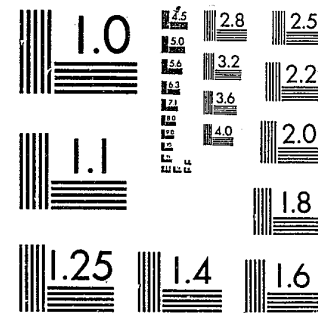


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MICROCOPY RESOLUTION TEST CHART
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National Institute of Justice
United States Department of Justice
Washington, D. C. 20531

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Energy Conservation Opportunities
Olmstead County Jail
at
Olmstead, Minnesota

Prepared for
Law Enforcement Assistance Administration
U.S. Department of Justice
Washington, D.C. 20531

Prepared by
Unified Industries Incorporated
6551 Loisdale Court
Springfield, Virginia 22150

and
JRB Associates, Incorporated
8400 Westpark Drive
McLean, Virginia 22102

September 3, 1981

This project was supported by Contract Number J-LEAA-016-80 awarded by the Law Enforcement Assistance Administration, U.S. Department of Justice, under the Omnibus Crime Control and Safe Streets Act of 1968, as amended. Points of view or opinions stated in this document are those of the author(s) and do not necessarily represent the official position or policies of the U.S. Department of Justice.

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ACQUISITIONS

1. INTRODUCTION AND GENERAL BACKGROUND INFORMATION

1.1 BACKGROUND

The Law Enforcement Assistance Administration (LEAA) national program for improved energy conservation in correctional facilities has three major objectives.

These are:

- o To demonstrate that there are cost-effective, readily available energy conservation strategies that are particularly effective in a correctional environment
- o To develop and disseminate accurate energy conservation information to corrections personnel
- o To provide guidance and technical assistance in developing and implementing an energy conservation program for various types of correctional facilities

To meet these objectives and to initiate allied energy conservation programs, LEAA sought the services of Unified Industries Incorporated (UII) and JRB Associates (JRB). The coordinated effort by these two firms has provided several areas of emphasis in this project. They are: onsite energy conservation surveys of two maximum security prisons, two medium security prisons, and three jails at locations selected by LEAA; preparation of an energy conservation handbook as a guide to facility management and engineering personnel; and the conduct of four regional energy conservation workshops at sites selected by LEAA. This report deals with the energy conservation survey conducted April 14-15, 1981 at the Olmstead County Jail, Minnesota.

The site survey involved investigation into several areas of potential energy conservation including, but not limited to, the following:

- o HVAC system analysis for enthalpy control and temperature setbacks
- o Equipment shutdown during periods of non-use
- o Electrical demand-limiting methods
- o Analysis of lighting systems

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- o Electric power factor correction
- o Heat recovery for water heating systems
- o Evaluation of the building envelope for reduced heat loss and infiltration

1.2 CONTENTS OF THE REPORT

The purpose of this report is twofold. It will serve to detail the findings of the energy conservation survey at the Olmstead County Jail, and it will make recommendations concerning measures which can be taken to reduce consumption. These measures are presented in section 3, Retrofit Options. Also, the potential cost savings associated with each option are presented to aid in the selection of the most cost-effective techniques for reduction of energy use.

2. SUMMARY OF RECOMMENDED RETROFIT PROJECTS

Option #	Description	Annual Energy Savings	Annual Cost Savings	Capital Cost	Payback Period (Yrs.)
1	Lower space temperature to 68° F	116 MBtu	\$ 769	\$ 500	0.65
2	Reduce outside air intake during heating season	1,115 MBtu 7,173 kWh	7,719	10,688	1.38
3	Replace incandescent (flood) lamps with fluorescent lamps and fixtures in the chases	18,475 kWh	841	1,827	2.2
4	Replace incandescent (flood) lamps with fluorescent lamps and fixtures	69,975 kWh	3,184	13,540	4.3
5	Lower space temperature during unoccupied periods	8 MBtu	170	300	1.8
6	Shut off hot water to unit heater in the garage	118 MBtu	782	20	.03
7	Replace existing standard fluorescent lamps with energy-conserving type lamps				
	(a) Maintenance Replacement	4,625 kWh	210	165	.79
	(b) Group Replacement	4,625 kWh	210	587	2.8

3. RETROFIT OPTIONS

3.1 OPTION 1 - LOWER SPACE TEMPERATURE TO 68° F

Space temperatures measured in the jail ranged from 72.5° F in the passive day room to 77.5° F in the administrative offices. The average measured temperature was 75° F (based on 28 temperature readings), which is higher than the recommended 68° F space temperature. Recalibrating the thermostats throughout the building can save approximately 9.1 percent of the energy required for heating.

Energy Savings	<ul style="list-style-type: none"> o Percent Savings - 1.3%/°F o Average Winter Temperature - 36° F o Annual Winter Hours - 6,552 hours o Measured Space Temperature - 75° F o Proposed Space Temperature - 68° F 						
	<p><u>Annual Energy Savings</u></p> $1.08 \times (65^\circ \text{ F} - 36^\circ \text{ F}) \times 6,200 \text{ cfm} \times 1.3\% / ^\circ \text{ F} \times (75^\circ \text{ F} - 68^\circ \text{ F})$ $\times 6,552 \text{ hours}$ $= 116 \times 10^6 \text{ Btu/year}$						
Energy Cost Savings	$116 \times 10^6 \text{ Btu/year} \times \$6.63 / 10^6 \text{ Btu}$ $= \$769/\text{year}$						
Capital Cost	<table border="0" style="width: 100%;"> <tr> <td style="width: 80%;">Recalibrate Thermostats</td> <td style="text-align: right;">\$100</td> </tr> <tr> <td>Replace 2 - Thermostats (Estimated)</td> <td style="text-align: right;"><u>400</u></td> </tr> <tr> <td></td> <td style="text-align: right;">\$500</td> </tr> </table>	Recalibrate Thermostats	\$100	Replace 2 - Thermostats (Estimated)	<u>400</u>		\$500
Recalibrate Thermostats	\$100						
Replace 2 - Thermostats (Estimated)	<u>400</u>						
	\$500						
Payback Period	<p><u>\$500</u></p> <p>\$769/year</p> <p>= 0.65 years</p>						

OPTION 2 - REDUCE OUTSIDE AIR INTAKE DURING THE HEATING SEASON

Approximately 6,200 cfm of fresh air is being supplied to the Olmstead County Jail. The maximum amount of fresh air (outside air) recommended in the ASHRAE Ventilation Standard 62-73 is 15 cfm per person. With a maximum of 50 persons (inmates, staff and other persons) occupying the living unit, the total amount of fresh air required is 750 cfm. Presently, the building exhaust air fans remove the entire 6,200 cfm of conditioned air.

To reduce the over-ventilation and energy waste during the heating season, the exhaust air and supply air should be decreased and a return air system should be added. The recommended design changes will provide the following ventilation conditions:

- o Supply Air - 3,100 cfm
- o Exhaust Air - 750 cfm
- o Return Air - 2,300 cfm
- o Outside Air - 800 cfm (>1.5 air changes/hour)

Two-speed fan motors are proposed to increase or decrease the supply air between summer and winter seasons. A simple set of switches will change the HVAC system from summer to winter operation (or vice versa). This energy-conservation opportunity will require about three (3) mandays of labor to rebalance the system for summer and winter operation.

The results of this option assume that Option #1 has already been implemented. If Option #1 is not implemented, the energy and energy cost savings will increase by approximately 10 percent.

