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A profile is presented of a high school designed to accommodate the organization of teachers into teams working with student groups of varying sizes--this organization is housed in a compact building with the teaching teams centered in clusters of classrooms. The building is heated in winter and cooled in summer by a heat pump system. The description emphasizes why the school was designed as it was and how it was designed and built. Schematics and photographs are included along with an evaluation of the school in relation to the program for which it was planned. (FS)

Profiles of Significant Schools

RICH TOWNSHIP HIGH SCHOOL
OLYMPIA FIELDS CAMPUS
RICH TOWNSHIP, ILLINOIS

Prepared by
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Editorial Associate

May 1960

Educational Facilities Laboratories
477 Madison Avenue, New York City

Profiles of Significant Schools

General Introduction

This is one of a series of "Profiles of Significant Schools." The series is designed to acquaint school administrators and members of boards of education with some of the latest developments in school planning and design. What makes a school significant? It may be an unusual solution to housing the school's educational program which is itself unusual. It may be an architectural solution of great promise. Or it may be an illustration of one point of view on an architectural issue, e.g. air conditioning, portability, subdivisibility.

Since a school cannot be fully understood apart from the program it houses, these profiles will generally describe briefly the educational bases of the design of the buildings. The profiles will attempt to show two things: first, why the school was designed as it was; and second, how it was designed and built. If possible, an evaluation of the school in relation to the program for which it was planned will be included.

These are profiles of individual schools, built in individual communities, to house individual programs. They may not serve ideally in other settings for other programs. However, they represent - in EFL's eyes - significant approaches to school-housing. We hope they will stimulate new and better schools.

The series of profiles is itself an experiment and we would appreciate your reactions to it as well as suggestions for making future profiles more useful.

Additional copies are available from the offices of Educational Facilities Laboratories, Inc., 477 Madison Avenue, New York 22, New York.

School:	Rich Township High School, Olympia Fields Campus, Rich Township, Illinois*

The school will be built in two stages:

	To be Completed	Grades	Enrollment
First:	1961	9 & 10	700
Second:	1964	9 - 12	1,500

Superintendent:	Robert G. Andree
Chairman, School Board:	Robert L. Ringwood
Architects:	Caudill, Rowlett, and Scott Texas, Oklahoma, Connecticut McPherson-Swing Associates Homewood, Illinois
Consulting Engineers:	Robert G. Burkhardt and Associates
Consultant on Heat Pump:	Robert Werden Valley Engineering Company Glenside, Pennsylvania

* The school has not been officially named, but it will be referred to here as the school at Olympia Fields or Olympia Fields to distinguish it from the existing Rich Township High School in Park Forest. Olympia Fields and Park Forest are two of five towns which make up Rich Township, a suburban community, located 30 miles south of Chicago.

Architects Rendering of the Olympia Fields Campus

The goal set by the planners of the Rich Township High School at Olympia Fields was efficient and productive education in an adaptable and economical building.

The educators and architects feel that the goal will be approached in this school:

By the organization of teachers into teams working with student groups of varying sizes, and

By the housing of this organization in a compact building with the teaching teams centered in clusters of classrooms. The school will be available for year-round use, heated in winter and cooled in summer by a heat pump.

Teaching in Teams

Since 1956 the administrative staff of Rich Township's Board of Education has been working experimentally with the University of Chicago to improve the quality of high school education in the existing high school at Park Forest.

The staff and the Board concluded that two or three teachers organized into a team could teach a group of up to 90 students more effectively than the same teachers assigned to single classes of uniform size. With team teaching the large group can be broken up into smaller groups of various sizes. The use of large group lectures under one teacher frees the other teachers in the team for seminars or conferences. Teachers can vary their activities according to their own special abilities, the needs of the students, and the requirements of the subject taught.

