAID BY ADDRESSEE

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

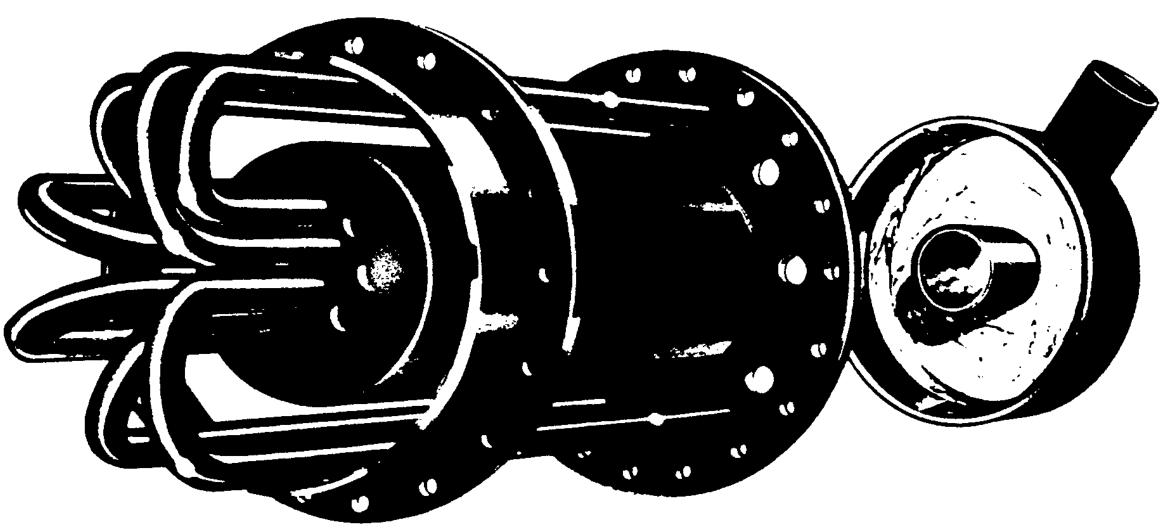
TURBOPOWER® is U.L. listed for less expensive type "B" venting which can save hundreds of dollars in up front costs.

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	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#8

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
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
FISCAL 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

5. 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.

PROJECT: INSTALL RADIANT HEATERS	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 #2

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
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	163685141.63
27	22000	15	330000	7740	337740	1640000	2045000	.21	396	166773540.73
22	22000	20	440000	10320	450320	1640000	2045000	.27	286	160596742.93
17	22000	25	550000	12900	562900	1640000	2045000	.34	156	109437773.27
12	22000	30	660000	15480	675480	1640000	2045000	.41	78	65638667.56
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

TASK DESCRIPTION	QUANTITY		LABOR				EQUIPMENT		MATERIAL		TOTAL	SHIPPING	
ECO # 14	NO. OF UNITS	UNIT MEAS	MH UNIT	TOTAL HRS	UNIT PRICE	COST	UNIT PRICE	COST	UNIT PRICE	COST		UNIT WT	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

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

GALLONS HOT WATER = 6565600
DELTA T = 100

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

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 = 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
ISCAL 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

. 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

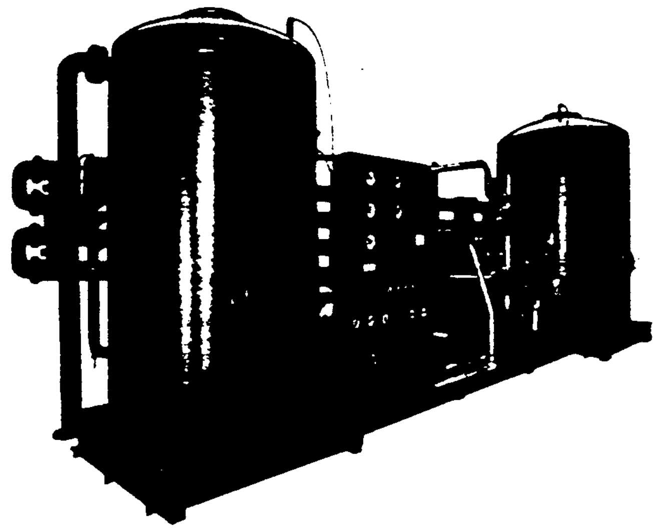
Ludell supplies the ideas and the components to build the most efficient customized system you can buy!

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.

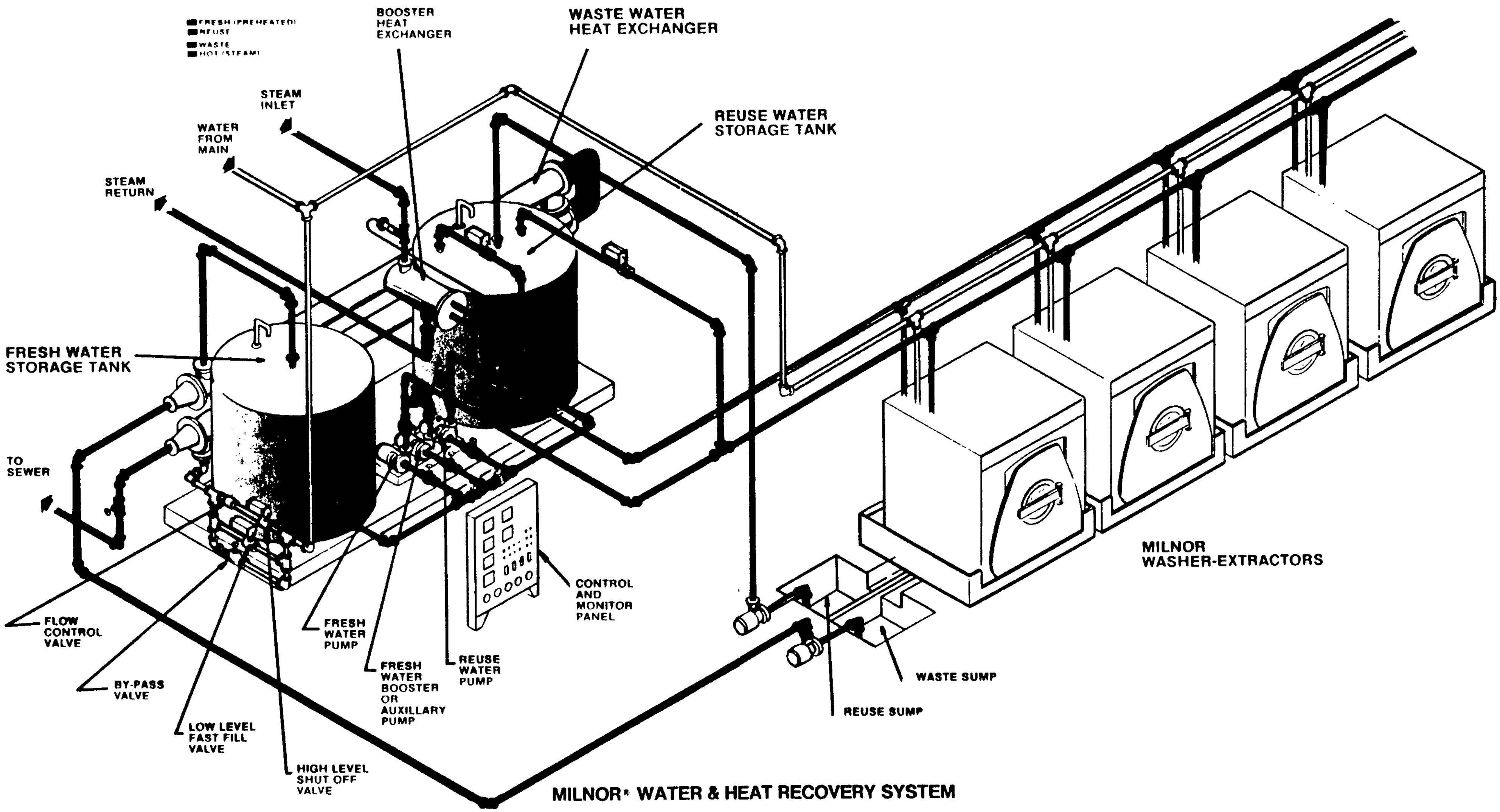
Or, Plug in a Ludell "Total Package" System.

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

ECO 15 A

INVITATION/CONTRACTOR:

CODE (Check one): ☐ A ☐ B ☐ C ☐ OTHER

EFFECTIVE PRICING DATE:

DRAWING NO.:

ESTIMATOR:

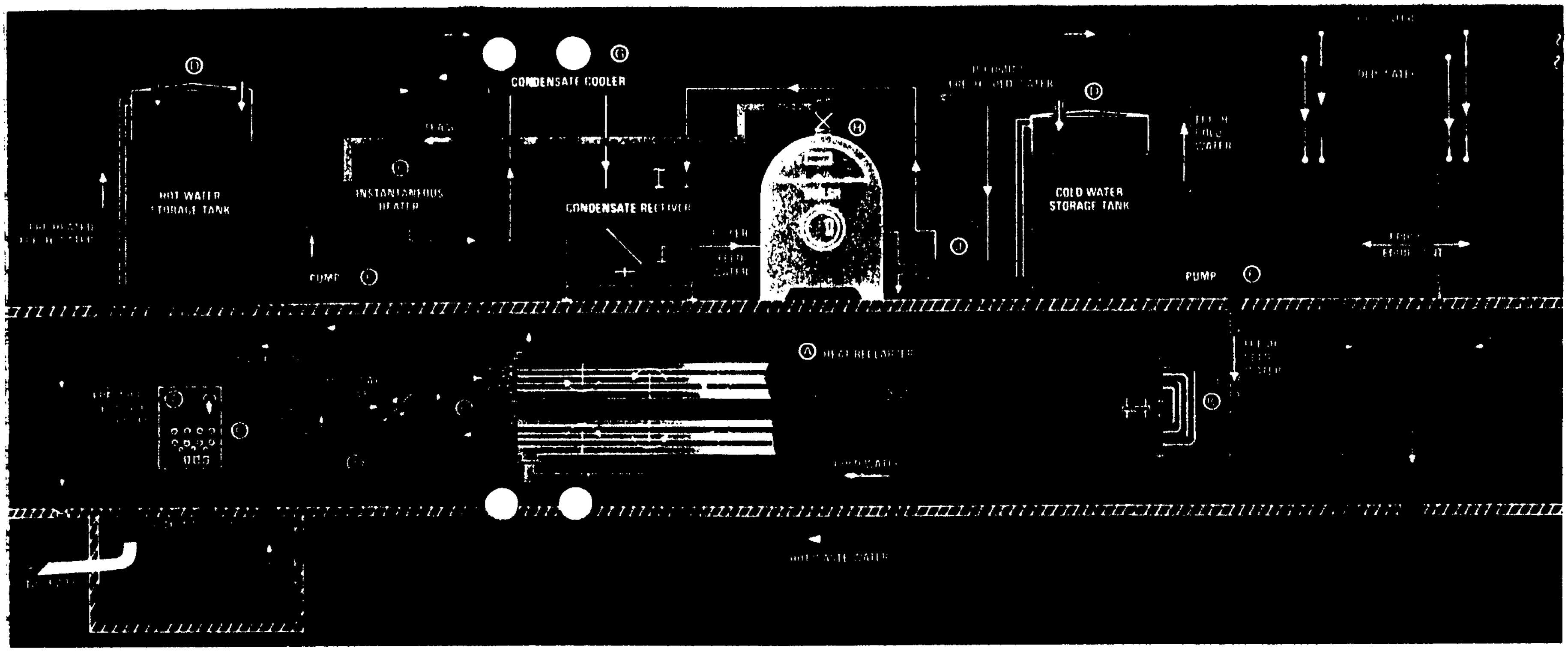
DATE PREPARED: 25 MAY 89

SHEET 1 OF 1 SHEETS

CHECKED BY:

TASK DESCRIPTION	QUANTITY		LABOR				EQUIPMENT		MATERIAL		TOTAL	SHIPPING	
	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													

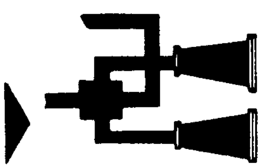
DA FORM 5418-R, Apr 85 * INCLUDES OVERHEAD & PROFIT



Ⓐ LUDELL HEAT RECLAIMERS — Ludell, the originator of continuous tube reclaimers, offers a wide rang · 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 Wate 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 Wate and Heat Recovery System designe for your plant converts downtime productive time. In the usual "Closed 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 fittings 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 fro 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.

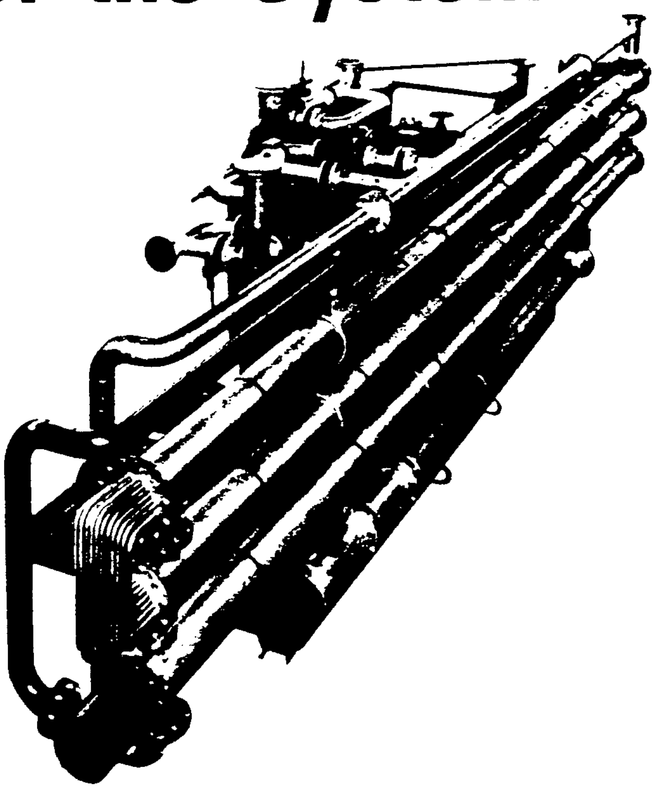
Solids Removal Systems mechanically screen and sediment solids and dirt before discharging into the sewer. Pumping of sludge from waste water pits is greatly reduced with Ludell Solids Removal System.