Energy Savings

- o System Design
 - Supply Air - 6,200 cfm
 - Exhaust Air - 6,200 cfm
 - Return Air - none
 - Outside Air - 6,200 cfm
 - Motor - 1.5 Hp
- o Design Temperature - -16° F
- o Equivalent Full Load Hours (EFLH) - 2,361 hours/year
- o Full Load $\Delta T = 81^\circ F [+65^\circ F - (-16^\circ F)]^{(1)}$
- o Maximum Occupancy - 50 persons
- o ASHRAE (and ACA) design criteria (Ventilation Standard 62-73)
 - 15 cfm/person (maximum)
- o Maximum Required Fresh Air - 15 cfm/person x 50 persons
 - = 750 cfm
- o Revised Design - Winter Operation
 - S.A. - 3,100 cfm
 - E.A. - 750 cfm
 - R.A. - 2,300 cfm
 - O.A. - 800 cfm (slight positive pressure)
 - Motor - two-speed, 1.5/0.37 hp

- o Summer Operation - use existing system

Annual Energy Savings (Heating):

$$1.08 \times \Delta T \times \Delta_{\text{outside air cfm}} \times \text{EFLH}$$

$$= 1.08 \times 81^\circ F \times (6,200 \text{ cfm} - 800 \text{ cfm}) \times 2,361 \text{ hours/yr}$$

$$= 1,115 \times 10^6 \text{ Btu/year}$$

(1) Based on 68° F space temperature.

Annual Electricity Savings:

$$(1.5 \text{ Hp} - 0.37 \text{ Hp}) \times 0.746 \text{ kW/HP} \times 39 \text{ wks/year} \times 168 \text{ hours/week}$$

$$\div 77\% \text{ motor efficiency}$$

$$= 7,173 \text{ kWh/year}$$

Energy Cost

Savings

$$1,115 \times 10^6 \text{ Btu/year} \times \$6.63/10^6 \text{ Btu} + 7,173 \text{ kWh/year}$$

$$\times \$0.0455/\text{kWh}$$

$$= \$7,719/\text{year}$$

Capital Cost

Ducting changes	\$5,638
Engineering design	2,000
Return air register	200
Controls and associated wiring;	1,500
includes new return air damper,	
exhaust air damper, summer/winter	
switch and damper motor.	
Civil work	500
Inline return fan	<u>850</u>
	\$10,688

Payback Period

$$\frac{\$10,688}{\$ 7,719/\text{year}}$$

$$= 1.38 \text{ years}$$

OPTION 3 - REPLACE INCANDESCENT (FLOOD) LAMPS WITH FLUORESCENT LAMPS AND FIXTURES IN THE CHASE

The chases are presently illuminated with 19 150-watt flood lamps (incandescent). These lamps operate continuously. It is recommended that nine 2-lamp fluorescent fixtures and one 1-lamp fixture replace the existing lighting system in the chases. These figures are based on a direct lamp-for-lamp replacement. The lumen output will increase by approximately 75 percent while the energy usage will decrease by nearly 75 percent. Also, the estimated lamp life for the fluorescent lamp is 10 times longer than for the flood.

Energy Savings

- o Existing Lamp Wattage - 19 x 150 watts
= 2,850 watts
- o Proposed Lamp Wattage - 19 x 39 watts⁽¹⁾
= 741 watts
- o Hours of Operation - 8,760 hours/year
(2,850 watts - 741 watts) x 8,760 hours/year ÷ 1,000 W/kW
= 18,475 kWh/year⁽²⁾

Energy Cost

Savings 18,475 kWh/year x \$0.0455/kWh
= \$841/year

(1) Fluorescent lamps should be energy-conserving "Lite White" F40LW; ballasts should be energy-conserving electronics type.

(2) Assumes that the lamps are replaced on a regular basis. If the number of burned-out lamps found in the chases is typical of average annual condition, then the savings and paybacks are as follows:

Energy Savings - 4,021 kWh/year

Energy Cost Savings - \$183/year

Payback Period - 10 years (less than 5 years for LCC)

Illumination Levels increased by 270 percent

It is important to remember that the labor to maintain the existing lighting system is a significant factor in any economic analysis. This is obvious from the large number of lamps not replaced after burning out. See figure 3-1. A life-cycle-cost (LCC) analysis of this option, including the maintenance cost for relamping, would decrease the payback period to less than 1 year.

Chase Location	Lamps	Operating	Burned Out
Work Release/Women's	1	1	-
Block 5-6	6	3	3
Block 3-4	6	1	5
Block 1-2	6	3	3

Figure 3-1. Existing Flood Lamps in Chases

Capital Cost	Fixture Removal -	\$ 190
	Single-lamp Fixtures -	53
	Two-lamp fixtures -	<u>1,584</u>
		\$1,827

Payback Period \$1,827
\$841/year
= 2.2 years

OPTION 4 - REPLACE INCANDESCENT (FLOOD) LAMPS WITH FLUORESCENT LAMPS AND FIXTURES

The cell blocks and hallways are illuminated by 109 flood (incandescent) lamps. Existing illumination levels were measured to be 15 to 30 footcandles. To increase the lighting levels throughout the facility, to meet or exceed the ACA lighting standard, and to conserve energy, the incandescent lamps should be replaced with a fluorescent lighting system. Destruction and vandalism is a major problem when considering the use of fluorescent fixtures in correctional facilities. However, floods have already been successfully replaced in the jail juvenile detention area. These fluorescent fixtures, standard in construction, have yet to be damaged.

Therefore, it is recommended that vandal-proof fluorescent fixtures⁽¹⁾ replace the existing flood lamps. A two-lamp fluorescent fixture can replace each pair of flood lamps in the hallways and dayrooms and a single-lamp fixture can replace the existing lamp in each cell. The illumination levels will increase by at least 75 percent, with a corresponding decrease in energy usage.

Energy Savings

- o Existing Lamps - 109 lamps x 150 watts/lamp = 16,350 watts
- o Proposed Lamps⁽²⁾
 - 54 1-lamp fixtures
 - 29 2-lamp fixtures

(54 lamps x 39 watts/lamp) + (58 lamps x 39 watts/lamp)
 = 4,368 watts

o Average Hours of Operation - 16 hours/day
 (16,350 watts - 4,368 watts) x 16 hours/day x 365 days/year
 ÷ 1,000 W/kW
 = 69,975 kWh/year

Energy Cost⁽³⁾

Savings 69,975 kWh/year x \$0.0455/kWh
 = \$3,184/year

Capital Cost	Install 83 fixtures @ \$150/fixture	\$12,450
	Disconnect/remove 109 fixtures @ \$10/fixture	<u>1,090</u>
		\$13,540
Payback Period ⁽⁴⁾	<u>\$13,540</u>	
	\$ 3,184/year	
	= 4.3 years	

(1) Vandal-proof fixtures will probably be a safe replacement in most cells, day-rooms and hallways. In areas (or cells) where vandal-proof fixtures may still pose a security problem, alternative schemes should be evaluated.

One alternative is the use of 120ER40 lamps. This replacement incandescent lamp reduces the energy usage (120 watts vs. 150 watts) while increasing the illumination level.