To implement these procedures, the staff and the program at the Park Forest school were spilt into four instructional divisions:

1. Humanities - English, social studies, languages, history;

2. Science and mathematics;

3. Vocational and fine arts - music, ceramics, arts and crafts, shop;

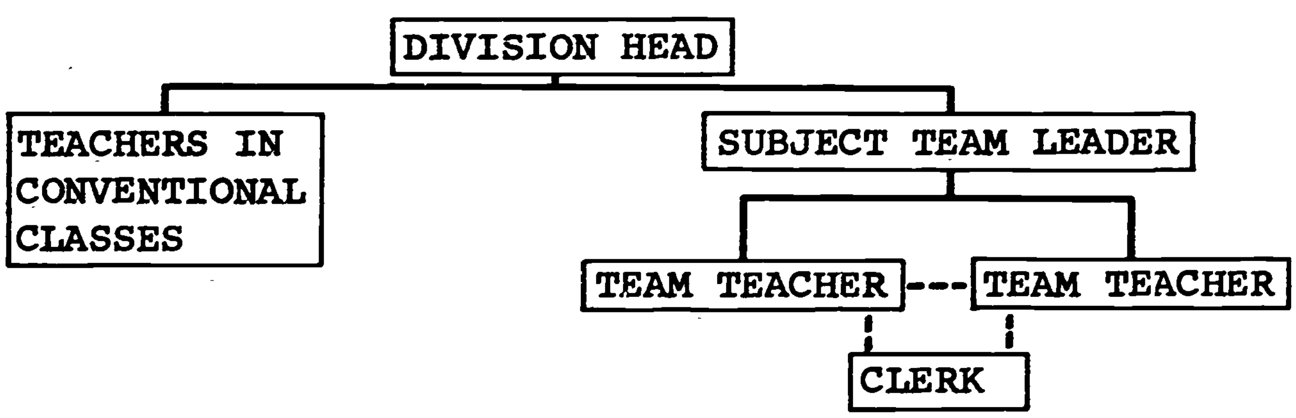
4. Health, safety and physical education.

There are no chairmen of subject departments; each division is headed by a teacher who supervises the other teachers assigned to his division. So far at Park Forest the team approach has been tried, and considered successful in American history, typing, some parts of the mathematics program, and a special ninth grade core curriculum program combining English and social studies.

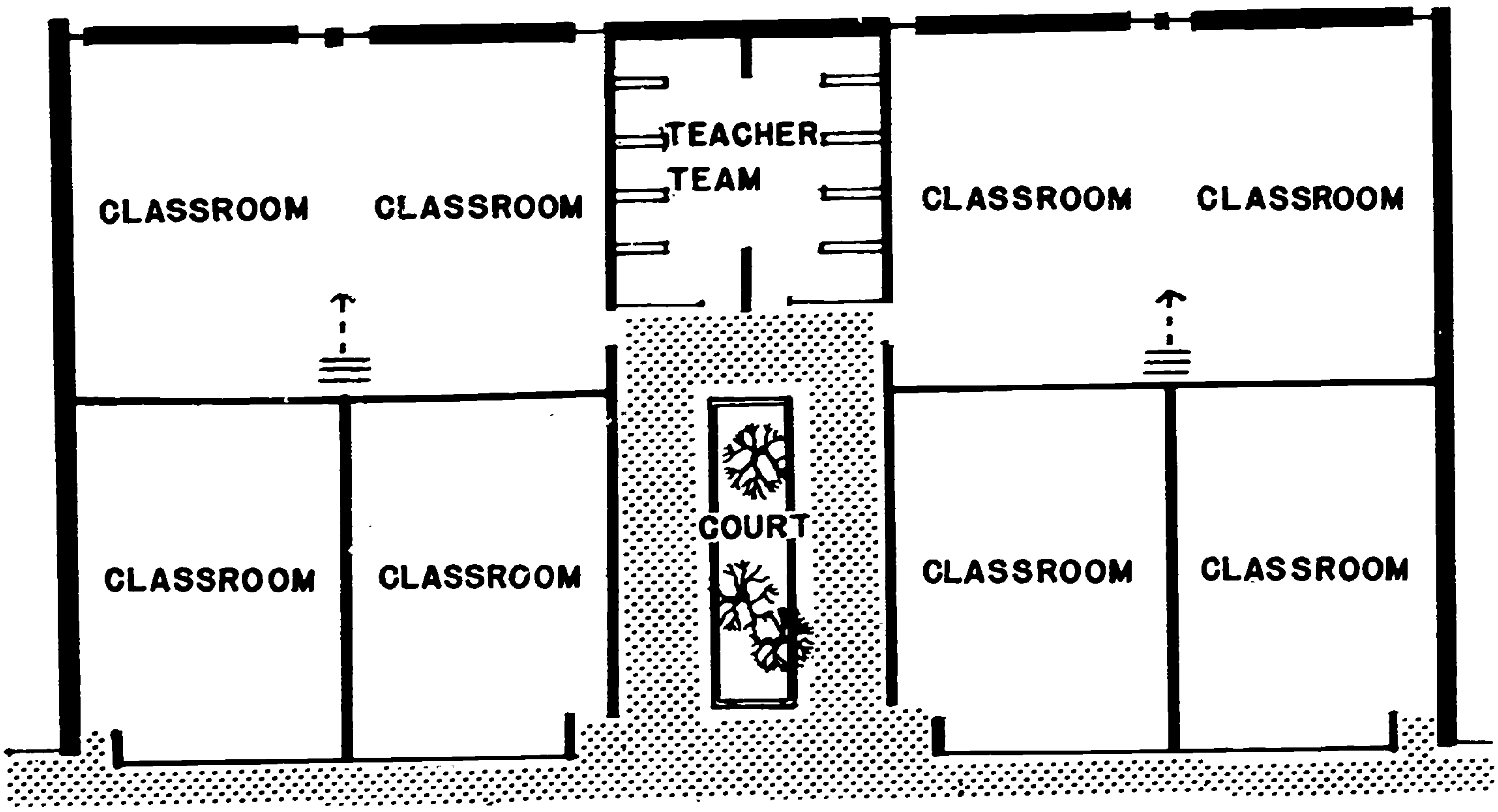
In 1958, when the rising school population made another high school inevitable, the new school at Olympia Fields was planned specifically around teacher teams.