Conservation. Ludell uses less fuel, less of everything in the balanced Hot Water and Heat Recovery System. And Ludell engineers are experts at incorporating ideas and equipment in your operation to attain the highest efficiency and savings.

Ludell Heat Exchangers: The Heart of the System.

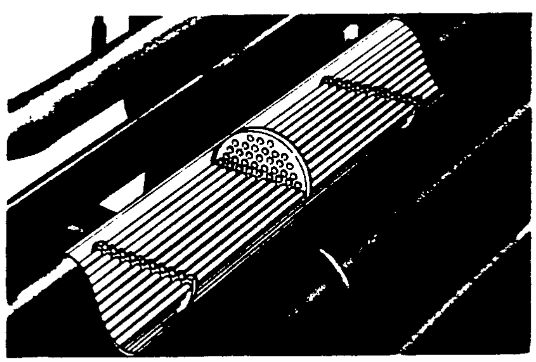
LUDELL CONSTRUCTION MAKES THE DIFFERENCE.

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:

5M 5-83

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

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
	CODE (*Check one*) ☐ A ☐ B ☐ C	DRAWING NO.	SHEET 1 OF 1 SHEETS
LOCATION FORT LEONARD WOOD	☐ OTHER ____	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-		
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.

PROJECT: STEAM TRAP REPLACEMENT	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 # 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 & REPLACEMENT	1	EA		1	39-	39-			78-	78-	117-		
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.

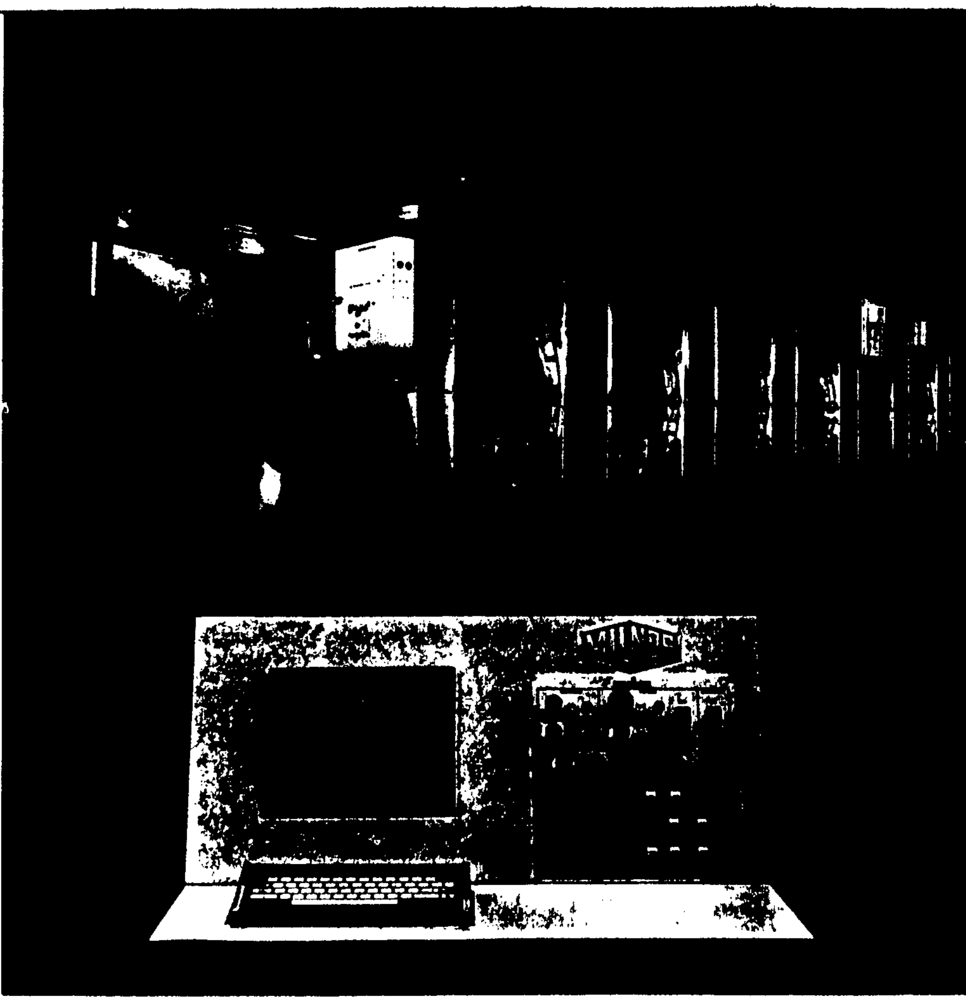
PROJECT	INSTALL CONTINUOUS BATCH WASHER
LOCATION	FORT LEONARD WOOD
INVITATION/CONTRACTOR	
CODE (Check one)	☐ A ☐ B ☐ C ☐ OTHER
EFFECTIVE PRICING DATE	
DRAWING NO.	
ESTIMATOR	
DATE PREPARED	25 MAY 89
SHEET	1 OF 1 SHEETS
CHECKED BY	

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

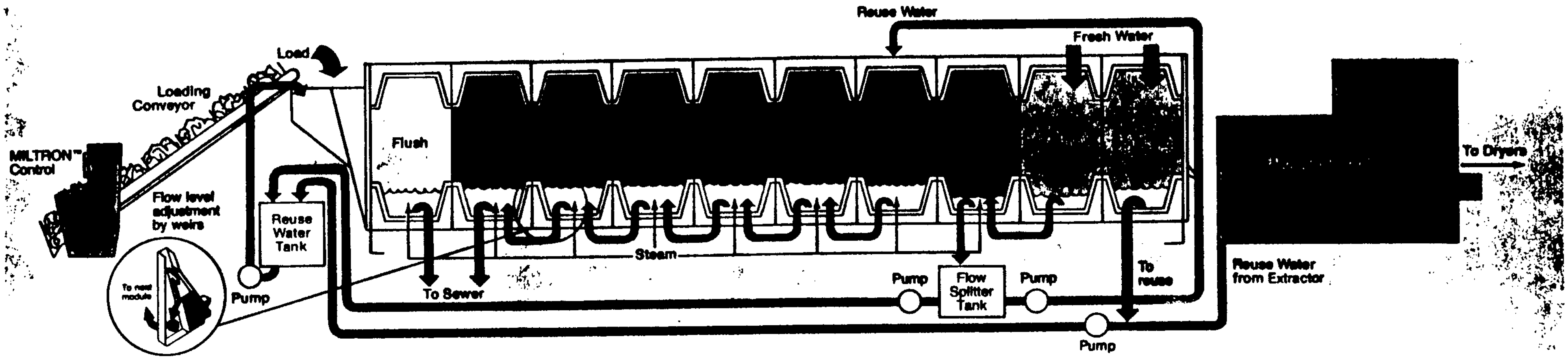
Work goes from soiled to clean more quickly, because the system continuously processes small, 110 lb. (50 kg.) batches.

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 (kg./hr.)	2640 (1200)	2200 (1000)	1760 (800)	1465 (665)
12 modules—lbs./hr. (kg./hr.)	3960 (1800)	3300 (1500)	2640 (1200)	2200 (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): (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.

INVITATION/CONTRACTOR:

EFFECTIVE PRICING DATE:

DATE PREPARED: 25 MAY 89

PROJECT: INSTALL TWO 220 lb DRYERS (GAS)

CODE (Check one) ☐ A ☐ B ☐ C ☐ OTHER

DRAWING NO.:

SHEET 1 OF 1 SHEETS

LOCATION: FORT LEONARD WOOD

ESTIMATOR:

CHECKED BY:

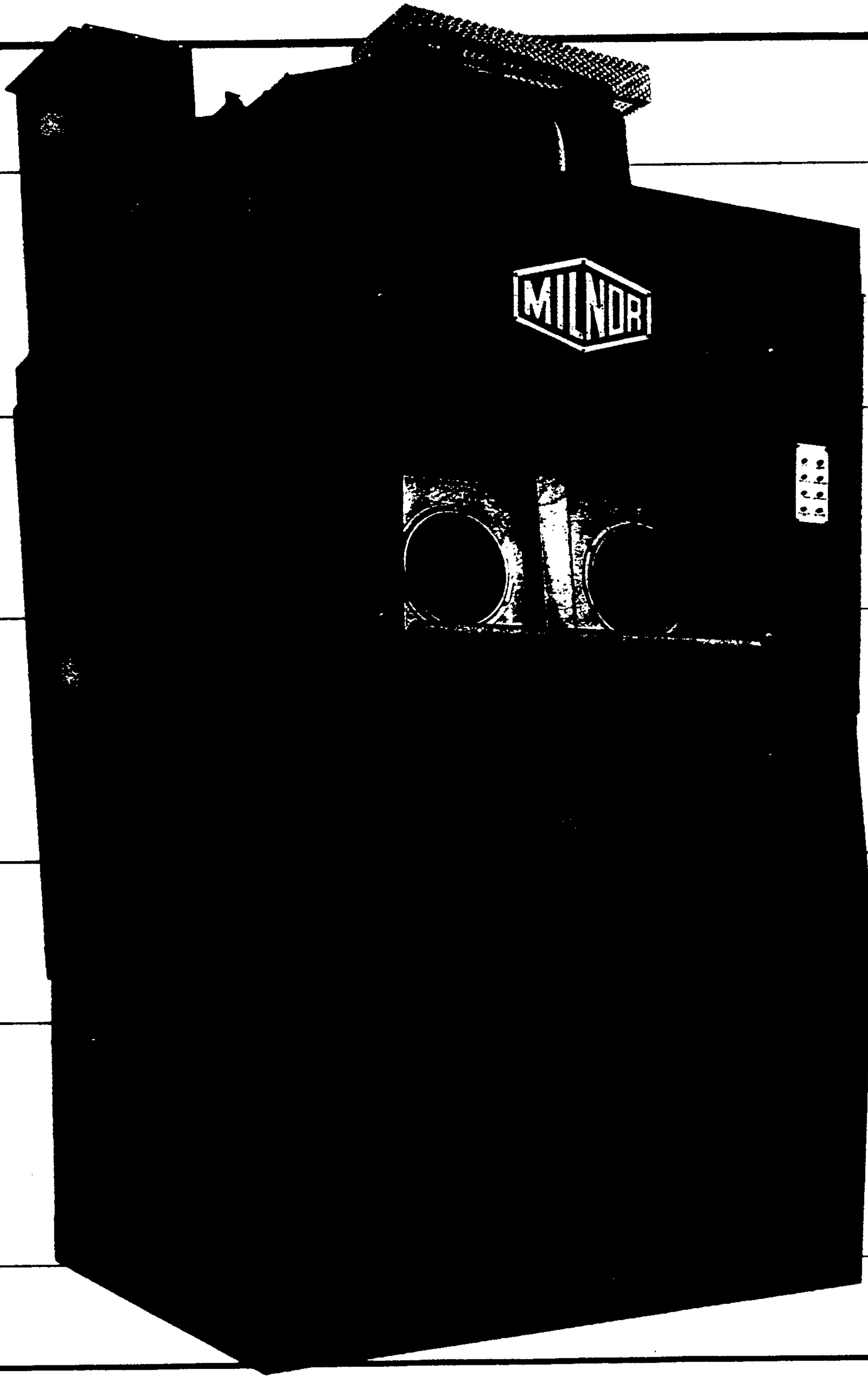
ECO # 20A

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

DRYERS

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

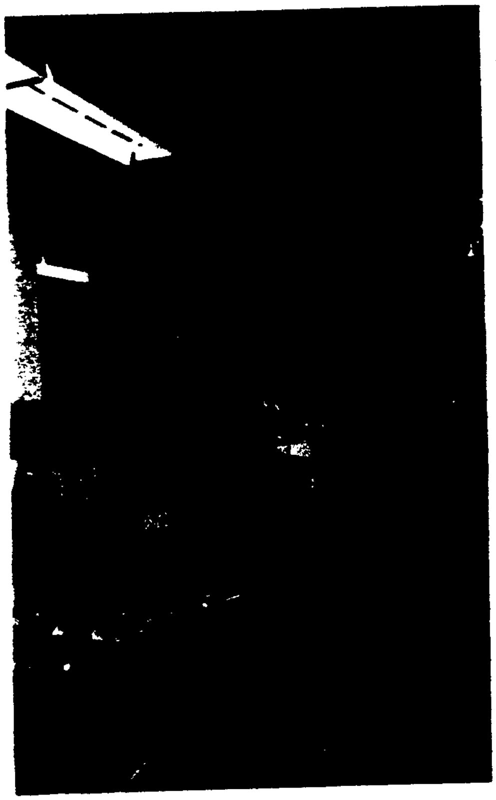


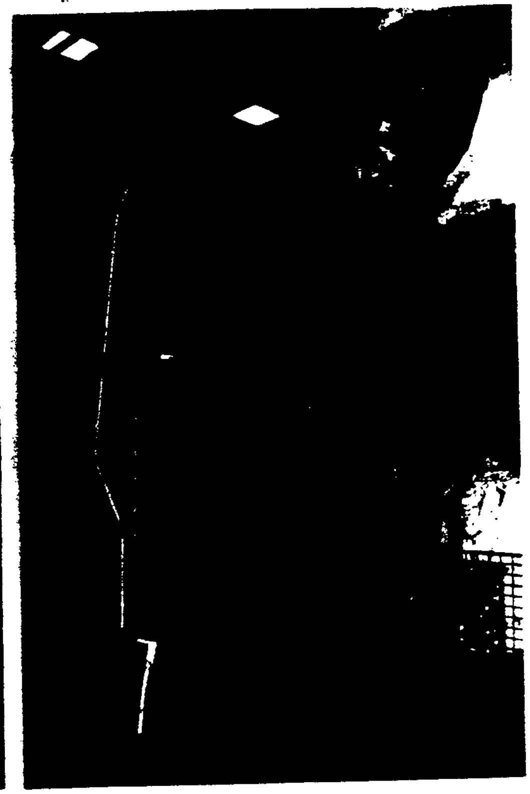
Dries rapidly and evenly

Conserves energy

F 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

...cities are keyed to popular batch wash... ere is a choice of one-batch (110 lb./50 k... and 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.