- (2) Estimated number of fixtures from facility layout. Depending on illumination levels desired and type of fixture selected, the number of fixtures and lamps may change slightly.
- (3) The existing lighting system provides about 100×10^6 Btu/year more heat during the winter than the proposed fluorescent lighting system. The additional energy cost to heat the facility would be approximately \$663/year. A revised payback period (not including the maintenance cost advantage) is 5.4 years. A life cycle payback period would be 2.5 years or less.
- (4) The life of fluorescent lamps is approximately 10 times that of a flood lamp. The decrease in maintenance cost will decrease the life cycle payback period to less than 2 years.

OPTION 5 - LOWER SPACE TEMPERATURE DURING UNOCCUPIED PERIODS

The passive recreation room and offices are not occupied from approximately 10 p.m. - 7 a.m. Room temperature can be lowered to 55° F during unoccupied periods by installing automatic reset thermostats which control the reheat coils supplying each area. Clocks operating the thermostat settings will signal the reheat coils to return the space temperature to 68° F prior to morning occupancy.

Energy Savings

- o Space Temperature -
 - Existing - 68° F (See option 1)
 - Proposed - 55° F between 10 p.m. and 6 a.m.
 - 68° F other times
- o Energy Savings - LEAA Handbook - 25%
 - EFLH Method-
 - Night Bin - @ 68° F - 895 EFLH
 - @ 55° F - 733 EFLH
 - Overall Savings - $\frac{895 - 733}{895}$
 - 2,361
 - = 7%

Method 1⁽¹⁾

- Total Steam Usage - $6,533 \times 10^6$ Btu
- Heating Steam Usage - $4,448 \times 10^6$ Btu
- Estimated Building GSF - 72,000
- Heating Degree Days (HDD) - 8,382

Heating Energy Requirements for Entire Building -

$$4,448 \times 10^6 \text{ Btu} \div 72,000 \div 8,382$$

= 7.4 Btu/gsf/HDD

Rooms Setback	GSF	10^6 Btu/year(heating)
Passive Recreation (#110)	572	35.5
Office (#113)	90	5.5
Office (#114)	183	11.4
	845	52.5

Annual Energy Savings (Method 1)

52.5×10^6 Btu/year x 0.15
 = 8×10^6 Btu/year

Method 2⁽²⁾

- Total ratings of three reheat coils - 27.6×10^3 Btuh
- Equivalent Full Load Hours (EFLH) - 2,631 hours/year

Annual Energy Savings (Method 2):

27.6×10^3 Btuh x 2,631 hours/yr x 0.15
 = 11×10^6 Btu/year

Method 3⁽³⁾

- Total cfm supplied (presently, 100% outside air) - 890 cfm

Annual Energy Savings (Method 3):

$1.08 \times \Delta T \times \text{EFLH} \times \text{cfm} \times 15\%$
 = $1.08 \times 81^\circ \text{ F} \times 2,631 \text{ hours} \times 890 \text{ cfm} \times 0.15$
 = 31×10^6 Btu/year

Estimated Annual Energy Savings - 25×10^6 Btu/year⁽³⁾

Energy Cost

Savings

25×10^6 Btu/year x $\$6.63/10^6$ Btu
 = \$170/year

Capital Cost	3 - Setback Thermostats @ \$100/unit	\$300
Payback Period	<u>\$300</u>	
	\$170/year	
	= 1.8 years	

- (1) Method 1 assumes that the jail is operated on a schedule similar to that of the remainder of the facility. Actually, the jail operates 168 hours per week, whereas the remainder of the facility operates from 50 to 90 hours per week. Therefore, an 8×10^6 Btu/year savings seems low. Also, most buildings operate at approximately 2 to 3 times the Btu/gsf/HDD level calculated above.
- (2) Method 2 used the reheat coils for each zone (room) as an estimating tool. This does not account for the preheat air being supplied to the reheat coils from the main air handling unit. Therefore, method 2 seems very low.
- (3) Method 3 uses the heat required to maintain the rooms at 68° F by supplying 890 cfm of heated air. This method is the most accurate of the three, but the estimated savings were tempered with some conservation judgment.

OPTION 6 - SHUT OFF HOT WATER TO THE UNIT HEATER IN THE GARAGE

The unit heater in the garage was maintaining a space temperature of 64° F. Since the garage is rarely occupied, the unit heater could be disconnected. The garage would act as a buffer zone between the ambient at the door and the conditioned space on three sides. The existing heating hot water lines are insulated as they pass through the garage.

Energy Savings	o Unit Heater Design Heating Capacity - 50,000 Btuh
	o Equivalent Full Load Hours - 2,361 hours/year
	<u>Annual Energy Savings:</u>
	50,000 Btu/hours x 2,361 hours/year
	= 118×10^6 Btu/year
Energy Cost	
Savings	118×10^6 Btu/year x $\$6.63/10^6$ Btu
	= \$782/year
Capital Cost	Shut off steam valve to unit heater - \$20
Payback Period	<u>\$20</u>
	\$782/year
	= 0.03 years

OPTION 7 - REPLACE EXISTING STANDARD FLUORESCENT LAMPS WITH ENERGY-CONSERVING TYPE LAMPS

It is recommended that energy-conserving fluorescent lamps (F40/LW/RS) replace all standard 4-foot fluorescent lamps (F40CW) at the Olmstead County Jail. By using Lite White type 4-foot fluorescent lamps, the lighting level is reduced by 3 percent but the energy used is reduced by 15 percent.

Energy-conserving lamps are also available to replace F48T12, F96T12 (Slimline), F96PG17 (Power Groove), F30T12, and F96T12/CW/1500 lamps. Although there were none located in the jail, other county facilities may benefit from the energy-conserving lamps. However, energy-conserving fluorescent lamps should not be used outdoors. Where ambient temperatures fall well below 60° F, the new lamps may not start.

Burn-out replacement requires only the incremental cost of the lamp itself. For group replacement, the cost of the new lamp and the labor to install the lamp must be used. The longer the annual hours of operation, the more cost-effective the burn-out replacement and group relamp with energy-conserving lamps will be. Each replacement should be evaluated for its own merit. Generally, if a 4-foot lamp is used continuously (24 hours/day), it is cost-effective* to group-relamp.