The Olympia Fields school will be organized by the same instructional divisions, and division heads will be in charge in both schools. When the new school opens, team teaching will be operating in those subject areas in which teams have proved successful at the Park Forest school. Other teachers will still teach conventional classes. As the experimental program progresses, teams will be added at both schools. Eventually all of the academic teaching at both schools may be done by teams.

When the team method is applied to a subject, a team is formed under the leadership of the appropriate division head.

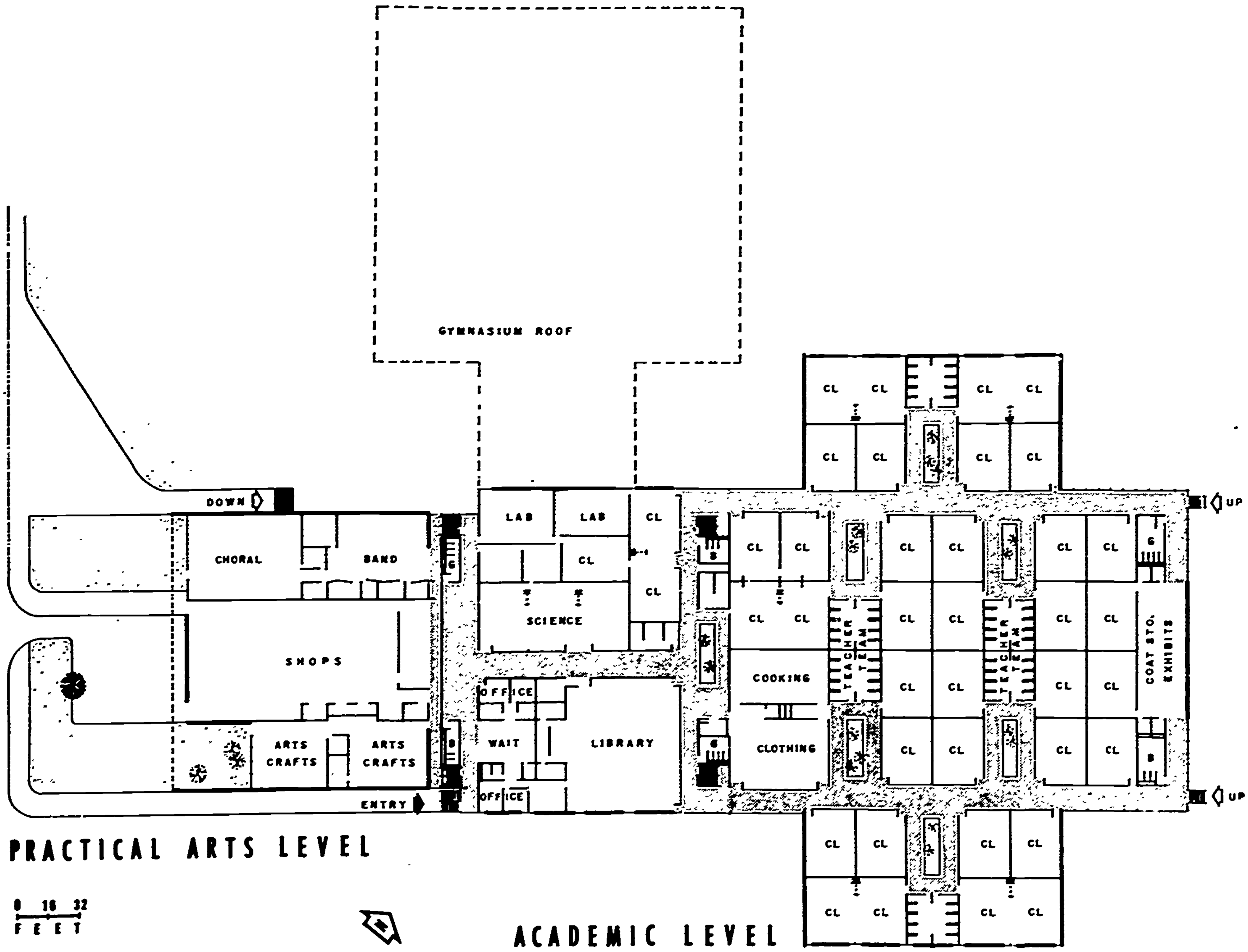


A team operating at the Olympia Fields school will be housed in a team headquarters at one side of a cluster of classrooms.



A classroom cluster shares an interior court. All teaching spaces in a cluster are readily available to the team.