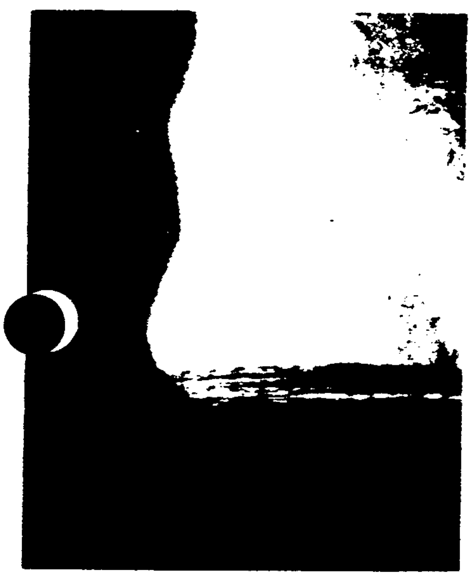
They save energy

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.

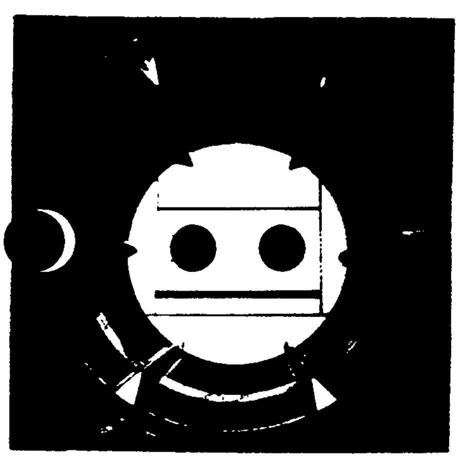
2. Basket has huge open area. About 65% of the basket's perforated side sheet is open. That's over one-third more open area than a major competitive dryer. So hot air can flow through the basket more freely.

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

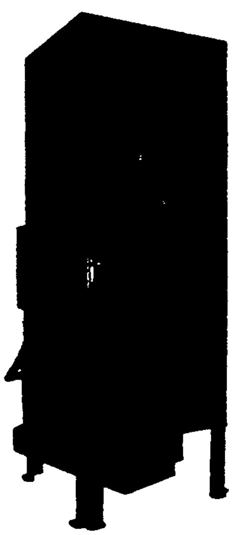
[illegible]OR uses fuel to dry the goods, not heat [illegible]undry. Working conditions benefit from [illegible]ective insulation and the fact that hot air is not blown out of the dryer in the unloading process.

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) eliminates 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[illegible] since the entire process — which takes [illegible]econds — occurs while the dryer is [illegible]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 troubleshooting.

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

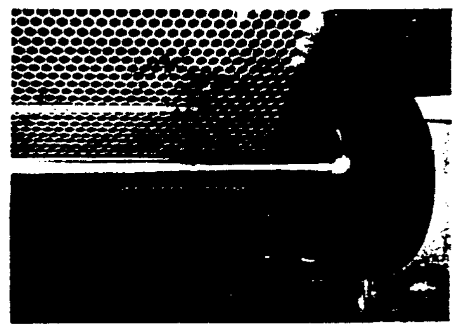
These dryers are highly adaptable

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.

MILNOR®

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.

PROJECT: INSTALL 400 lb GAS DRYER

LOCATION: FORT LEONARD WOOD

INVITATION/CONTRACTOR:

CODE (Check one): ☐ A ☐ B ☐ C ☐ OTHER

EFFECTIVE PRICING DATE:

DRAWING NO.:

ESTIMATOR:

DATE PREPARED: 24 MAY 89

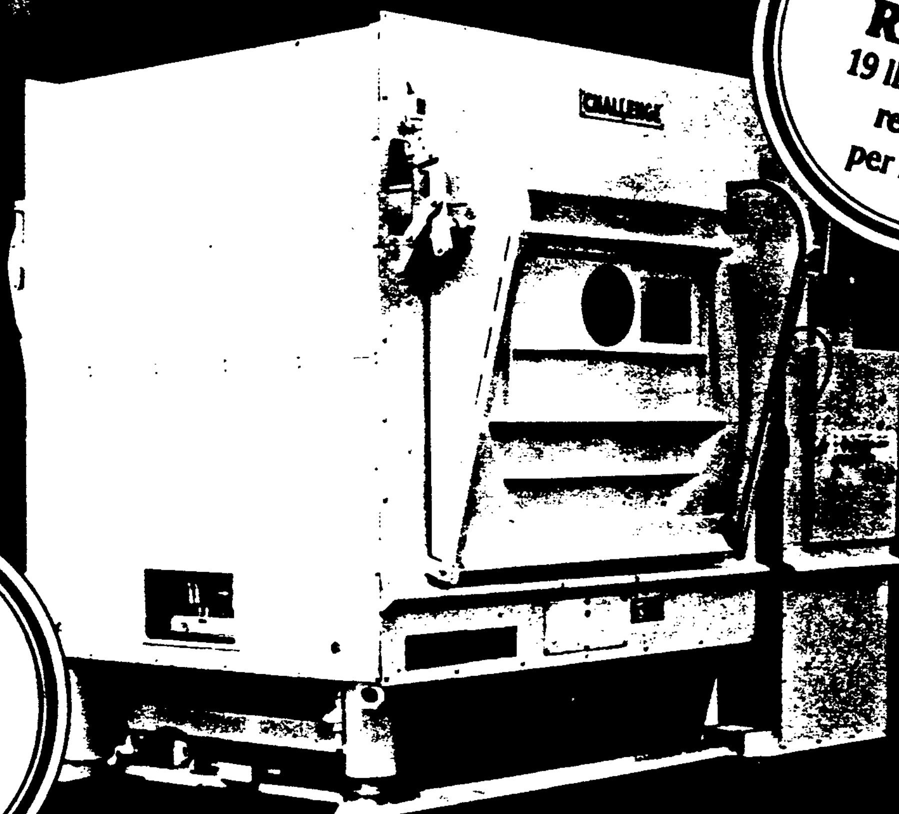
SHEET 1 OF 1 SHEETS

CHECKED BY:

ECO # 20B 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
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

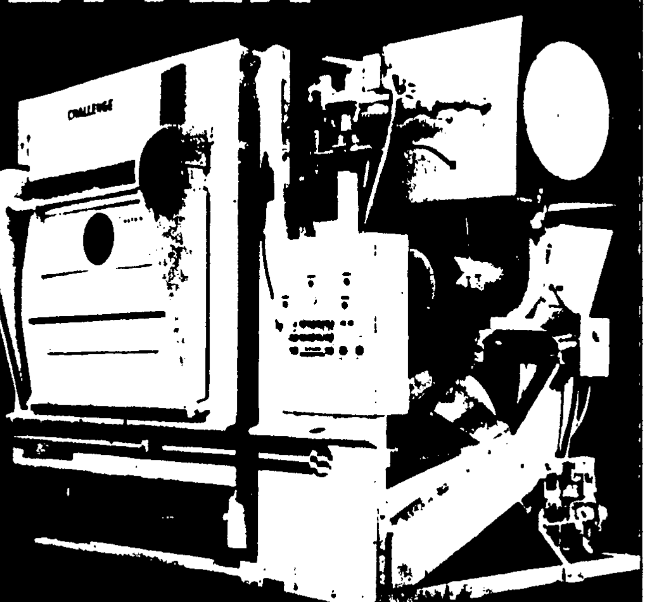
CHALLENGE

PACESETTER™

TUMBLER-DRYERS

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

IV - 59



[illegible]

Here [illegible] overview of the advantages 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 ceilings
- New state of the art, plug-in type basket burner [illegible] system
- Teflon [illegible] seals standard — no basket wipers required
- Combine [illegible] highest production and highest efficiency

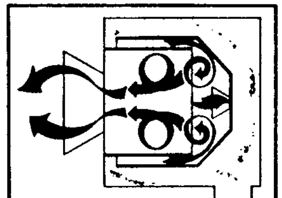
Reasonable purchase price, long and dependable life, and operating savings combine to reduce your total cost of ownership. Further, Pacesetter's high productivity can deliver very fast payback.

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

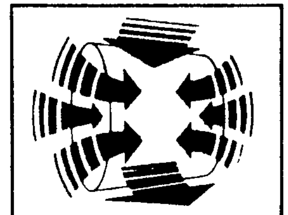
In this unique double-shell burner, air is precirculated in the outer shell before passing through louvers into the combustion chamber. Inside the chamber, turbulence is actually much greater than in any other type burner—assuring thorough fuel-air mixing for highest efficiency.

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

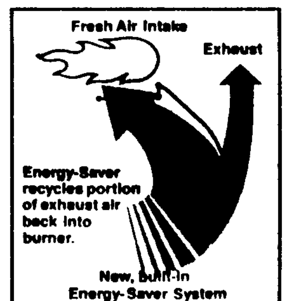
Flow directs heated air into the center of the load through the wide open ends of the Challenge basket. Generous and uniform air flow minimizes heat loss and does a far better drying job.

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

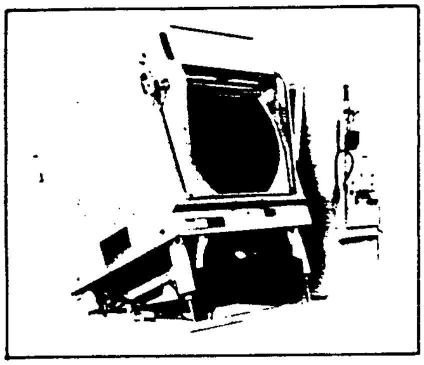
When high production is your priority, you will want to operate the Pacesetter in the open loop mode, and you can count on a water removal rate of at least 19 lbs. per minute. In the open loop mode fuel consumption will be only 2,050 BTUs per pound of water removed.

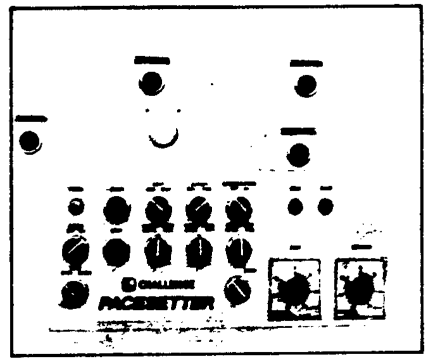
To maximize fuel efficiency, just activate the built-in Energy-Saver with the flick of a switch. Immediately your fuel efficiency factor improves to 1,800 BTUs per pound of water removed. Your production rate falls by less than 2% while your efficiency improves by more than 13%. You can achieve major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

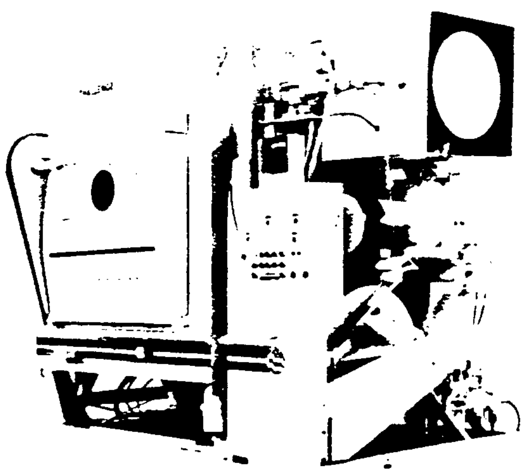
Pacesetter's large loading and unloading doors simplify handling and readily accommodate sling, conveyor and cake loading. Special wide design quickly accepts the largest loads. Two-hand controls assure maximum operator safety, and guide rails prevent doors from swinging when opening or closing.

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
LOCATION FORT LEONARD WOOD	CODE (Check one) ☐ A ☐ B ☐ C ☐ OTHER ______	DRAWING NO.	SHEET / OF / SHEETS
		ESTIMATOR	CHECKED BY

ECO # 21

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
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

ECO # 23

)ESCRIPTION: 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.