Energy Savings

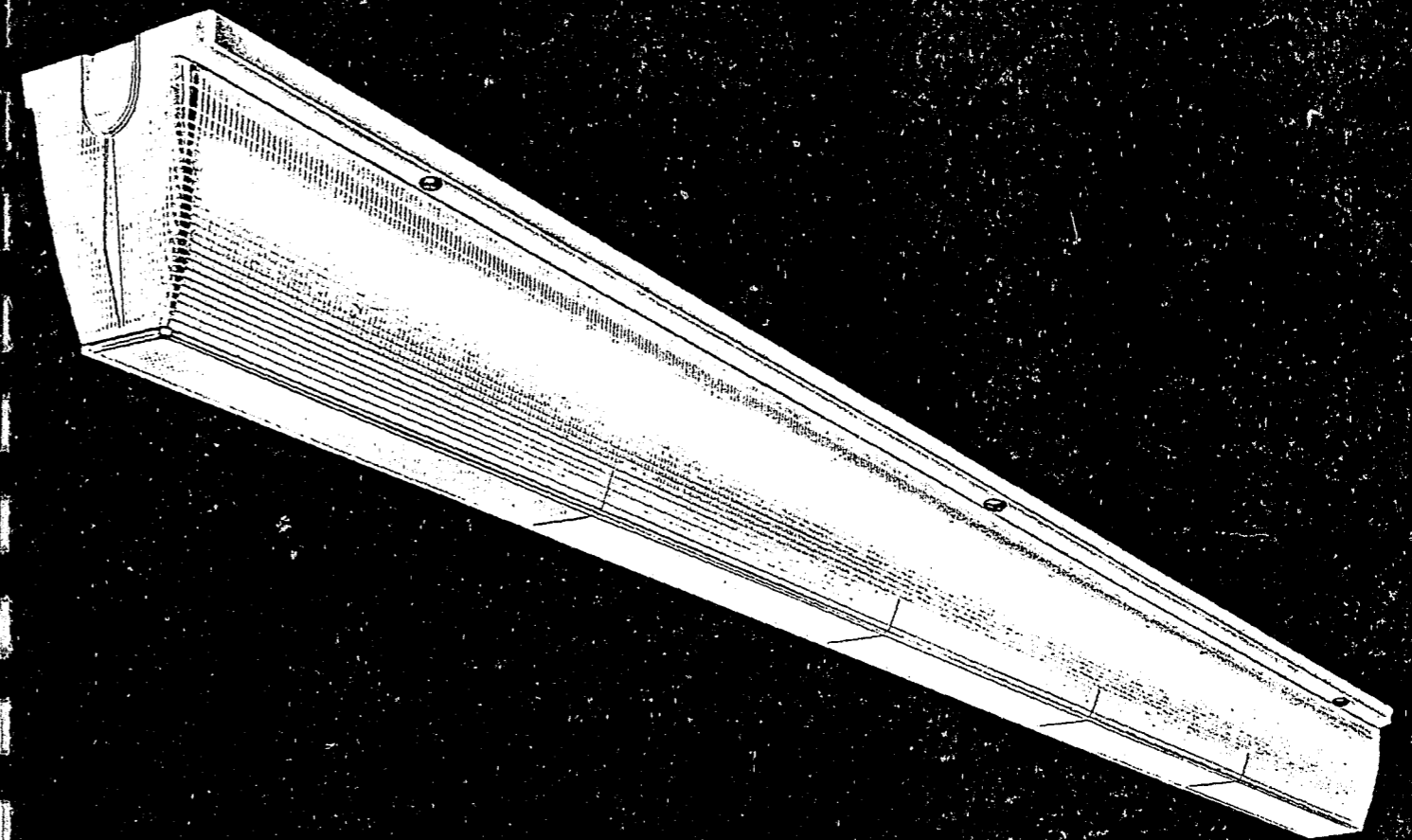
- o Measured Illumination Levels - 30 to 60 footcandles
- o Average Daily Hours of Operation - 16 hours
- o Existing Lamps - 132-F40CW (Standard Fluorescent)
- o Replacement Lamps - 132-F40LW (Lite White lamps)

132 lamps x 6 watts/lamp x 16 hours/day x 365 days/year
 ÷ 1,000 W/kW
 = 4,625 kWh/year

* < 2.5 year payback period

Energy Cost		
Savings	4,625 kWh/year x \$0.0455/kWh	
	= \$210/year	
Capital Cost	a) Maintenance Replacement	
	132 lamps @ \$1.25/lamp -	\$165
	b) Group Replacement (include labor)	
	132 lamps @ \$4.45/lamp -	<u>587</u>
		\$752
Payback Period ⁽¹⁾	a) Maintenance Replacement	
	<u>\$165</u>	
	\$210/year	
	= 0.79 years	
	b) Group Replacement	
	<u>\$587</u>	
	\$210/year	
	= 2.8 years	

(1) Estimated lamp life is 3.5 years.



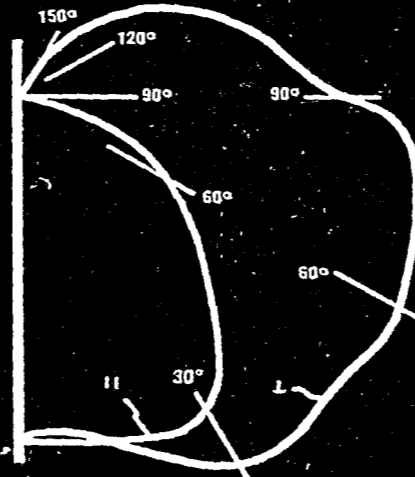
**INDESTRUCTIBLE Model No. 7140
Fluorescent — Ceiling Fixture**

**COEFFICIENTS OF UTILIZATION — ZONAL CAVITY METHOD
EFFECTIVE FLOOR CAVITY REFLECTANCE 0.20.**

RC	80				70				50				30				10				0	
RW	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0	
1	70	65	61	58	66	62	58	55	56	53	50	50	48	46	45	43	42	39	38	35	32	30
2	62	55	49	44	58	52	47	42	47	43	39	42	39	36	38	35	32	30	28	25	22	20
3	56	47	41	36	53	45	39	34	41	36	31	36	32	29	33	29	26	24	22	19	16	13
4	51	41	34	29	48	39	33	28	35	30	26	32	27	24	28	25	22	20	18	15	11	9
5	46	36	29	24	43	34	28	23	31	25	21	28	23	20	25	21	18	16	14	11	7	5
6	42	32	25	20	40	30	24	19	27	22	18	25	20	16	22	18	15	13	11	8	5	3
7	39	28	22	17	36	27	21	17	24	19	15	22	17	14	20	16	13	11	9	6	3	1
8	35	25	19	15	33	24	18	14	22	17	13	20	15	12	18	14	11	9	7	5	2	0
9	33	23	17	12	31	22	16	12	20	15	11	18	13	10	16	12	9	8	6	4	1	0
10	30	21	15	11	29	20	14	10	18	13	10	16	12	9	14	11	8	7	5	3	0	0

HIGH OUTPUT (-20°)

RC	80				70				50				30				10				0	
RW	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0	
1	55	52	49	46	52	49	46	44	44	42	40	40	38	36	36	34	33	31	29	27	24	21
2	49	44	39	35	46	41	37	34	37	34	31	33	31	28	30	28	26	24	22	20	17	14
3	44	38	33	29	42	36	31	27	32	28	25	29	26	23	26	23	21	19	17	15	12	9
4	40	33	28	24	38	31	26	23	26	24	21	25	22	19	23	20	18	16	14	12	9	6
5	36	29	23	19	34	27	22	19	25	20	17	22	19	16	20	17	14	13	11	9	6	3
6	33	25	20	16	31	24	19	16	22	18	14	20	16	13	18	15	12	11	9	7	4	1
7	31	23	17	14	29	21	17	13	19	15	12	17	14	11	16	13	10	9	7	5	2	0
8	28	20	15	12	26	19	15	11	17	13	10	16	12	10	14	11	9	8	6	4	1	0
9	26	18	13	10	24	17	13	10	16	12	9	14	11	8	13	10	7	6	4	2	0	0
10	24	16	12	9	23	16	11	8	14	10	8	13	9	7	11	9	6	5	3	1	0	0



Unbreakable HERCULEX wraparound design lens is INJECTION MOLDED to precise tolerances for maximum strength. Patent pending "twist outs" in each end permit surface conduit and continuous row applications in wet locations without an adapter. Unique design makes the fixture simple to install. Fixture is engineered to withstand attack by the most determined vandals. Positive lamp mounting protects lamp from failure due to shock. Ideal for use in areas where vandalism or breakage could be a costly maintenance problem. Can be installed outdoors, on ceilings or walls.