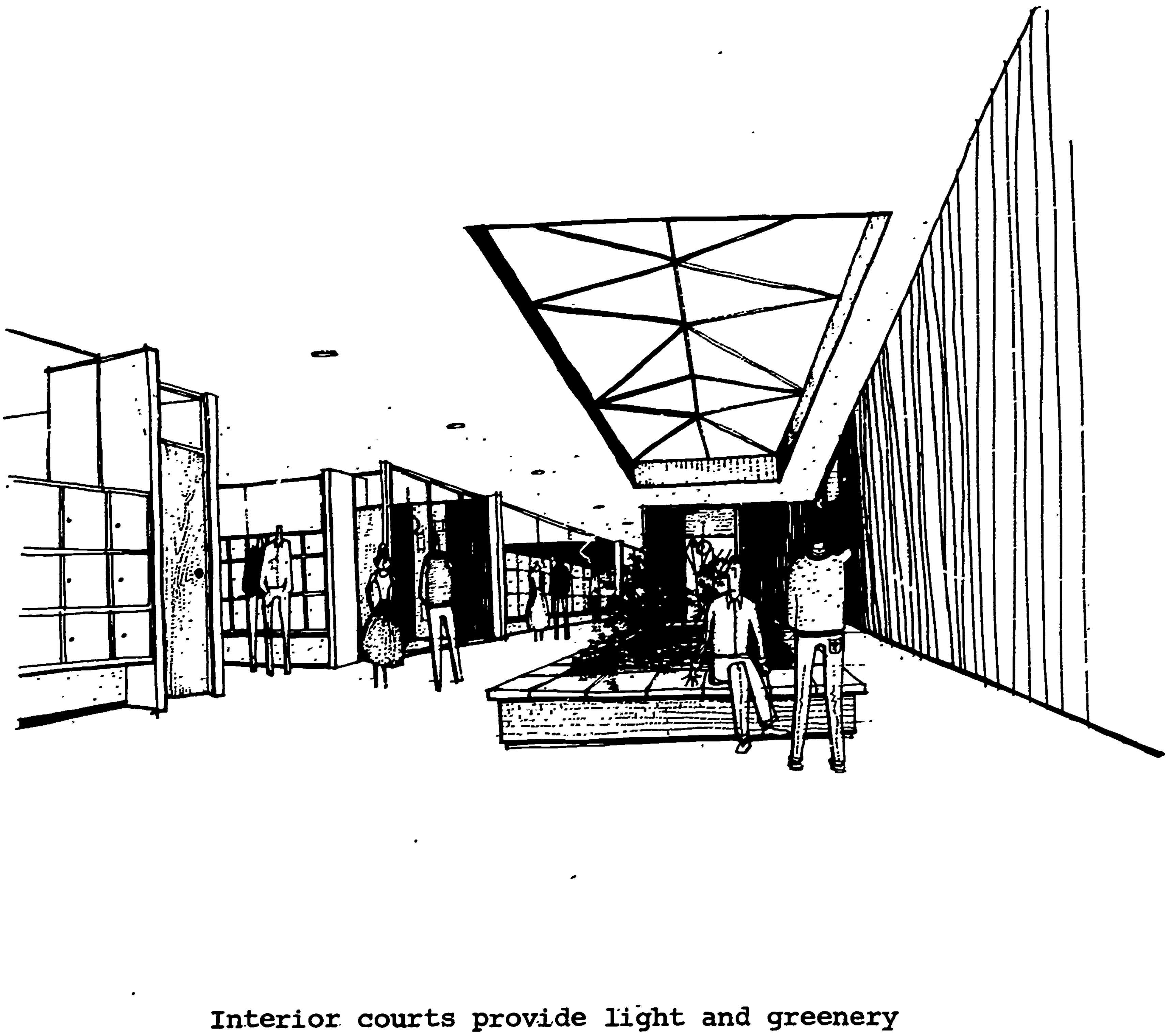
A team of three teachers, for instance, can organize a class of up to 90 students as one large group to hear a lecture on material suitable for all levels of ability or to see a film or television program. Or the class can be split into two sections for material which demands more student participation - each of two teachers might instruct 45 students, allowing the third teacher free time for the preparation of material or student conferences. Or the group can be divided equally among the three teachers. Or, if one teacher is delivering a lecture or showing a film which is too elementary for some students but too advanced for others, the teachers can form special seminar groups of bright and slow. Or the 90 students can be split up into discussion groups of 10, each with its own student leader, while the teachers circulate among the groups.