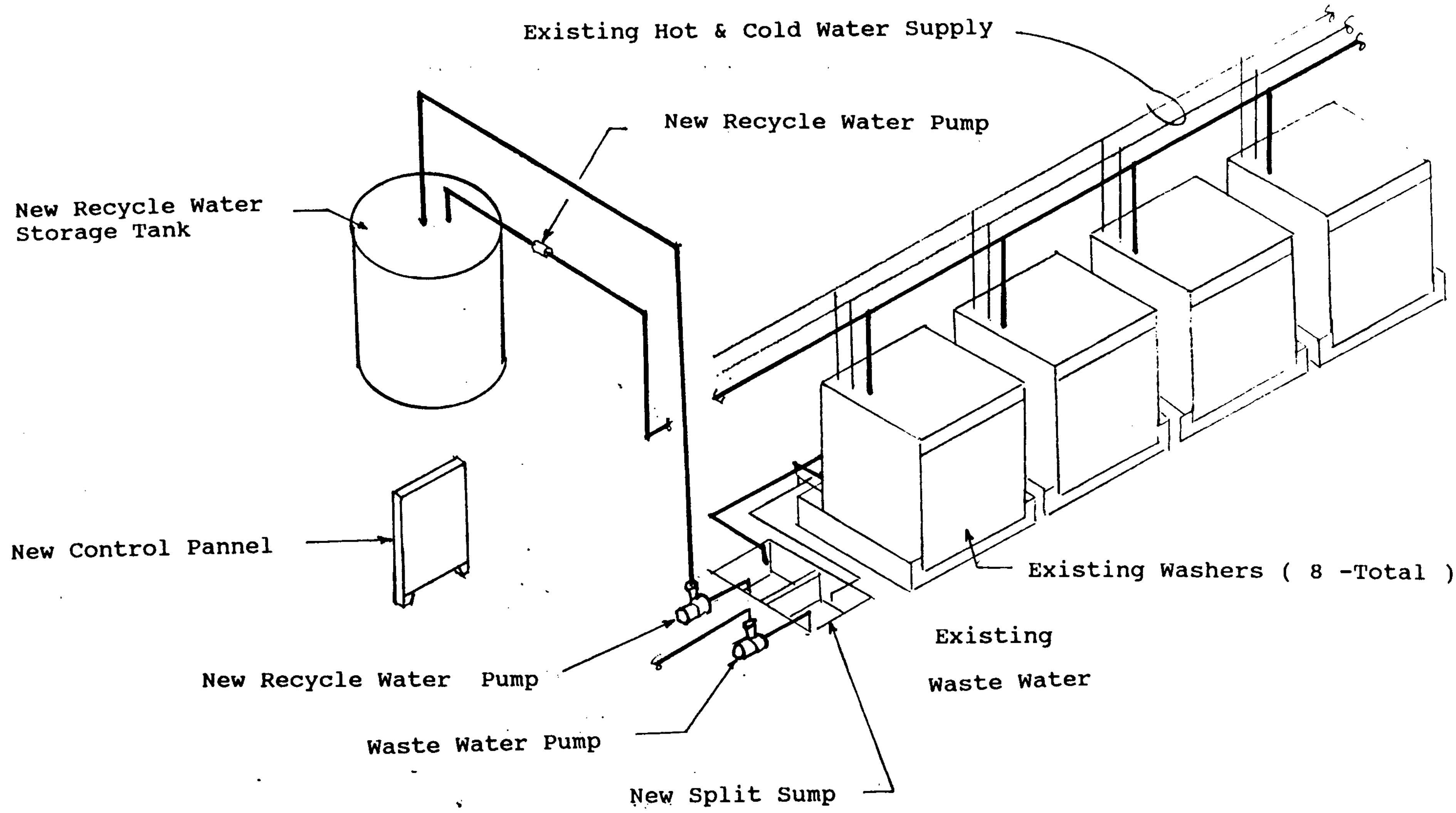
PROJECT RECYCLE RINSE WATER	INVITATION/CONTRACTOR	EFFECTIVE PRICING DATE	DATE PREPARED 24 MAY 89
LOCATION FORT LEONARD WOOD	CODE (Check one) ☐ A ☐ B ☐ C ☐ OTHER	DRAWING NO. / ESTIMATOR	SHEET 1 OF 1 SHEETS CHECKED BY

ECO #23

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
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



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

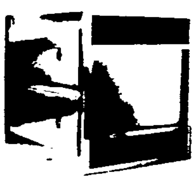
ESTIMATOR

CHECKED BY

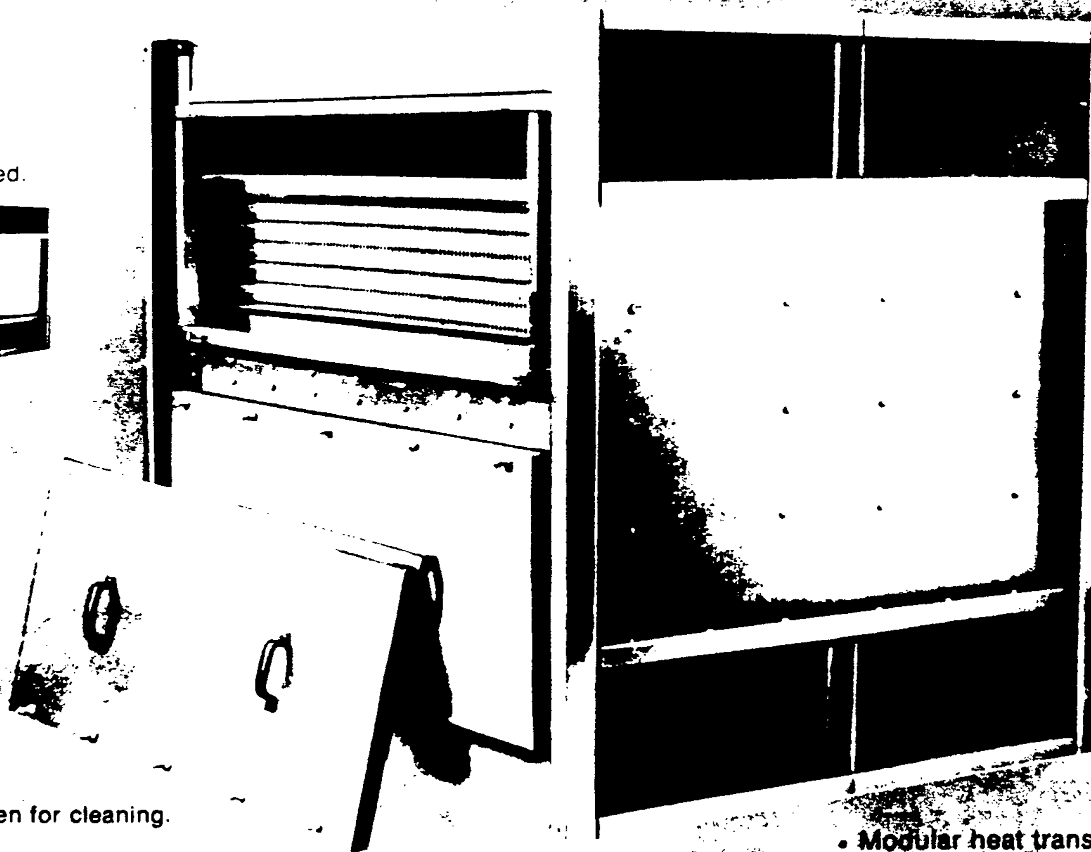
ECO #4 TASK DESCRIPTION	QUANTITY		LABOR				EQUIPMENT		MATERIAL		TOTAL	SHIPPING	
	NO. OF UNITS	UNIT MEAS	MH UNIT	TOTAL HRS	UNIT PRICE	COST	UNIT PRICE	COST	UNIT PRICE	COST		UNIT WT	TOTAL WT
AIR TO AIR HEAT													
EXCHANGER	2	EA					185,000	370,000			370,000		
SUPPLY EXHAUST DUCT	2	EA			1200	2400-			1800-	3600-	6000		
ELECTRICAL SERVICE		LS									1800-		
											377,800		
TOTAL THIS SHEET													

DA FORM 5418-R, Apr 85

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 DES CHAMPS 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 amount 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 range of temperature with low operating 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

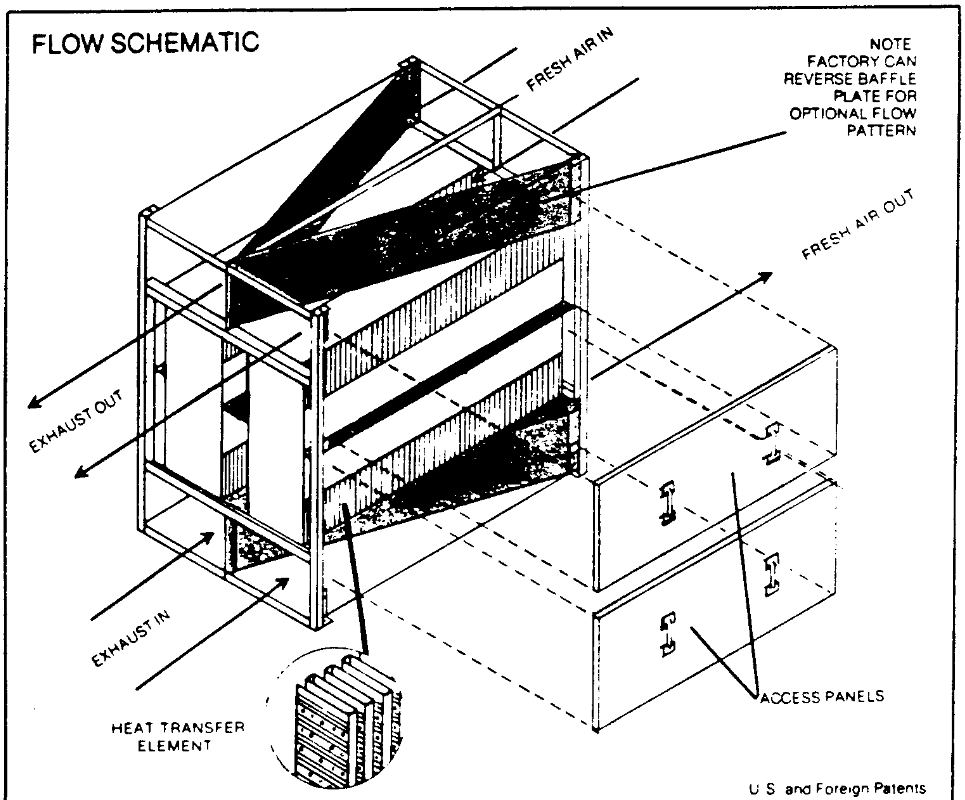
Proper precautions must be taken with the exterior inlet and exhaust to assure that no contaminated air will return to the building or process through the inlet air duct.

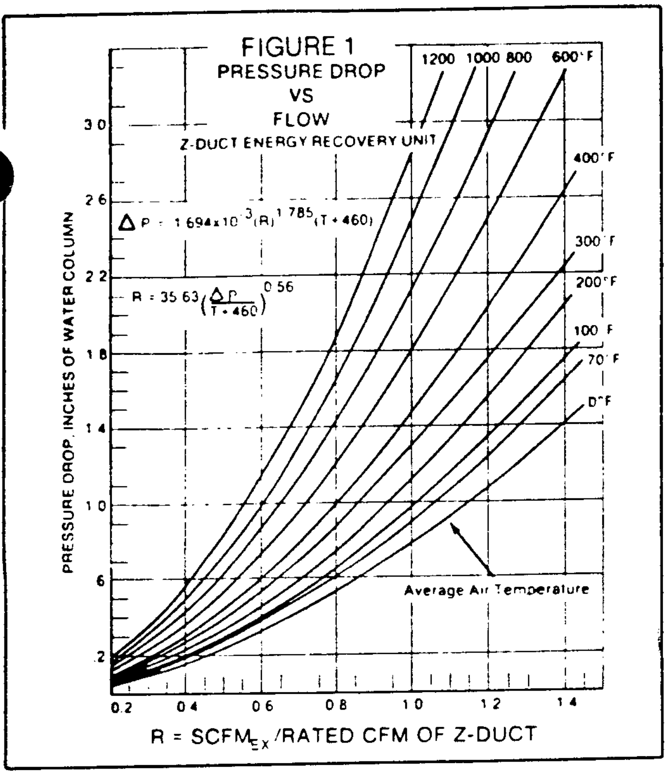
For high temperature and special environments, consult DLI for the appropriate materials and special design features that will assure the long life and efficiency of the system.

STANDARD Z-DUCT SPECIFICATIONS

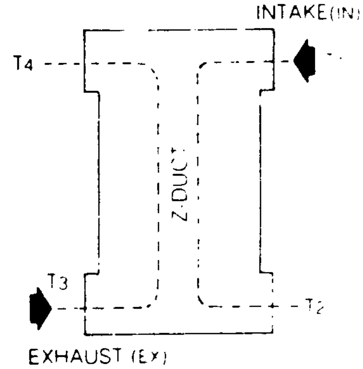
Z-Duct Series 75 modules are designed for 4,000, 6,000, 8,000, and 10,000 CFM with 0.93-inch W.C. pressure drop.

FLOW SCHEMATIC





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.