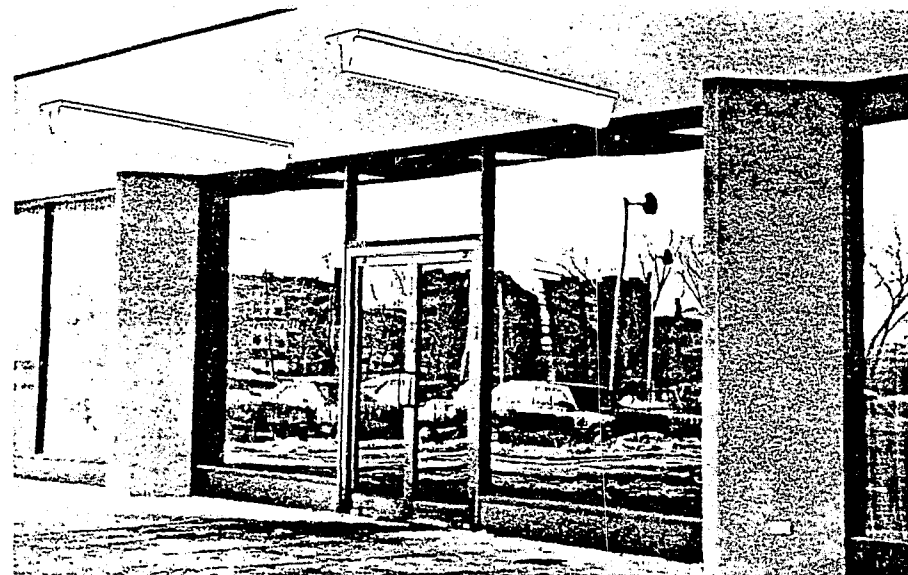
16 gauge steel backplate, white baked enamel finish
 2" K.O. for outlet box mounting
 1/2" K.O.'s in ends for surface conduit, each fixture furnished with special glands for maintaining water tight construction. Engineered for rapid installation with two captive screws, chain wireway holder and other contractor oriented work savers.
 Indestructible Herculex lens, injection molded, prismatic, U.V. stabilized. Wraparound design encloses all metal parts.
 Patented "TWIST-OUTS" for surface conduit or continuous row mounting. (Note: for continuous row mounting allow 7/8" between backplates). Nipples and locknuts furnished for wiring between butted fixtures.
 Six (6) recessed stainless steel tamper-proof screws. Two (2) are captive for rapid alignment of lens.
 Single lamp 40 watt ballast. Rapid start, class "P" 120V CBM-ETL-HPF 50° (see back page for optional ballasts). Closed cell neoprene gasket
 UL approved for wet locations

1 — 40 watt 48" rapid start (not furnished).

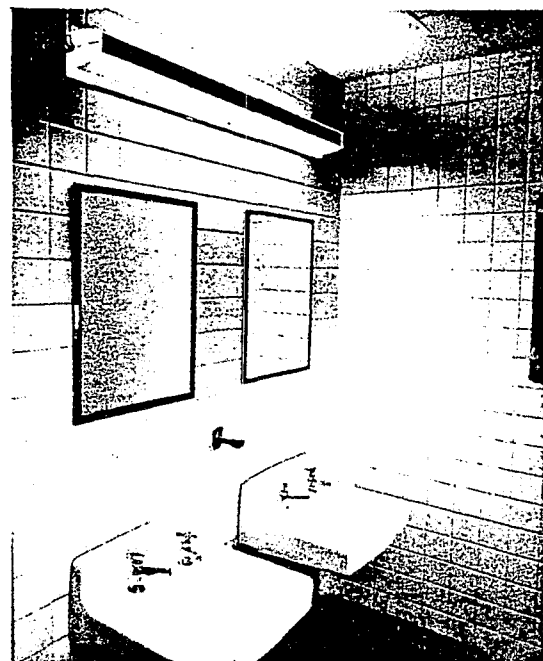
There are eight (8) 1/4" K.O.'s provided on the back plate. We recommend the use of six of them to mount fixture.

Six (6) 1/4" x 20 machine screws with masonry anchors to mount in concrete
 Six (6) 1/4" lag screws or toggle for mounting in frame construction

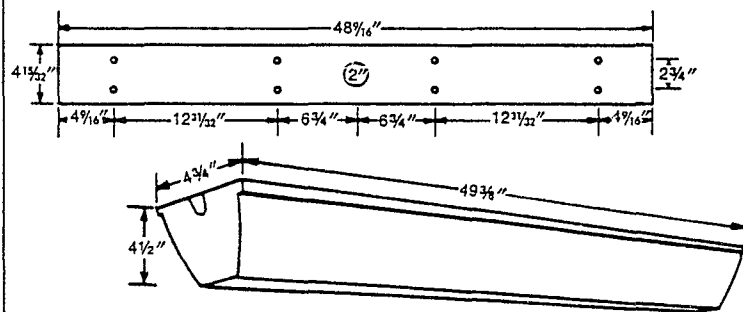
Combine indestructibility with the added convenience of an emergency lighting system. The Kenall 7140EL incorporates an emergency lighting system, including rechargeable, sealed nickel-cadmium batteries, an inverter/charger, and a test switch and charging indicator as required by many codes. Reliable, no-glare lighting, operative for 90 minutes, is automatically provided by the regular fluorescent system the instant power is lost. No unsightly special purpose lighting is necessary.



Optional ballasts permits outdoor installation with economical Model #7140. This fixture is gasketed for use in wet areas.



Optional wood grained vinyl lens permits mounting above mirror while shielding the users eyes from glare.

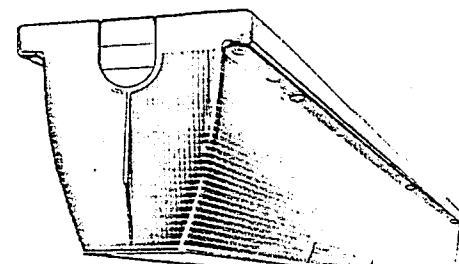


Kenall Guarantee

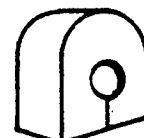
This fixture is virtually indestructible. It is guaranteed to withstand vandalism better than any lighting fixture on the market. Kenall will replace any fixtures vandalized within one year if installed according to our instructions.

Specifications:

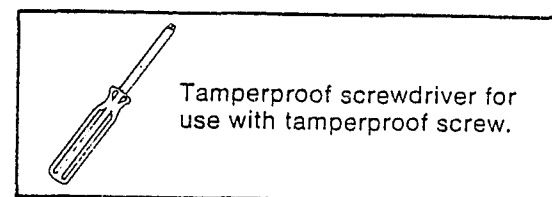
- A 16 gauge steel backplate, white baked enamel finish
- B 2" K.O. for outlet box mounting
- C 1/2" K.O.'s in ends for surface conduit, each fixture furnished with special glands for maintaining water tight construction.
- D Engineered for rapid installation with two captive screws, chain wireway holder and other contractor oriented work savers.
- E Indestructible Herculex lens, injection molded, prismatic, U.V. stabilized. Wraparound design encloses all metal parts.
- F Unique "TWIST-OUTS" for surface conduit or continuous row mounting. (Note: for continuous row mounting allow 7/8" between backplates). Nipples and locknuts furnished for wiring between butted fixtures. (see below)
- G Six (6) recessed stainless steel tamper-proof screws. Two (2) are captive for rapid alignment of lens.
- H Single lamp 40 watt ballast. Rapid start, class "P" 120V CBM-ETL-HPF 50° (see back page for optional ballasts).
- I Closed cell neoprene gasket
- K UL listed for wet locations



Patent Pending "TEAR OUT" design for surface conduit.