The Compact School

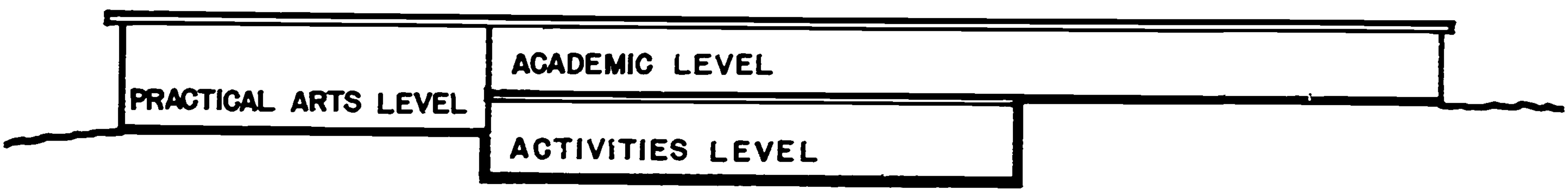
The idea of compact classroom clusters suggested to the planners of the school at Olympia Fields a compact arrangement of the entire school with each division housed in its own separate area of the building.

The interior courts on the academic level will provide an oasis of greenery in a large building mass. Natural light enters the courts through skylights. Glass walls between courts and the interior classrooms will counteract any closed-in feeling that windowless classrooms might produce in students and teachers.