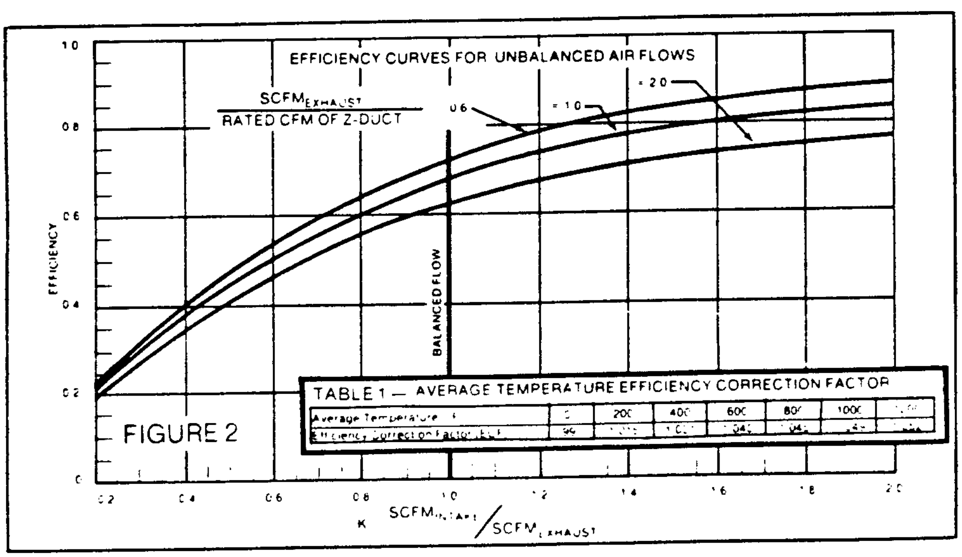


FIGURE 2

TABLE 1 — AVERAGE TEMPERATURE EFFICIENCY CORRECTION FACTOR

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

INVITATION/CONTRACTOR	EFFECTIVE PRICING DATE	DATE PREPARED 6-2-89
CODE (Check one) ☐ A ☐ B ☐ C ☐ OTHER	DRAWING NO.	SHEET 1 OF 1 SHEETS
	ESTIMATOR	CHECKED BY

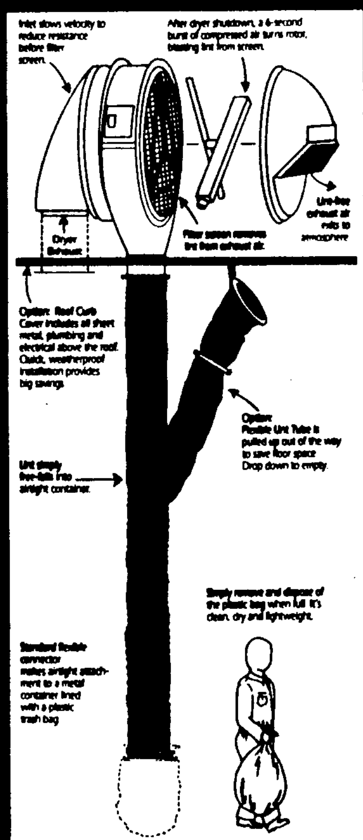
PROJECT: 400 lb DRYER EXHAUST HEAT RECOVERY

LOCATION: FORT LEONARD WOOD

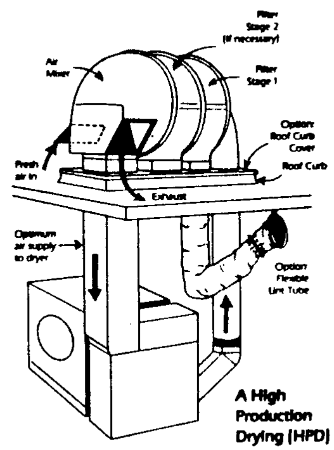
ECO #24A TASK DESCRIPTION	QUANTITY NO. OF UNITS	QUANTITY UNIT MEAS	LABOR MH UNIT	LABOR TOTAL HRS	LABOR UNIT PRICE	LABOR COST	EQUIPMENT UNIT PRICE	EQUIPMENT COST	MATERIAL UNIT PRICE	MATERIAL COST	TOTAL	SHIPPING UNIT WT	SHIPPING TOTAL WT
HT. RECOVERY & FILTER UNIT	3	EA			1600-	4800-	15,000	45,000-	300-	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) Systems:

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.

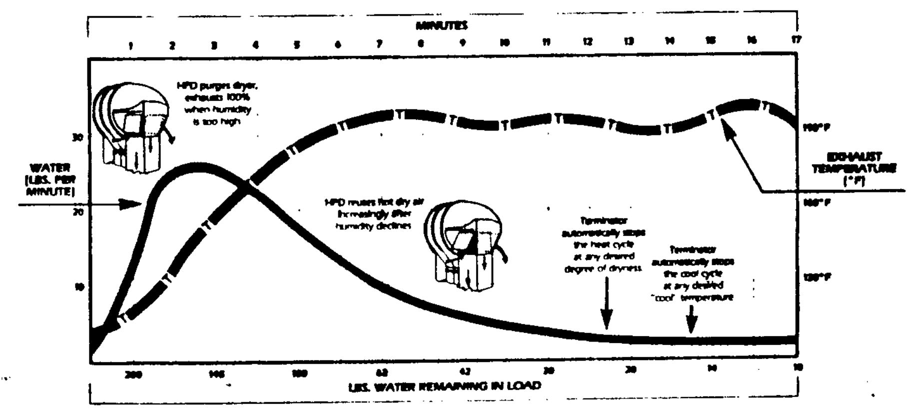
HPD: Supplies 100% of dryer make-up air.

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

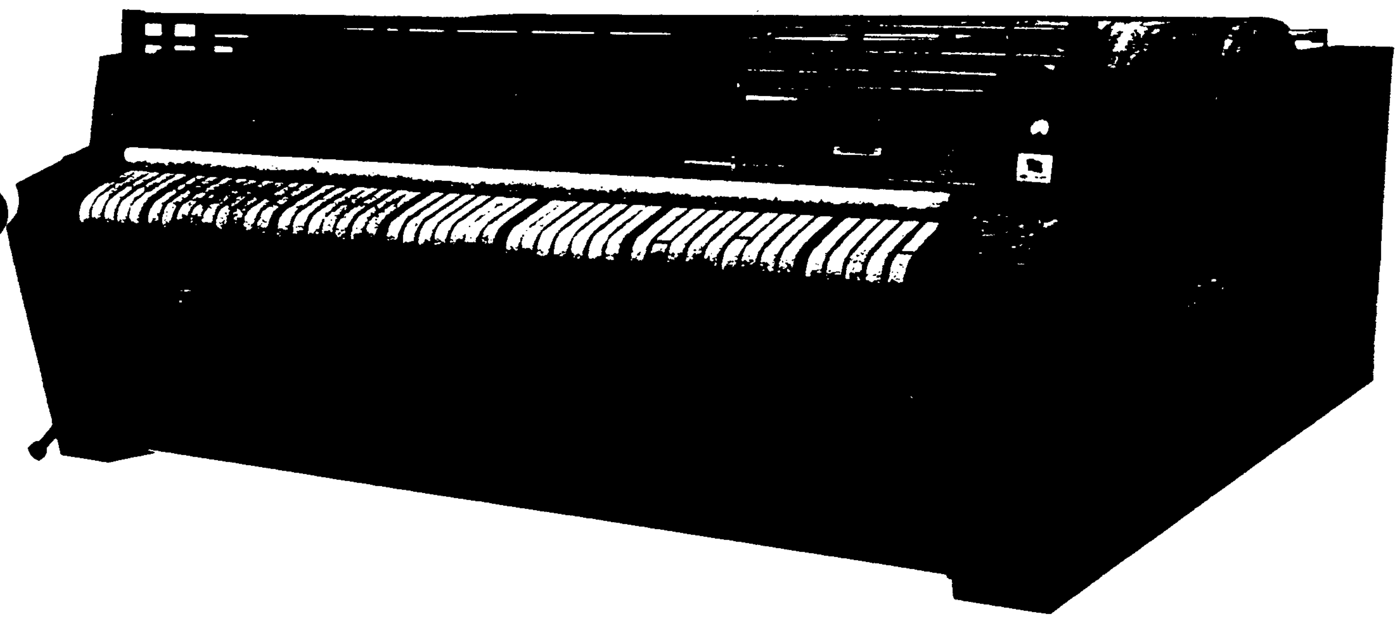
TASK DESCRIPTION	QUANTITY		LABOR				EQUIPMENT		MATERIAL		TOTAL	SHIPPING	
ECO # 26	NO. OF UNITS	UNIT MEAS	MH UNIT	TOTAL HRS	UNIT PRICE	COST	UNIT PRICE	COST	UNIT PRICE	COST		UNIT WT	TOTAL WT
THERMAL FLUID HEATER	1	EA				2500–		22,000–			24,500–		
ULTIMA 36 2 ROLL PRESS	1	EA				10,000–		121,000			131,000–		
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



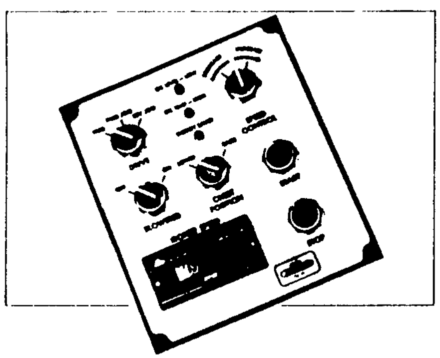
The benchmark in quality flatwork finishing.
SUPERSTARS, in use the world over, are designed and built in the U.S.A.
Each features the ready availability of all U.S.A. made components and JENDRIVE II—a completely self-contained slide-out drive unit.

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.

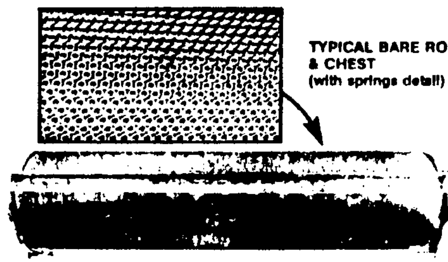
5/10 Warranty Plus

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 - 2060 lbs./hr. (766 - 936 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.

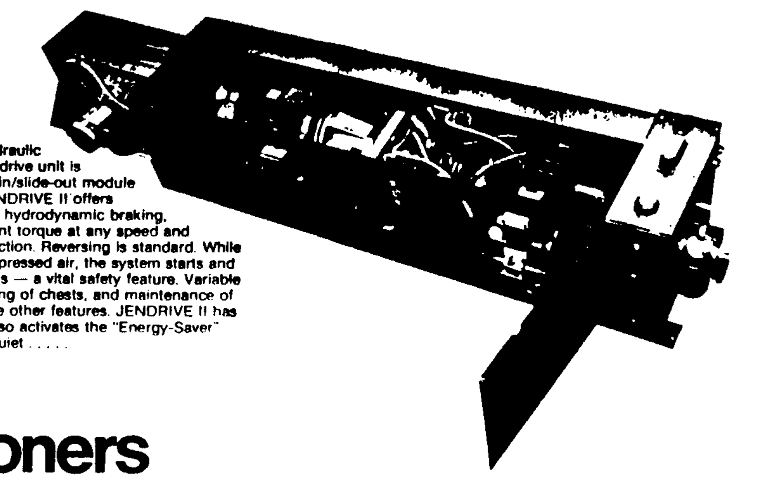
THERMAL MODELS	Superstar 700	Superstar 800
SPEEDS AND PRODUCTIVITY**		
1 Roll Std. Speed	15 - 100 ft./min. (5 - 30 m./min.)	15 - 100 ft./min. (5 - 30 m./min.)
Cottons (@ 50% moisture) @ 450°F	600 - 750 lbs./hr. (273 - 341 kg./hr.)	680 - 850 lbs./hr. (308 - 386 kg./hr.)
50/50 Blends (@ 30 - 35% moisture) @ 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' (4.06 m. x 1.98 m. x 1.83 m.) 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' (4.06 m. x 1.98 m. x 1.83 m.) 7100 lbs. (3220 kg.)

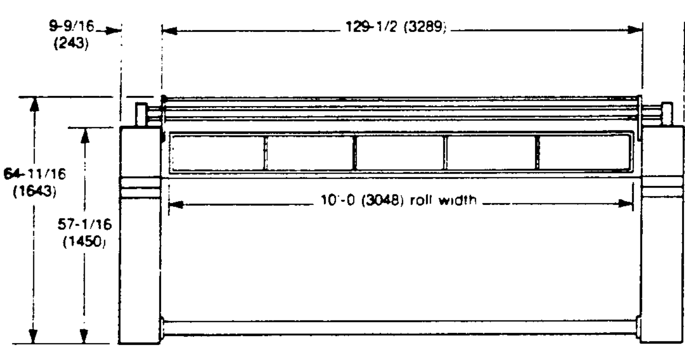
[illegible]

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)



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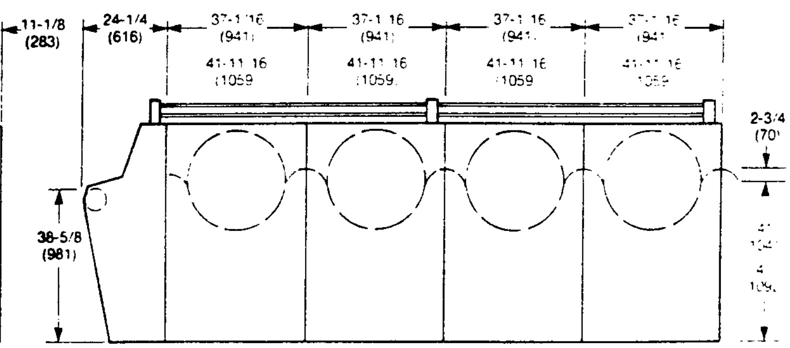

SIDE

For additional information contact your local Jensen Distributor.

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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.

INVITATION/CONTRACTOR

EFFECTIVE PRICING DATE

DATE PREPARED 26 MAY 89

PROJECT COLD WATER LAUNDERING

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

DRAWING NO.

SHEET 1 OF 1 SHEETS

LOCATION FORT LEONARD WOOD

ESTIMATOR

CHECKED BY

ECO # 27

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 ON	4	MHRS		4	33-	132-					132-		
ONE 600 lb WASHER													
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 ARMY	FY 19 91 MILITARY CONSTRUCTION PROJECT DATA	2. DATE 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.

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.

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

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

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

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	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)
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	11537510	11541786.8
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
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

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-		
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

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)				

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D – Designer

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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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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 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)				

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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	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.

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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.

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*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-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.

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COMMENT ATTACHED – Significant information summarized or explained and attached.

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* 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-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)				

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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A – DFAE
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.

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COMMENT ATTACHED – Significant information summarized or explained and attached.