7140—will be furnished with 2 gaskets and 2 locknuts
 7140-2—will be furnished with 2 gaskets, 4 locknuts and 1 pipe nipple

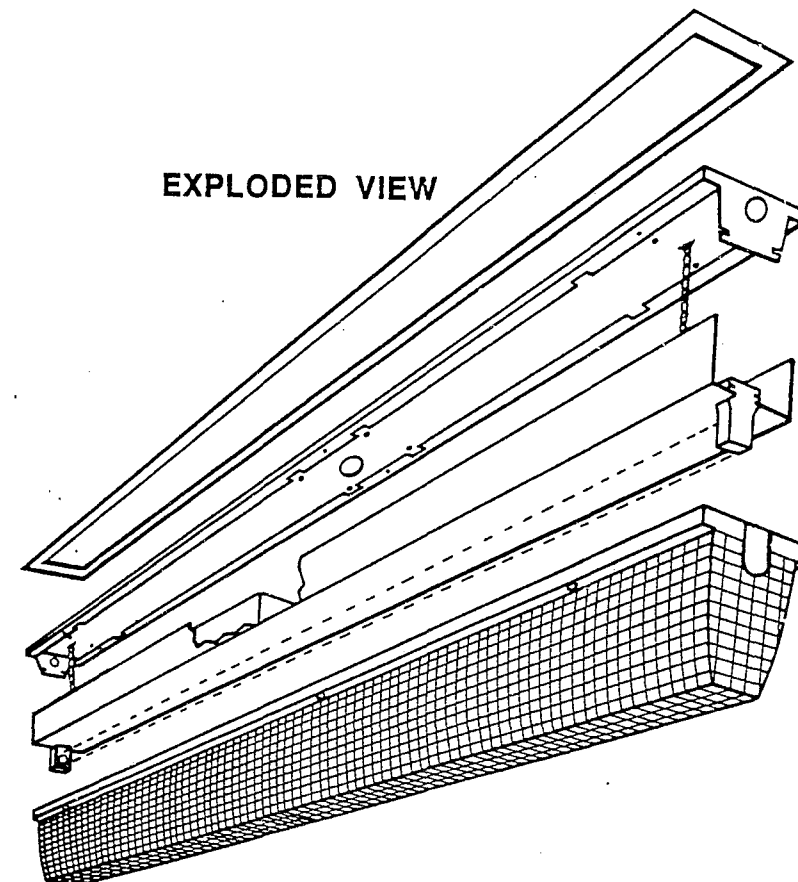


Tamperproof screwdriver for use with tamperproof screw.



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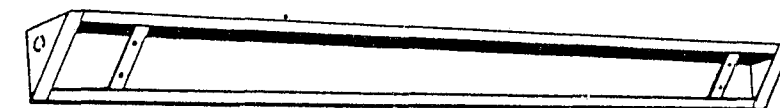
EXPLODED VIEW



ORDERING INFORMATION

Catalog No.	Ballast	Lamps (Not Furn.)
7140	120V R.S. Class P, CBM, ETL, HPF 120V 0°—add 0° to Catalog No. 277V—add 277V to Catalog No. 277V-0°—add 277V-0° to Catalog No.	(1) 40W 48" RS
7140-2	120V R.S. Class P, CBM-ETL, HPF 120V 0°—add 0° to Catalog No. 277V—add 277V to Catalog No. 277V-0°—add 277V-0° to Catalog No.	(2) 40W 48" RS
7140EL	120V R.S. CBM, ETL, HPF, EL 277V R.S. add 277V to Catalog No.	
681	18 gauge steel corner mounting bracket with 2 K.O.'s for 1/2" conduit	
9000	Tamperproof Screwdriver	

OPTIONAL: Convenience Outlet—add CO to Catalog No.
 Night Light—add NL to Catalog No.
 Switch—add S to Catalog No.

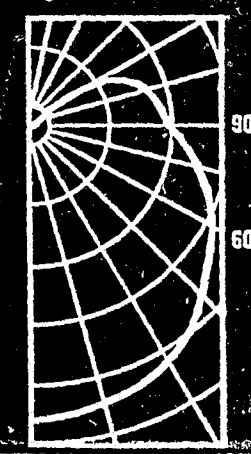


681 corner mount bracket

18 gauge steel
 2 K.O.'s for 1/2" conduit
 White baked enamel finish

6 mounting holes provided
 Threaded for simple fixture mounting with 4 (four) 1/4 x 20 machine screws

**INDESTRUCTIBLE Model No. 7240
Fluorescent — Ceiling Fixture**



COEFFICIENTS OF UTILIZATION — ZONAL CAVITY METHOD
EFFECTIVE FLOOR CAVITY REFLECTANCE 0.20

RC	80				70				50				30				10				0
	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
1	.45	.43	.41	.39	.43	.41	.39	.38	.38	.37	.35	.35	.34	.33	.33	.32	.31	.31	.30	.30	.30
2	.41	.37	.34	.31	.39	.36	.33	.30	.33	.31	.28	.31	.29	.27	.28	.27	.25	.24	.24	.23	.22
3	.37	.32	.29	.26	.36	.31	.28	.25	.29	.26	.24	.27	.24	.22	.25	.23	.21	.20	.20	.19	.18
4	.34	.29	.25	.22	.32	.28	.24	.21	.26	.22	.20	.24	.21	.19	.22	.20	.18	.17	.17	.16	.15
5	.31	.25	.21	.18	.29	.24	.20	.18	.22	.19	.17	.21	.18	.16	.19	.17	.15	.14	.14	.13	.12
6	.28	.22	.18	.15	.27	.22	.18	.15	.20	.17	.14	.19	.16	.14	.17	.15	.13	.12	.12	.11	.10
7	.26	.20	.16	.13	.25	.19	.16	.13	.18	.15	.12	.17	.14	.12	.16	.13	.11	.10	.10	.09	.08
8	.24	.18	.14	.11	.23	.17	.14	.11	.16	.13	.11	.15	.12	.10	.14	.12	.10	.09	.09	.08	.07
9	.22	.16	.12	.10	.21	.15	.12	.10	.14	.11	.09	.14	.11	.09	.13	.10	.08	.07	.07	.06	.05
10	.21	.15	.11	.09	.20	.14	.11	.08	.13	.10	.08	.12	.10	.08	.12	.09	.07	.06	.06	.05	.04

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The unbreakable HERCULEX wraparound diffuser is INJECTION MOLDED to precise tolerances. Ultraviolet stabilized for outdoor application . . . no exposed metal to create costly maintenance problems. Engineered to withstand attack by a hammer, baseball bat, rocks, etc., in the hands of even the most determined vandal. It will even stop a .22 caliber bullet! When a vandalproof Kenall is hit, a unique mounting system protects the enclosed lamp from shock or breakage. Lamp breakage resulting from diffuser deflection is eliminated by molded tabs on diffuser which engage slots in back plate. Ideal for either indoor or outdoor applications, wherever vandalism or breakage is a costly maintenance problem.

16 gauge steel back plate, white baked enamel.

Herculex indestructible diffuser, injection molded, U.V. stabilized, Standard is opalescent (available in clear on special order).

Stainless steel captive tamperproof screws (2).

Seal tight design — neoprene gasket.