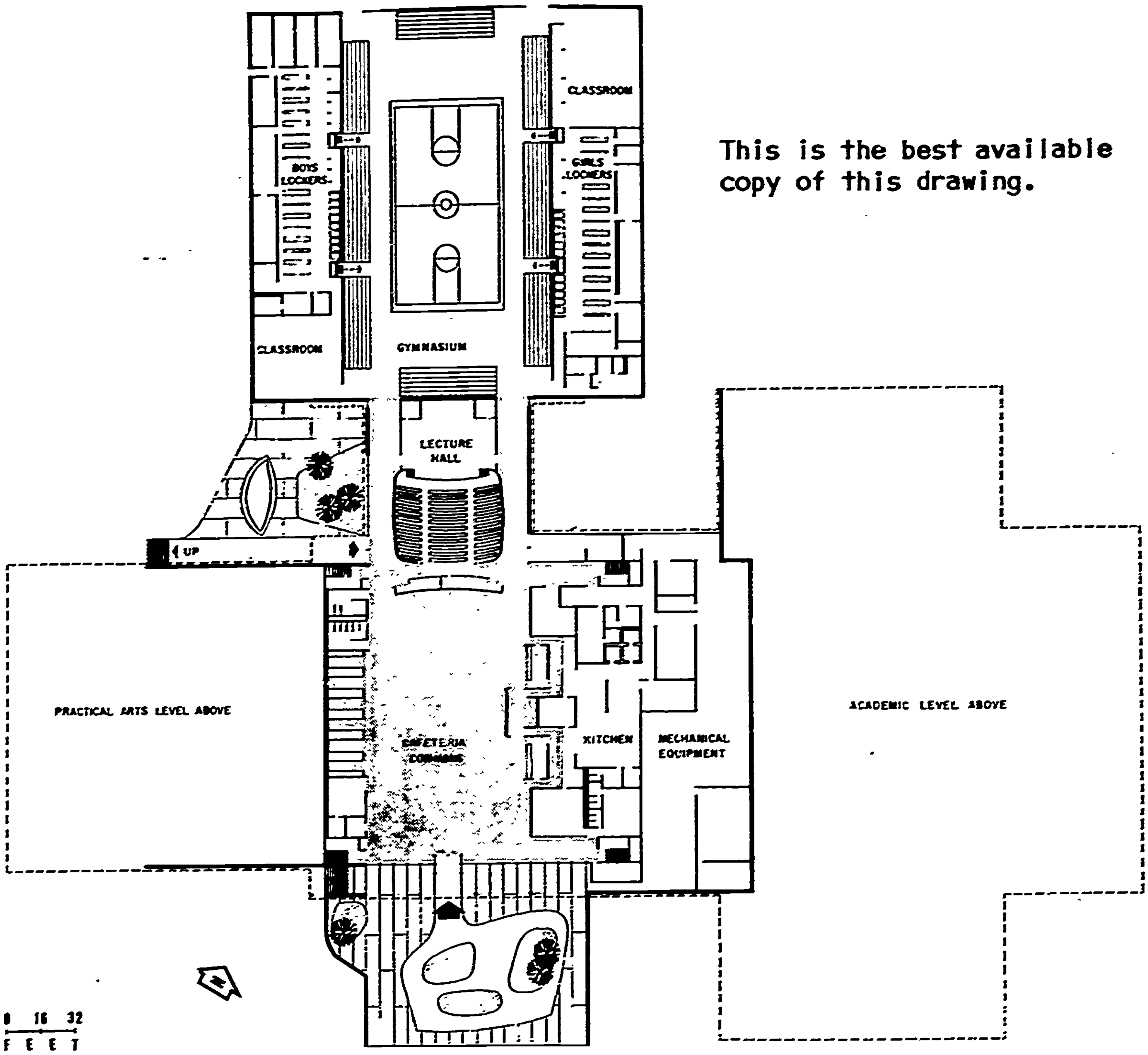
Interior courts provide light and greenery

The school is situated on a 50-acre site with two small hills, one slightly higher than the other. The architects placed the school across the tops of the hills. The different levels of the site will provide the necessary variations in ceiling heights within the school, and the valley between the hills will contain a lower floor housing the cafeteria-commons room and the mechanical facilities.



By fitting the school to its site, the architects were able to use a single flat poured-in-place gypsum roof, and a slab-on grade floor with a minimum of excavation.

The activities level will contain the cafeteria-commons room, kitchen facilities, the teacher's dining room-snack bar, a teacher lounge, a room for school journalism, and storage and mechanical facilities space. The lecture hall - little theater and the gymnasium (which houses the health, safety and physical education division) extend to the rear of the school at this level.