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* 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-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			

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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•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-A-R, Feb 82

B. SITE DEVELOPMENT

See Tech. Data Checklist Item		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

C. ARCHITECTURAL & STRUCTURAL (Continued)

See Tech. Data Checklist Item		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

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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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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DA FORM 5025-D-4-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-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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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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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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DA FORM 5025-E-R, Feb 82

See Tech. Data Checklist Item	F. FIRE PROTECTION 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 ARMY	FY 19 91 MILITARY CONSTRUCTION PROJECT DATA	2. DATE 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.

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

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

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.

TO BE DETERMINED – Information needed but not currently available. Enter code for information source.

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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.

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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 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)				

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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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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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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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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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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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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	NR			
	(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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DA FORM 5025-B-1-R, Feb 82

B. SITE DEVELOPMENT (Continued)

See Tech. Data Checklist Item		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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DA FORM 5025-C-1-R, Feb 82

C. ARCHITECTURAL & STRUCTURAL (Continued)

See Tech. Data Checklist Item		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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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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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

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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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

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)				

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design data checklist

DA FORM 5025-E-R, Feb 82

See Tech. Data Checklist Item	F. FIRE PROTECTION 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		2. DATE
ARMY	FY 19 91 MILITARY CONSTRUCTION PROJECT DATA	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

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

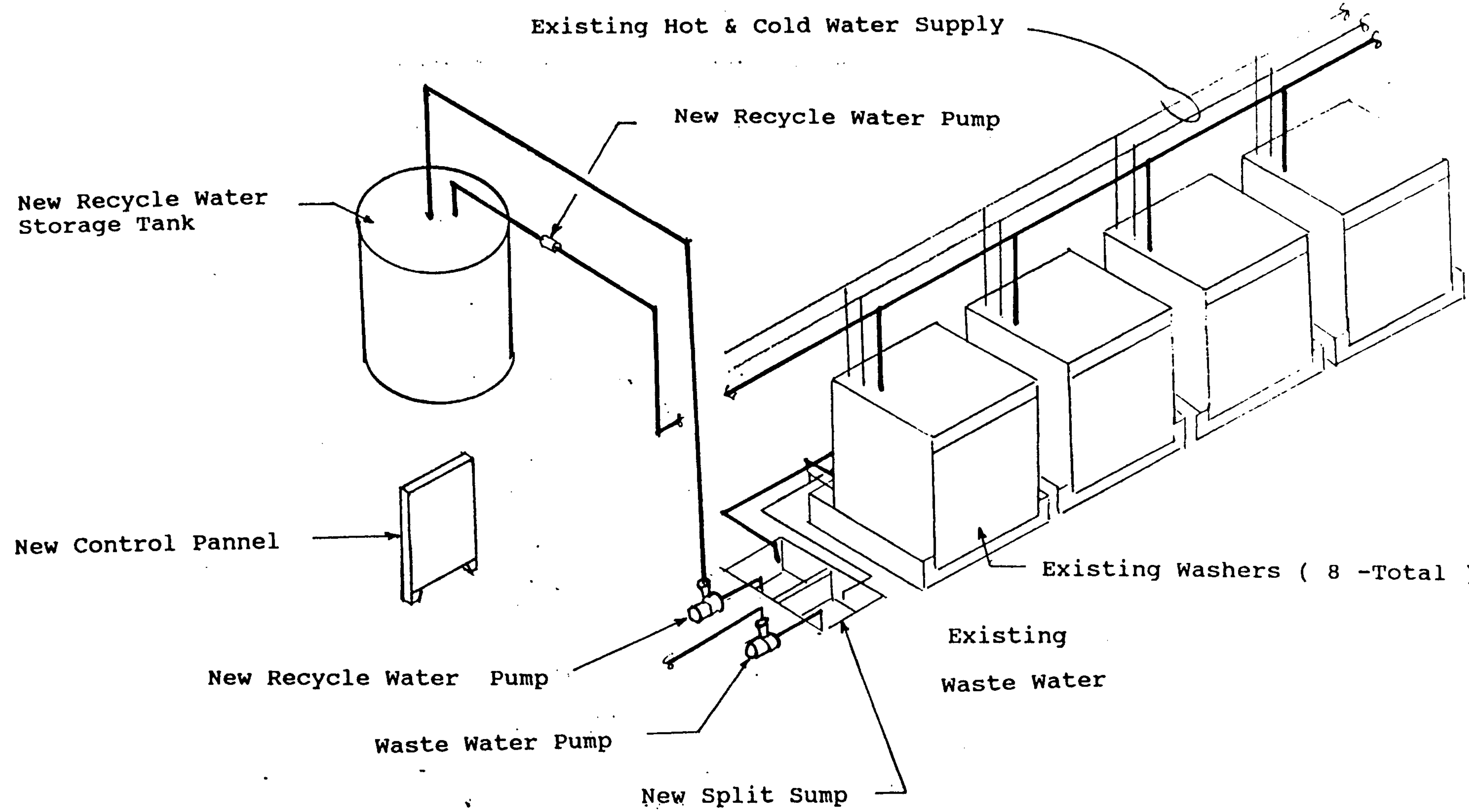
CHECKED BY:

ECO #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

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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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
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- 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)				

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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.

ITEM	COMMENT
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

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

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

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

C. ARCHITECTURAL & STRUCTURAL (Continued)

See Tech. Data Checklist Item	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	NR			
	(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

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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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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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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DA FORM 5025-E-R, Feb 82

See Tech. Data Checklist Item	F. FIRE PROTECTION — 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

FY 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	[illegible]	1	[illegible]	22728
	MEDIUM	3		40		55	30	34	4	[illegible]	[illegible]	[illegible]	05 222
	LARGE				1								1
.13	PILLOWCASES	5295	5319	5183	5163	5670	5726	5264	5455	[illegible]	[illegible]	[illegible]	6044 64223
1.25	SHEET COTTON	9112	9323	8619	8735	9314	[illegible]	7801	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] 42951
.194	TABLECLOTH	132	911	1494	11026	1386	11803	2303	[illegible]	[illegible]	[illegible]	1687	174519672
.18	TOWEL HAND	[illegible]	7993	7551	7882	8953	7780	3236	8493	5242	[illegible]	1834	9810 144337
	LAUNDRY BAG LARGE	692	650	673	1819	631	1048	1713	1634	[illegible]	[illegible]	1442	6978543
	BABY ITEMS PER LB.	545	575	537	570	635	[illegible]	576	470	[illegible]	[illegible]	422	9887275
	BATHROBE	2416	2560	2035	2149	2370	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1682	206522953
4.2	BLANKET COTTON	2443	2269	2357	2524	2835	2991	2488	11701	1336	[illegible]	1864	271628457
	BLANKET WOOL	4							25	5			34
.09	CLOTH WASH	5403	5060	5737	5958	5202	2216	5474	5007	5444	5152	5377	6:2566697
	COAT CONVALESCENT	[illegible]	30	33	30	35	46	44	20	49	[illegible]	[illegible]	20445
	COAT OPERATING/SCRUB	[illegible]	2290	[illegible]	2436	1761	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2131022266
	GOWN OPERATING/XRAY	3761	3195	3535	4068	2118	2335	[illegible]	[illegible]	3655	3572	[illegible]	3985 41898
.10	GYM SHORTS	201	1030	174	425	383	1188	1195	176	167	[illegible]	161	1982837
.11	PAJAMA COAT	4156	2880	3234	2824	3202	31834	2625	2248	2131	2297	2666	331736446
.4	TROUSERS	3872	2740	2400	2914	3290	3766	2666	2276	1916	2456	2443	386 34804
	PAD FLOOR 3X5	92	131	91	122	112	152	146	120	142	[illegible]	141	[illegible] 14493
	PANTS CONVALESCENT/SCRUB	1735	2115	2657	1883	11788	2798	2091	3011	[illegible]	[illegible]	1901	[illegible] 26806
	TOWEL BATH	11094	9382	8790	10577	7605	12087	9814	7534	[illegible]	[illegible]	[illegible]	1149 118712
	WRAPPER	5177	4913	4218	5218	7665	5521	5134	[illegible]	4735	[illegible]	5378	6225 68422
	COVER HAMPER	[illegible]	338	268	299	276	305	271	200	238	223	307	794 3858
	PILLOW	[illegible]	63	85	65	24	41	68	28	[illegible]	[illegible]	40	[illegible] 631
	SHEEPSKIN	3			3		2	10	3				1 22
	CAST DR/ORTHO/FOOD H	3	1				148			[illegible]		2	201
	SMOCK						44	50	17	180	123	140	20614
	DRESS HOSP.	100	105	125	105	130	184	177	130	222	98	60	1251557
	SALVAGE HOSP. DAMAGED							363					353
	DYE NEW ITEMS	1610	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	77	77	61	42	23	57	71	62	37	[illegible]	40	53672
	CLOTH WASH	[illegible]	7157	2774	2595	6970	16282	9644	7883	[illegible]	[illegible]	9318	[illegible]
	NAPKIN	4253	2524	5656	3771	3457	3519	4765	4399	4137	4330	3049	350947369
.3	PILLOWCASE	46793	23300	21709	17039	34486	35960	33783	34371	42731	[illegible]	44538	39284 435955
	SALVAGE DYE SHOP/TOWEL ORT.	1178			31	21			185			1527	3553
1.25	SHEET COTTON	84235	[illegible]	45736	32021	67552	69865	65981	65465	[illegible]	[illegible]	[illegible]	[illegible] 325499
.99	TABLECLOTH ALL	3600	1784	2680	2389	2169	2439	2951	2994	[illegible]	[illegible]	[illegible]	311 231665
	UNIFORM, FROCK FOOD H		5	8									16
	SMOCK	286	244	290	208	289	249	274	274	203	312	238	322 3184
	SMALL												

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	OCT. 86	NOV. 86	DEC. 86	JAN. 87	FEB.	MAR. 87	APR. 87	MAY. 87	JUNE 87	JULY 87	AUG	SEPT. 87
BAG SLEEPING	5392	5177	11920	3620	3493	4003	4991	3301	3793	5658	4679	595456976
BLANKET	10640	10695	8483	9771	9586	12555	10528	11610	13627	11136	12308	125731307118
TROUSERS SWEAT	1637	2427	2908	3558	3910	3863	3536	2381	3000	4273	3550	307738699
TOWEL BATH	10829	8599	7812	8477	9325	14218	17118	10772	12295	11974	13242	1091513757
SHORTS GYM	4454	4107	4208	1281	3856	3813	3369	2501	2307	4052	5371	3787[illegible]706
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	84	145	134	213	186	83	295	131	147	160	91	1231892
SHIRT, TEE-SWEAT-JERSEY	5326	4605	6497	4422	6353	[illegible]	6270	[illegible]	4793	5612	10381	649379949
BAG LAUNDRY-DUFFEL	3886	3898	4467	2378	2566	[illegible]	3214	[illegible]	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	5538	[illegible]557358
COVER CANTEEN	79	1100	86	187	102	226	393	1352	[illegible]	198	514	[illegible]3606
COVER HELMET					80			58	[illegible]	144	158	635
DRAWERS COTTON/WOOL			11	25	57	200	135	64	125		87	704
GLOVE/CHEMICAL/[illegible]	651	42		52	132	20	49	21	11	5		6999
JACKET FIELD NBC	992	1589	1663	964	867	1204	912	747	190	733	243	75910863
LINER FIELD JACKET	79	1551	1378	360			1518	804	416	323	200	856719
LINNER 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	165023440
PACK FIELD 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	610253099
RUG. SQ. FT.												
RAGS	4944	2829	2527	4150	4189	4552	4876	4097	3343	4299	[illegible]	35[illegible]46320
SHELTER HALFS	4836	3754	4244	2599	2934	3584	3733	[illegible]	3627	5453	5068	4527 47098
SHOE-TENNIS	151	18	123	30	44	173	34	94	33	38		94 832
SOCKS						16		437	26	382		518 1379
TROUSERS FIELD NBC	1265	1095	2474	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 49491
MISC SMALL	401	779	336	100	199	1444	879	2083	1733	3355	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	488	656	346	645	380	221	3415738
TROUSER UTILITY/BDU	607	756	863	577	645	683	613	493	443	573	480	1747207
LOT #3-LAUNDRY ORIGANIZATIONAL 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	4344672
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	[illegible]	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]	[illegible] 283

	OCT. 86	NOV. 86	DEC. 86	JAN. 87	FEB.	MAR. 87	APRIL 87	MAY 87	JUNE 87	JULY 87	AUG.	SEPT. 87
SHIRT EXCEPT BDU	95	81	98	45	123	156	140	145	82	169	151	18 1486
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	429	291	373	443	367	5[illegible] 3873
MISC. SMALL		56	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[illegible] 71
NAPKIN	12		11									0
PILLOWCASE	14	10	1	2		2	14	1				44
SHEET CONTOUR	3	4										0
SHEET REGULAR	6	4	1			6	9					20
TABLECLOTH	4	1	6			2				2	2	[illegible] 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	9	27	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	129 595
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
LOT #5 IPR 24 HOUR												
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	625	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	777	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