2 lamps, 40-watt ballast, rapid start, Class "P", 120 V CBM-ETL-HPF 50°. (See ordering information for optional ballasts.

Removable 16 ga. steel wireway.

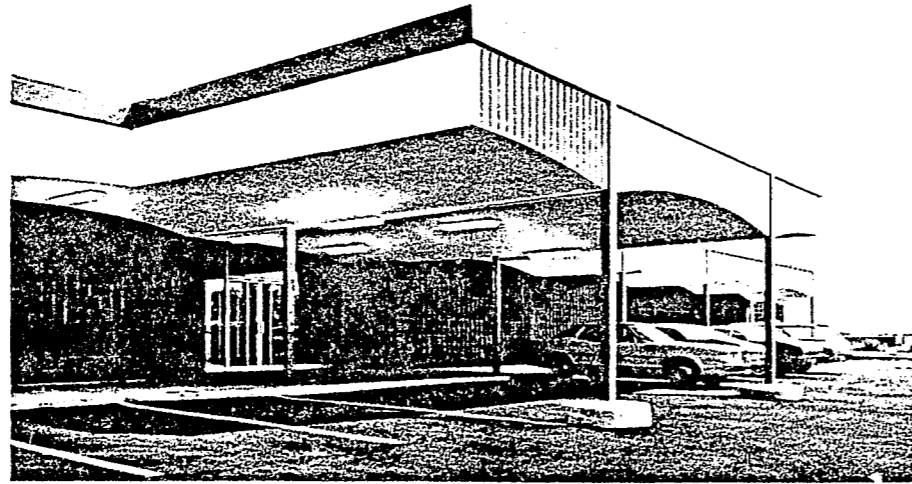
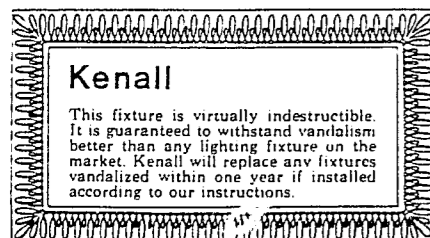
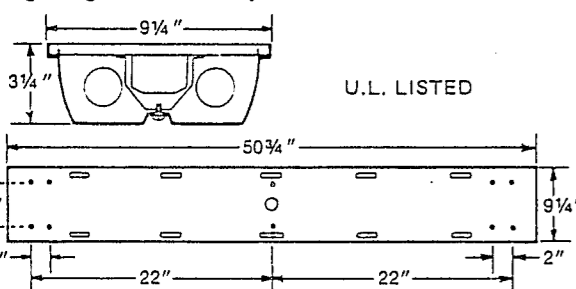
2-40 watt 48" rapid start (not furnished).

There are ten (10) 1/4" holes provided on the back plate. We recommend the use of 6 to mount the fixture:

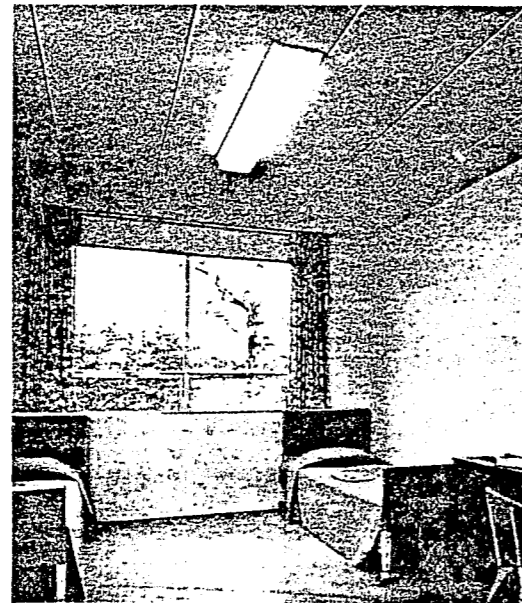
Six (6) 1/4" x 20 machine screws with masonry anchors to mount in concrete.

Six (6) 1/4" lag screws or toggle bolts for mounting in frame construction.

Combine indestructibility with the added convenience of an emergency lighting system. The Kenall 7240EL incorporates an emergency lighting system, including rechargeable, sealed nickel-cadmium batteries, an inverter/charger, and a test switch and charging indicator as required by many codes. Reliable, no-glare lighting, operative for 90 minutes, is automatically provided by the regular fluorescent system the instant power is lost. No unsightly special purpose lighting is necessary.

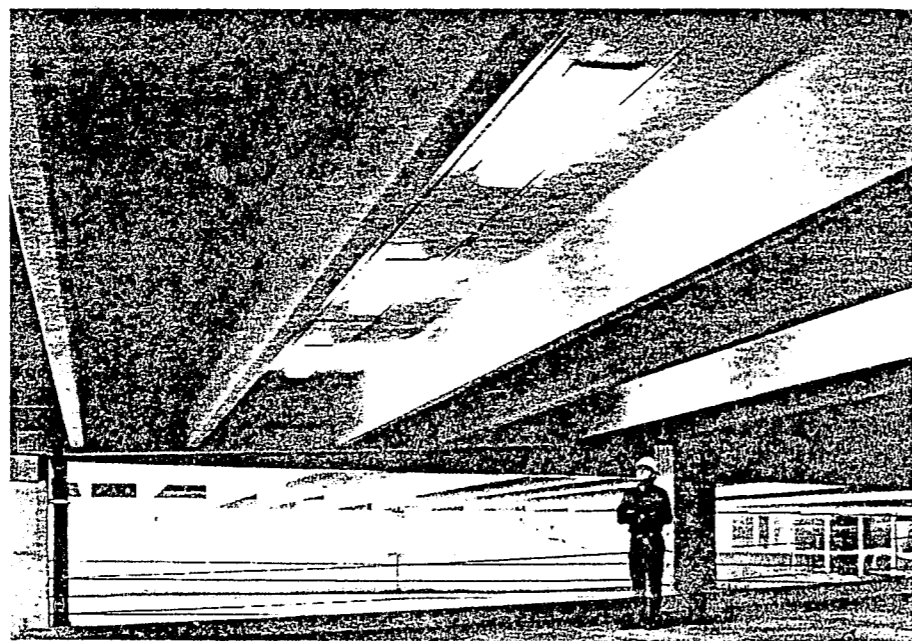


Security is provided for tenants of a shopping center by Kenall fluorescent #7240, without any sacrifice in appearance.



Special problems with patient safety in a mental hospital were solved with the use of the Kenall fluorescent fixture #7240.