	OCT. 86	NOV. 86	DEC. 86	JAN 87	FEB	MARCH 87	APRIL 87	MAY 87	JUNE 87	JULY 87	AUG. 87	SEPT. 87
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	3610	6460	11837	9052	11183	9360	[illegible]
2 BUNDLE PER. WEEK	102012	95570	47258	56110	69616	75670	75311	65409	96945	138083	120896	[illegible]
PERMANT PARTY	1931	433	1332	1512	1426	1620	1567	1176	1344	1452	1193	[illegible]
	14349	[illegible]	11093	13737	12237	14484	14471	12784	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	[illegible]	[illegible]	52	90	[illegible]	123	32	1	2	357		782
CORPORAL							1					12
CURTAIN/DRAPES	123	586	554	399	432	118	375	188	207	187	248	2303643
HOOD WINTER LINED	1	129	209		50	19	21	55	39			75577
JACKET ALL	2				1		8					516
ALTAR CLOTH ALL	9	[illegible]		4	7			20	2	5		1067
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	2003022
TABLECLOTH ALL	4			6		14	13	35	5	7	13	10107
ROBE/GOWN ALL	22				39		32		24		67	518
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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	OCT. 86	NOV. 86	DEC. 86	JAN. 87	FEB	MARCH 87	APRIL 87	MAY 87	JUNE 87	JULY 87	AUG	SEPT-87
LOT # 8												
SHIRT WOOL	109	143	24		83	47		63	30	17		5 593
TROUSER WOOL	39				66	45		5				10 106
LOT # 9 ORGANIZATIONAL DRY CLEANING 48 HR.												
COAT AG. PHASE II	2716	3193	4143	279	1990	1839	1842	1234	2663	3335	2967	25 028291
TROUSER AG. PHASE II	3098	3903	4348	1680	3541	2978	2669	2471	3089	4986	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	78	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 CIV MIL	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 W/O LINER MIL CIV	6	17	4	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	163	132	99	115	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	FEB	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
~~[illegible]~~												
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 PANTSUITS DRESS	417	1670	290	333	271	381	363	250	270	267	316	2913749
MISC. SMALL	1	29				11		19	113			85258
MEDIUM		4	1	2	2			16		147		9181
LARGE												0
CURTAINS/DRAPES	521	156	78	174	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
PILLOW CASE	6724	6152	6093	4908	5583	5718	3887	4100	4205	3771	4887	3984	[illegible]
SHEET COTTON	9539	9113	7492	8561	9645	9052	4873	4014	7079	5613	8881	6283	[illegible]295
TABLECLOTH	2180	1372	1663	1369	1454	1433	1159	1383	1401	1191	1250	1162	17007
TOWEL HAND	9776	8139	7260	7569	9909	9480	8077	9622	8345	5687	1441	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	7295
BATH ROBE	2562	2460	1945	1518	2323	1659	1240	1190	967	1216	1269	850	19273
BLANKET COTTON	2333	2956	2762	2224	2850	2685	1788	1731	1811	1513	1726	1879	27558
BLANKET WOOL	2	27	5		7							5321	5362
CLOTH WASH	8535	5568	5627	6272	6673	5806	5172	5081	5080	4300	5202		62[illegible]
CART CONVALCENT	20	25	41	35	12	20	88	5	20	35	32	60	373
CART OPERATING/SCRB	2277	2371	2318	1861	2515	2637	2168	2340	2116	1923	2430	2081	[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	2475	1647	32987
TROUSERS	4058	4508	3006	3077	3895	2469	1590	1761	2025	211	2313	1756	32628
PAD FLOOR 3X5	148	121	8	128	81	32	129	140	44	149	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	8265	10196	8310	122,[illegible]5
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	13	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 [illegible]	4226	3362	3245	3778	3133	2193	2542	2707	2304	1528	2504	12[illegible]
ORGANIZATIONAL 72 HR.													
APRON FOOD H	33	1	45	28	19	31	50	10	11	5		10	270
CLOTH WASH	4628	6396	4929	5182	6578	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	35061	42889	78338	84092	90392	64721	7[illegible]517
TABLECLOTH ALL	2572	2397	3328	2473	2812	3087	2814	2770	2980	2811	2380	3030	33414
UNIFORM FROCK F.H												123	123
SMOCK	264	53	324	285	253	292	227	150	250		2292	2709	2048
MISC. SMALL			1			3	3				~~2285~~	2178	390
MED.								1			19	315	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	AU .8	SEP. 88
BAG SLEEPING	4491	6084	4603	2644	3819	3477	2601	2288	3511	4195	6259	4526 [illegible]
BLANKETS	11475	10336	7295	9160	7675	9972	9736	8423	9904	9467	13207	111994 [illegible]
TROUSER SWEAT	3472	3151	2348	2373	2215	2411	2306	1850	1839	2620	5062	3158 3308
TOWEL BATH	8851	8872	6318	7275	9198	10066	10768	12959	15583	17521	19601	17807141 [illegible]
SHIRT GYM	2789	3250	3041	2167	2501	2027	1825	1780	2193	2923	3102	3263 [illegible]
COVERALL/OVERALLS	42	37	175	171	163	171	219	84	346	100	142	84 17[illegible]
PAD MATTRESS	394	543	340	370	335	467	368	364		376	456	8278 [illegible]
SPREAD BED	124	100	171	88	123	115	153	95	213	152	242	211 17[illegible]
SHIRT TEE. SHIRT JERSEY	7678	7006	6019	4233	6682	5427	3991	3940	5180	5532	11178	7362 [illegible]
BAG LAUNDRY, DUFFEL	3666	3799	3423	2531	2985	2425	2901	2022	1824	3227	6664	4053 [illegible]
CAP BDU	333			500	321	150	301	14	559	265		212 26[illegible]
COVER AMMO	511	184	80		50	98	126	22		200		3101299
COVER MATTRESS	4305	4001	3551	3012	3365	3699	3833	4361	3515	3712	3032	4692 [illegible]
COVER CANTEEN	466	465	170		84	135	256	88	47	240	1230	1262 5[illegible]
COVER HELMET	83		98	60		77		138		165	1717	2358
DRAWERS, COTTON, WOOL	461		1008	532	1239	623	464	117	758	636	1718	835 7[illegible]
GLOVE. CHEM. T FINGER			22	17	74	25	19	8		5	29	11 213
JACKET FIELD. NBC	160	514	493	396	381	425	448	637	334	377	427	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 1[illegible]
NECK BAND HELMET	2300	1900	1350	1450	1444	1150	850	700	20			126 11[illegible]
PACK FIELD ALL	645	52	334	195	117	291	81	57	127	235	319	24-13
PILLOWS	5076	3889	3217	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	1662	3344 [illegible]
SHELTER HALVE	4415	3902	3347	2020	2506	2894	2202	2009	1943	3474	6383	3069 [illegible]
SHOE TENNIS			48		30	48	46					37 209
SOCKS	479	522	550	343	796	52	244	223	1305	403	1205	734 6855
TROUSER FIELD, NBC	959	258	203	758	2159	959	852	788	696	237	1154	896 10515
UNDERSHIRT, WOOL	117		406	25	118		552	123	213	266		95 2[illegible]
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	2658 [illegible]
MED	6	8	9		1	3	6	8	447	10	249	36 4[illegible]
LARGE											262	342
SHIRT UTILITY/BDU	378	210	411	575	324	608	651	353	2058	439	722	1171 8097
TROUSER UTILITY/BDU	316	256	529	444	456	539	640	715	1580	160	1006	543 7704
LOT III 3. LAUNDRY ORGANIZATIONAL 48 HR												
COAT FOOD H/MED.	438	395	361	331	388	457	335	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	18	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	34	55	40 40
CURTAINS/DRAPES	15	14										59
JACKET FIELD												[illegible]

	OCT. 87	NOV. 87	DEC. 87	JAN 88	FE.	MAR. 88	APR. 88	MAY 88	JUN. 88	JUL. 88	A. 88	SEP. 88
SHIRT EXCEPT BDU	192	141	118	101	77	103	127	120	152	116	128	1 19 1588
SHIRT BDU	364	325	329	325	339	424	369	413	484	457	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 4597
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	11 290
LARGE	3	7	6		5	3	4	4	5	13	7	30 87
COVERALL	2	4		3				1		1		11
HANDKERCHIEF	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	22	[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	[illegible]	6	57
SOCKS	65	14	52	53	19	66	6	13	26	81	32	27 474
SPREAD BED			1		1		1	1	3		1	8
TOWEL BATH	43	16	17	13	22	44	11	18	12	19	11	12 238
TOWEL BEACH												0
MISC. SMALL												0
MED.												0
LARGE												0
LOT #5 24 HR IPS												
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	5 120
SHIRT EXCEPT BDU	30	8	47	48	17	64	74	63	83	81	53	48 568
SHIRT BDU	123	117	107	115	138	178	144	418	539	290	429	183 28[illegible]
SKIRT	2		3	2	3	3	4	9	6	3	16	3 51
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	88	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	
RUG. SQ FT.									52	1			53
SHIRT TEE									43	93	80		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	17	14		39
PILLOWCASE									2				2
SHEET	10								4	4			18
LOT#6 PAYROLL DEDUCTION													
1 BUNDLE PER WEEK 2 BUNDLE PER WEEK PERMANENT PARTY	4730 49646 1136 10724	4602 45127 1173 10669	2581 29472 1103 10288	2205 27683 1133 10744	2192 28736 1032 11645	1461 13841 1530 14825	1750 [illegible] 1430 13414	741 7768 1293 1388	3168 35665 1490 14278	4953 58925 13676 1457	3312 44640 1402 13272	2328 26763 1344 12747	[illegible] [illegible] [illegible] [illegible]
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	1376
COAT LONG LINED		37	5	166	2	96	41		5	1	897		691
CORPORAL													0
CURTAIN/DRAPES	152	316	45		259	362	284	51	49	501	448	23	2490
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	8	260	130	1721
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	32	403	136	2599
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	264	9		421
MISC. SMALL		31								4			35
MED.										1			1
LARGE													0
CAP PILE		16	4	38	210	625	239	253	95	8			1488
CAP GARRISON			123				165			133	39		460
COVERALL/OVERALL	227	176	141	53	39	36	23	22	23	10	27	12	789
SCRAF WOOL		22								10			81
DRESS				15									180

	OCT. 87	NOV 87	DEC 87	JAN. 88	FEB	MAR. 88	APR 88	MAY 88	JUN 88	JUL 88	A	SEP. 88
LOT # 8												
SHIRT WOOL	8	114		283	269	600		122	-	7		1403
TROUSER WOOL	69	45	47	74	38	117						39
LOT # 9 ORGANIZATIONAL DRY CLEANING 48 HR.												
COAT AG. PHASE II	2740	2178	3148	197	1204	1368	818	937	1516	3193	3918	2053
TROUSER AG. PHASE II	3386	3287	3729	1239	1939	1893	1232	1351	2168	3196	5499	3195
SHIRT	2711	2103	2784	191	1194	1303	787	899	1509	3193	3933	2031
LOT # 10 IPR DRYCLEANING 72 HR.												
BLOUSE	44	59	62	49	43	56	68	92	71	91	87	82
COAT FUR TRIMMED	2									21	1	1
COAT SPORT/UNIFORM	94	78	83	202	47	83	85	85	64	45	56	98
COAT LONG LINED MIL/CIV	2	6	1	3	39	2	40	1	20	-	4	12
COAT LONG LINED W/LINER	42	40	41	37	46	48		38		4	3	17
CURTAIN/DRAPES	82	37	20	24		78	43	75	231	14	6	8
DRESS EXCEPT EVENING	39	26	36	29	40	48	59	42	60	42	47	73
DRESS EVENING	4	1			1						2	13
RUG SQ. FT.	65	53	49		60			87	37	4	1	3
SKIRT W/O PLEATS	33	54	56	52	58	72	89	55	66	57	32	58
SKIRT W/ PLEATS	1	4	4	5		1			3	12	3	5
SHIRT ALL MIL/CIV	58	62	63	373	57	54	73	80	85	46	58	110
SHIRT W/MILITARY CREASES	3	2	1	8	2	6	4	2		0	4	9
SUIT CIV. 2 or 3 PC	65	75	79	65	40	57	79	88	52	31	70	75
SWEATER	75	92	106	108	109	70	73	72	39	19	14	51
TABLECLOTH H-PROCESS	1				1					1		
NECKTIE	13	14	14	13	7	4	15	14	16		3	1
TROUSER ALL	26	285	225	583	280	252	297	328	314	302	248	300
UNIFORM MILITARY	10	11	10	11	11	9	11	13	8	4	6	10
MISC. SMALL	16	9	9	162	7	10	11	29	20	12	20	39
MED	7	10	7	4	3	11	6	13	3	4	12	1
LARGE	5	4		6	2	5	11	11	7	8	24	13
LOT # 11 IPR DRY CLEANING (SAME DAY)												
BLOUSE	11	10	4	8	3	9	10	8	9	15	5	39
COAT FUR TRIMMED						1				4		1
COAT SPORT/UNIFORM	35	45	61	36	19	34	29	33	28	12	13	55
COAT LONG W/[illegible]	1	10	2	3	1	2	10	2	6	2	1	4
COAT LONG W/[illegible]	6	17	30	30	29	16		4			2	7
SHIRT W/MIL CREASES					1					12	3	
CURTAINS SQ. YDS.			6			22	29			10	1	
DRESS EXCEPT EVENING	11	3	10	8	12	12	14	14	15	14	16	27
RUG SQ. FT.										5		
SKIRT W/O PLEATS	19	13	25	16	8	29	10	10	11	16	13	29
SHIRT ALL MIL/CIV	69	36	55	44	56	62	52	51	152	55	75	73
SUIT CIV. 2 or 3 PIECE	21	18	30	24	15	13	18	20	29	19	5	28
TROUSER ALL	113	147	152		95	178	197	46	234	31	139	215
UNIFORM MILITARY	18	23	14	7	12	14	7	17	8	3	6	2
SWEATER	19	28	49	39	37	21	16	13		4	2	11

	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	36
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	3195
MISC. SMALL			103			2	100						205
MED		2					2				10		14
LARGE			8										8
CURTAINS/DRAPES	46	264	892	113		4		24	36			720	2729

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
	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	451	360.8
	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	2473	2473
	SHEETS FITTED	1.25	35852	44815.00	125241	156551.25
			---------	---------	---------	---------
			830615	594501.90	865186	695720.77

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	825498	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	572	520.52
	APRON	.25	114	28.50	205	51
			---------	---------	---------	---------
			10517	8783.71	9816	8034.83
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	0
	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	0
	QUILT	4.70	0	.00	0	0
	RUGS	1.35	0	.00	0	0
	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
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			14248	28156.48	16447	30446.57

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	1351
	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	17821.38	8733	17458.23
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
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			107931	1295172.00	49357	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	783	2033.20	691	1796.6
	CORPORAL	1.00	2	2.00	0	0
	CURTAINDRAPES	2.50	3613	9032.50	279[illegible]	6575
	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	841.8
	TROUSER WOOL	1.60	165	264.00	390	624
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			16290	27989.67	20628	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
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			95725	151929.39	79091	125448.85

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	2308.4
	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
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			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
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			6122	7463.38	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	9.80	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	6957.4
	TOTAL PRODUCTION ALL ITEMS		3452655	4364230.54	3159646	3470014.97
	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	1752	1055.5	1156.5	876
	PAD FLOOR 3 X 5	1.35	148	29	128	199.8	39.15	172.8
	PANTS CONVALESCENT/SCRUB	.50	1581	1995	1618	790.5	997.5	809
	TOWEL BATH	.57	8265	10198	8310	4711.05	5812.86	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	61211	56266	38315.39	44[illegible]	63151.69

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	64721	105115	112988.75	80901.25
	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	9547	13207	11199	23867.5	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	3328	6664	4053	2496	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/TFINGER	.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	123	0	0	8.61
	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/PACK	.19	583	1356	350	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	2515.5
	TROUSERS UTILITY/BDU	3.20	160	1006	543	512	3219.2	1737.6
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			216073	262600	206471	196683.5	245617.51	203294.75

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	312	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
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			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	32	27	12.15	4.8	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
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			1725	1352	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	1449	543	1778.38	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 IF					0	0	0
	PERMENANT PARTY BE					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	112.	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	.16	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	.61	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	3916	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	11678.97

LAUNDRY PRODUCTION DATA

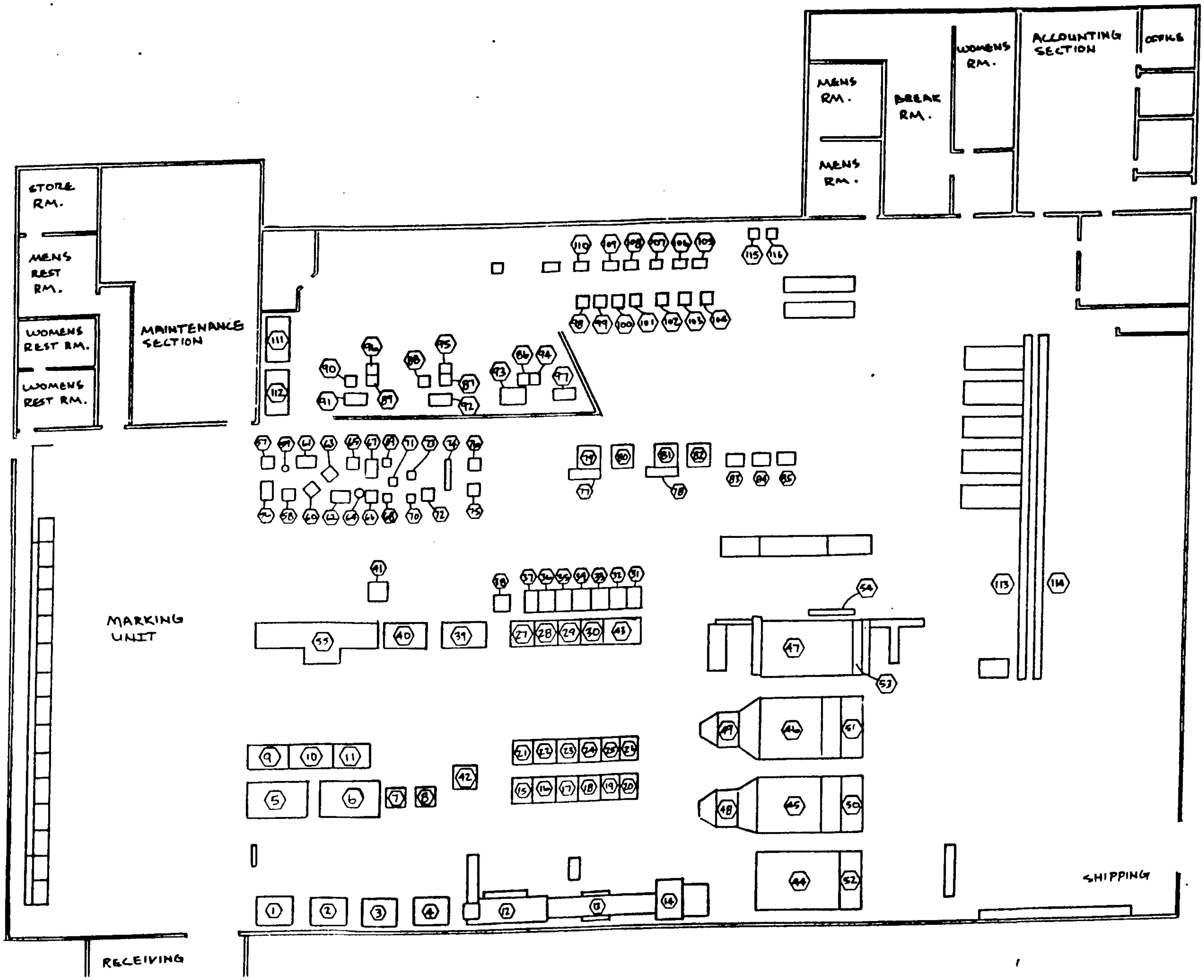
LOT #	ITEM DESCRIPTION	UNIT WEIGHT LBS	JUL 88 # OF ITEMS LAUNDERED	AUG 88 # OF ITEMS LAUNDERED	SEP 88 # OF ITEMS LAUNDERED	JUL 88 # OF LBS LAUNDERED	AUG 88 # OF LBS LAUNDERED	SEP 88 # OF LBS LAUNDERED
LOT #10 - IPR DRY CLEANING 72 HR								
	BLOUSE	.47	91	87	82	42.77	40.89	38.54
	COAT FUR TRIMMED	3.00	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	15	14	51	15	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	2.90	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	885.42	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	920	0		1012
			---------	---------	---------	---------	---------	---------
			0	213	1225	0	276.4	1408.5
	TOTAL PRODUCTION ALL ITEMS		291786	349264	273588	335503	379223.75	327146.28
	TOTAL PRODUCTION DRY CLEANING		13038	17218	10530	19911.62	26035.24	15481.78
	TOTAL PRODUCTION LAUNDERED ITEMS		278748	332046	263058	315591.18	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
MARKING UNIT
RECEIVING
MENS RM.
MENS RM.
BREAK RM.
WOMENS RM.
ACCOUNTING SECTION
OFFICE
SHIPPING

D -

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 2,750,000 BTU 8000 CFM AIRFLOW THRU DRYER
GAS INPUT	-	3 MILLION BTU 80 LB COMPRESSED AIR 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 (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
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 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
		1 AMP 220 VOLT
	SHAPE POST	1/2" STEAM LINE
	SHIRT PRESS	MODEL CRLYA1
		2.5-2.75 BHP AT 100-140 PSI STEAM
		0.53 CU. FT. AIR AT 80 PSI
	COLLAR PRESS	
	BAG SLEEVER	1.75 BHP AT 100 PSI STEAM
		0.03 CU. FT. AIR AT 80 PSI
		0.166 CU. FT. FREE AIR
	LONG COAT PRESS	1.75 BHP AT 100-125 PSI STEAM
		0.03 CU. FT. AIR AT 80 PSI
PRESSING STATION (3 EACH)		
	3 MISCELLANEOUS PRESS	
		95-100 POUND STEAM SUPPLY
		70-80 POUND COMPRESSED AIR
AJAX PRESSING STATION		
HANGER CONVEYOR		2 MOTORS
		1/2 HP 115-208-230
PRESSING STATION		
	13 INDIVIDUAL PRESSES	
		1/2" STEAM LINES
		1 BOILER HP
		55 POUND AIR PRESSURE
		85 POUND STEAM PRESSURE
14 MARKING MACHINES		COMPRESSED AIR
AIR COMPRESSORS		TWI STAR MOD TA 0265 EC111JJ
		125 LB 230 VOLT
		TWI STAR TA225 WW2-125
		60 HP

APPENDIX "E"

COMPUTER INPUT

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:
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```
*   1 *  INPUT=LOADS  ..
-    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 ..
```

```

      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:
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```
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* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

FORT LEONARD WOOD LAUNDRY PLANT STUDY PC-DOE/DOE-2.1B 1/01/86 0:05 LDL RUN 1

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	1158.	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	47799.0	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	1593.3	0.0	315.0	325.0

REPORT- LV-C DETAILS OF SPACE LAUNDRY ----------(CONTINUED)--------

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	79[illegible].	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	185.00	0.00	0.00	0.00
WEST-WINDOW	WEST-WALL	270.00	0.00	0.00	0.00	0.00

FORT LEONARD WOOD LAUNDRY PLANT STUDY

PC-DOE/DOE-2.1B 1/01/80 0:05 LDL RUN 1

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
```

FORT LEONARD WOOD LAUNDRY PLANT STUDY PC-DOE/DOE-2.1B 1/01/80 0:05 SDL RUN 1

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

	- - - - - - - - - C O O L I N G - - - - - - - - -					- - - - - - - - - H E A T I N G - - - - - - - - -					- - - E L E C - - -	
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	31086.	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	29682.	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

EQUIPMENT	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 54.4E	0.0	0.0	0.0	0.0 0.0E	1787.0	84.0 24.6E	0.0	2564.0	2749.5	3195.1
FEB	998.3	0.0	169.2 49.6E	0.0	0.0	0.0	0.0 0.0E	1641.6	77.3 22.7E	0.0	2344.6	2513.8	2920.1
MAR	1122.6	0.0	193.9 56.5E	0.0	0.0	0.0	0.0 0.0E	1844.2	86.6 25.4E	0.0	2658.2	2851.1	3314.4
APR	1039.8	0.0	185.5 54.3E	0.0	0.0	0.0	0.0 0.0E	1703.4	79.3 23.2E	0.0	2517.4	2702.9	3148.3
MAY	9[illegible].8	0.0	166.5 48.8E	0.0	0.0	0.0	0.0 0.0E	1508.6	70.0 20.5E	0.0	2248.6	2415.1	2815.0
JUN	99[illegible]	0.0	181.[illegible] 53.0E	0.0	0.0	0.0	0.0 0.0E	1619.0	74.9 22.0E	0.0	2432.0	2614.0	3048.7
JUL	99[illegible].0	0.0	181.0 53.0E	0.0	0.0	0.0	0.0 0.0E	1618.8	74.9 22.0E	0.0	2432.8	2613.8	3048.5
AUG	945.0	0.0	172.8 50.6E	0.0	0.0	0.0	0.0 0.0E	1545.2	71.5 21.0E	0.0	2322.2	2495.0	2910.0
SEP	991.0	0.0	181.0 53.0E	0.0	0.0	0.0	0.0 0.0E	1618.8	74.9 22.0E	0.0	2432.8	2613.8	3048.5
OCT	963.0	0.0	174.4 51.1E	0.0	0.0	0.0	0.0 0.0E	1575.8	73.1 21.4E	0.0	2352.8	2527.2	2948.0
NOV	902.2	0.0	166.6 47.0E	0.0	0.0	0.0	0.0 0.0E	1478.4	68.9 20.2E	0.0	2181.4	2341.5	2727.5
DEC	1123.3	0.0	193.0 56.5E	0.0	0.0	0.0	0.0 0.0E	1845.3	86.7 25.4E	0.0	2659.3	2852.3	3315.7
	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======	=======
	12073.3	0.0	2143.5 626.0E	0.0	0.0	0.0	0.0 0.0E	19786.2	922.2 270.2E	0.0	29147.2	31290.7	36437.5

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 0 — 10	10 -- 20	20 — 30	30 — 40	40 -- 50	50 -- 60	60 — 70	70 -- 80	80 -- 90	90 — 100	100 - 110+	TOTAL HOURS	ANNUAL LOAD (MBTU)	FALSE LOAD (MBTU)	ELEC USED (MBTU)	THERMAL USED (MBTU)
STM-BOILER	1089	0	2277	0	0	0	0	0	0	0	0	3366	12073.6	0.0	9[illegible].2	197[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

FORT LEONARD WOOD LAUNDRY PLANT STUDY PC-DOE/DOE-2.1B 1/01/80 0:05 PDL RUN 1

REPORT- PS-6 ELECTRICAL LOAD SCATTER PLOT

TOTAL HOURS AT HOURLY DEMAND AND TIME OF DAY

DEMAND KW	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
I	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 654.8 KBTU/SQFT-YR GROSS-AREA 654.8 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.

CEMRK-ED-MF Revised 19 September 1988

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 2 copies
U.S. Army Engineer District, Kansas City
ATTN: CEMRK-ED-MF/David Werner
700 Federal Building
Kansas City, Missouri 64106-2896

Commander 2 copies
Missouri River Division
ATTN: CEMRD-MD-ED
P.O. Box 103, Downtown Station
Omaha, Nebraska 68101-0103

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. <u>Completion Schedule</u>. 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. <u>Method of Payment.</u>

a. <u>Title I Services - </u>Study & Report. Payment for the study & report work and services will be made in accordance with the following procedures:

<u>Partial Payment</u>. 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. <u>Additional Conferences</u>. 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.