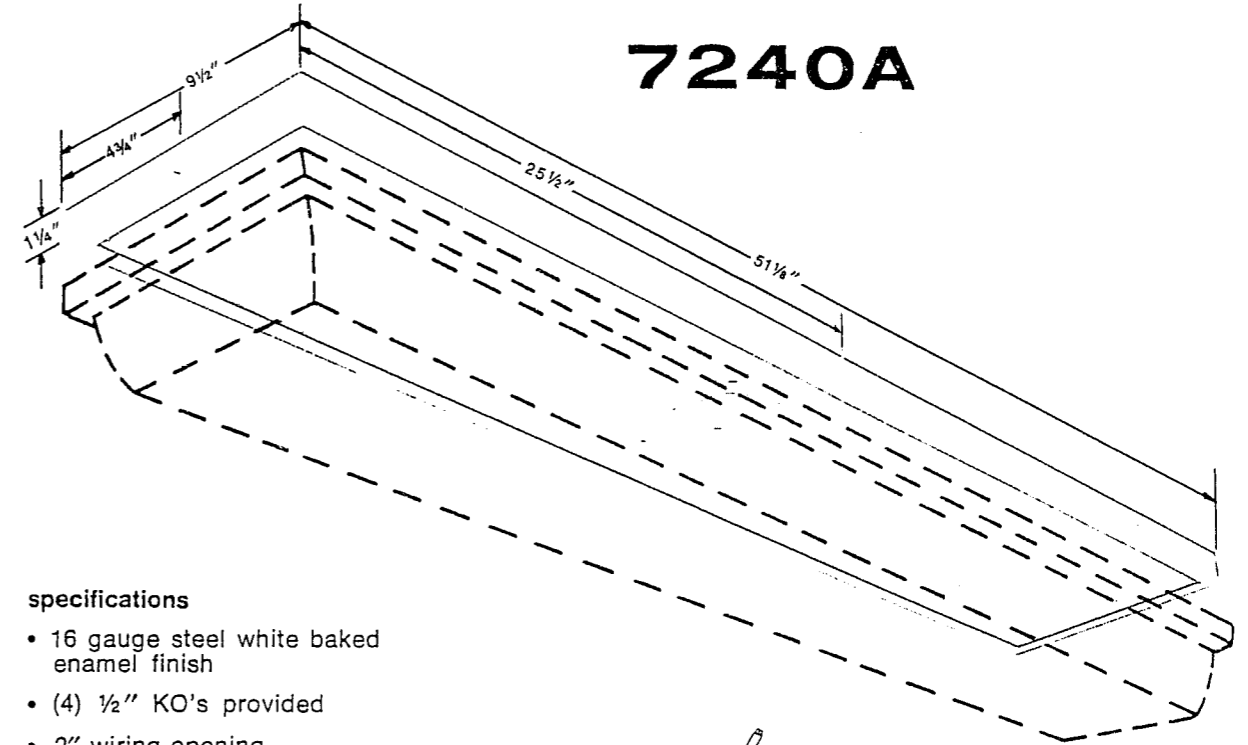
Architectural Photos by Shimer, Hedrick - Blessing



Architects' choice of #7240 fluorescent fixtures enhances massive effect in multi-storied parking facility. Kenall vandalproof fixtures guarantee that this effect will not be interrupted by breakage.

Adapter for 7200 Series . . . Surface Conduit Mounting

7240A



specifications

- 16 gauge steel white baked enamel finish
- (4) 1/2" KO's provided
- 2" wiring opening
- (6) 1/4" mounting holes (mounting hardware provided)



Tamperproof Screwdriver for use with tamperproof screws.

ORDERING INFORMATION

Catalog No.	Ballast	Lamps (Not Furn.)
7240	120V R.S., Class P CBM, ETL, HPF 120V - 0° / Add 0° to Cat. No. 277V / Add 277V to Cat. No. 277 - 0° / Add 277V-0 to Cat. No.	(2) 40W 48" R.S.
7240CL	Optional clear diffuser for 7240	
7240EL	120V R.S., CBM, ETL HPF/EL Add 120V 277V R.S., CBM, ETL HPF/EL Add 277V	(2) 40W 48" R.S.
7240A	Adapter for surface conduit	
9000	Tamperproof Screwdriver	

OPTIONAL:
For Night Light — add FNL to Catalog No.

AVAILABLE UNDER:
GSA CONTRACT No.
GS-OOS-32233
and
HUD CONTRACT No.
OHP (CO) 38



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Fluorescent Security Fixture engineered for use in areas where adequate illumination is mandatory such as cells, lock-ups, corridors and dayrooms. Opalescent Herculex® polycarbonate diffuser fastens to 16 ga. steel back plate with tamper-proof stainless steel screws and clips, virtually eliminating removal of diffuser by inmates. Diffuser is flush with ceiling to eliminate contraband storage. Steel ballast cover and molded diffuser tabs guard against lamp breakage through diffuser deflection. An integral fluorescent Night Light (shown) is optional. Pull Chain Switch is also available.

16 gauge steel back plate, white baked enamel.

Herculex® indestructible diffuser injection molded, U.V. stabilized, standard is Opalescent (available in Clear on special order).

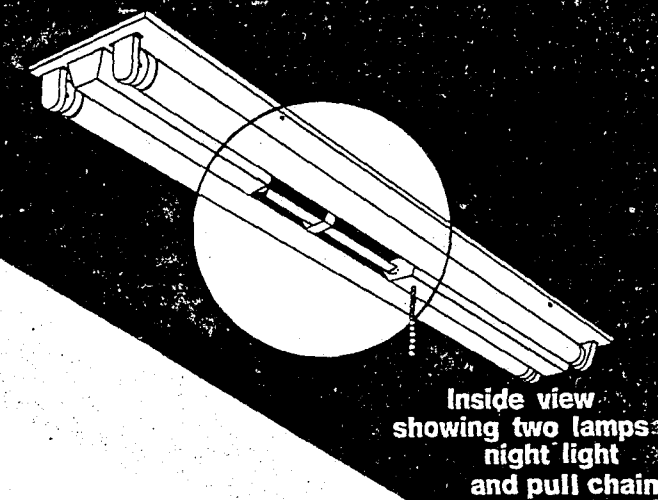
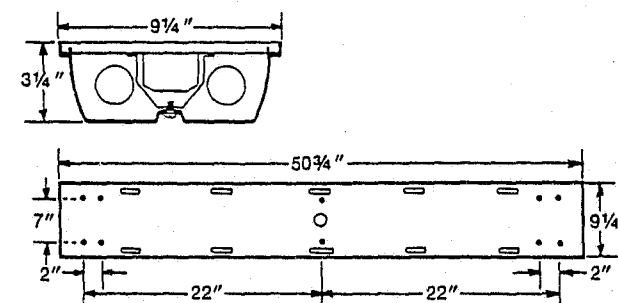
Stainless steel tamper proof screws (6) and clips fasten diffuser to back plate. Two in center are captive.

Seal tight design — Neoprene Gasket.

There are (10) 1/4" holes provided on the back plate. We recommend the following mounting method:

Ten 1/4" x 20 machine screws and masonry anchors for concrete construction.

Ten 1/4" x 20 bolts for steel construction.



Inside view showing two lamps, night light and pull chain

Optional 682 Corner Bracket



Heavy 16 ga. Steel Corner Bracket allows corner mounting of 7240. Bracket mounts flush with wall and ceiling, eliminating possible contraband storage. Six mounting holes on ceiling and wall faces. Fixture mounting holes correspond with bracket mounting holes for easy installation.

ordering information

Catalog No.	Ballast	Lamps (Not Furn.)
7240	120V R.S., Class P CBM,ETL,HPF	(2) 40W
Two center screws only	120V - 0° / Add 0° to Cat. No.	48" R.S.
7240MS	277V/ Add 277V to Cat. No.	
S. S. screws and clips	277 - 0°/ Add 277V-0 to Cat. No.	
7240A	Adapter for Surface Conduit	
682	Corner Mounting Bracket	
Add NL	Suffix for F-8, T-5 Night Light Sockets and Ballast	
Add S	Suffix for Break Away Pull Chain Switch	
9000	Tamperproof Screw Driver	

Kenall

This fixture is virtually indestructible. It is guaranteed to withstand vandalism better than any lighting fixture on the market. Kenall will replace any fixtures vandalized within one year if installed according to our instructions.

END