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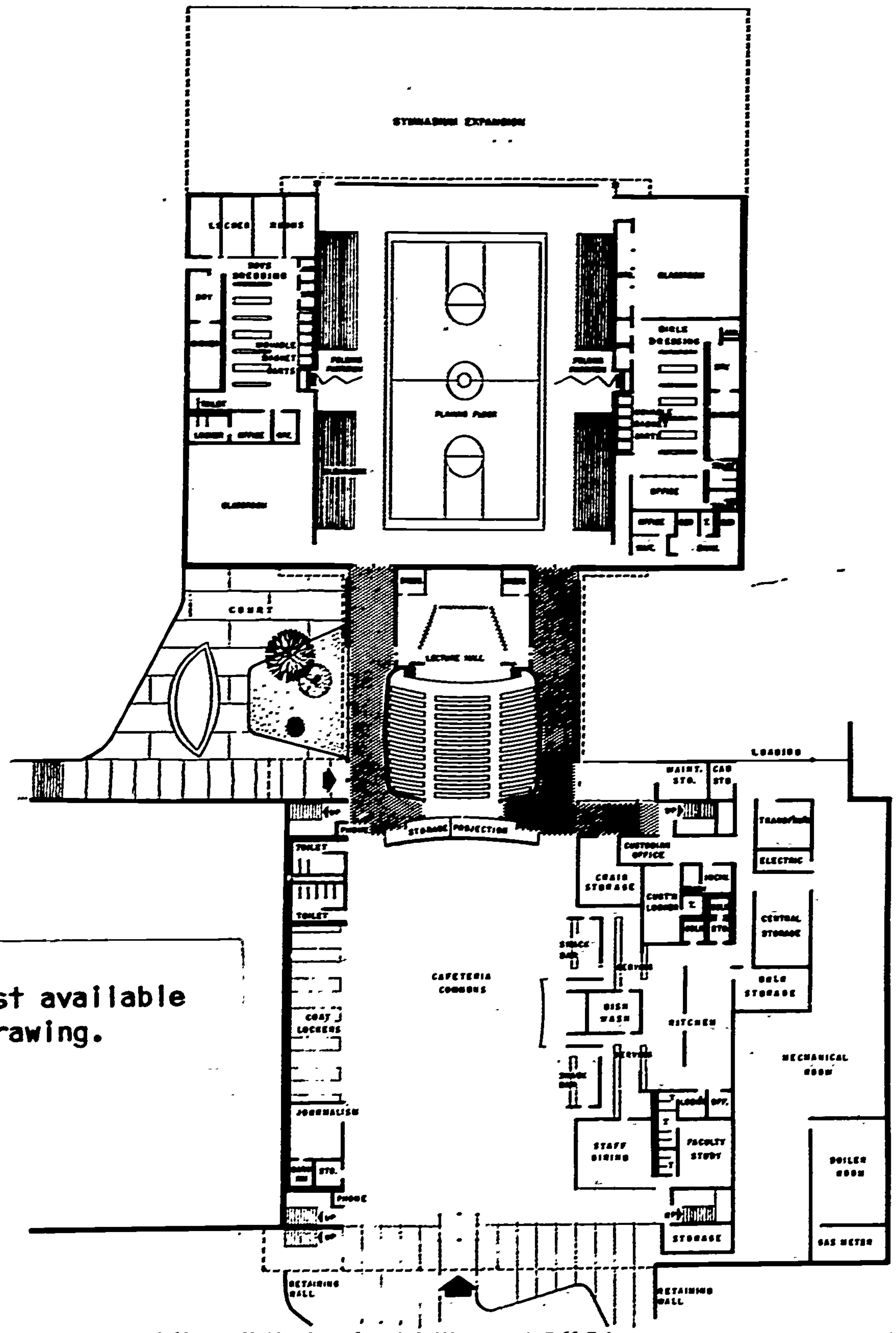
ACTIVITIES LEVEL

The Adaptable School

When completed, the school at Olympia Fields will house 1,500 students in grades 9-12 taught in groups of varying size by teams of teachers. This 1,500 student school, however, will not be needed in Rich Township until 1964. The growth of the school population is such that only 700 students will need to be housed in the Olympia Fields school by September, 1961. At present, the Board plans that these will be students in grades 9 and 10.

Therefore, the school will be built in two stages. The first will be the basic core of the building. The school has been designed so that the units making up the second stage can be added easily and economically to the first stage.

The complete lower floor of the building will be built in the first stage, except for one-third of the gym. The cafeteria-commons room, the kitchen, and the theater-lecture hall are large enough to serve the 1,500 student school - only equipment will have to be added.



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PLAN - UNIT A-LOWER LEVEL

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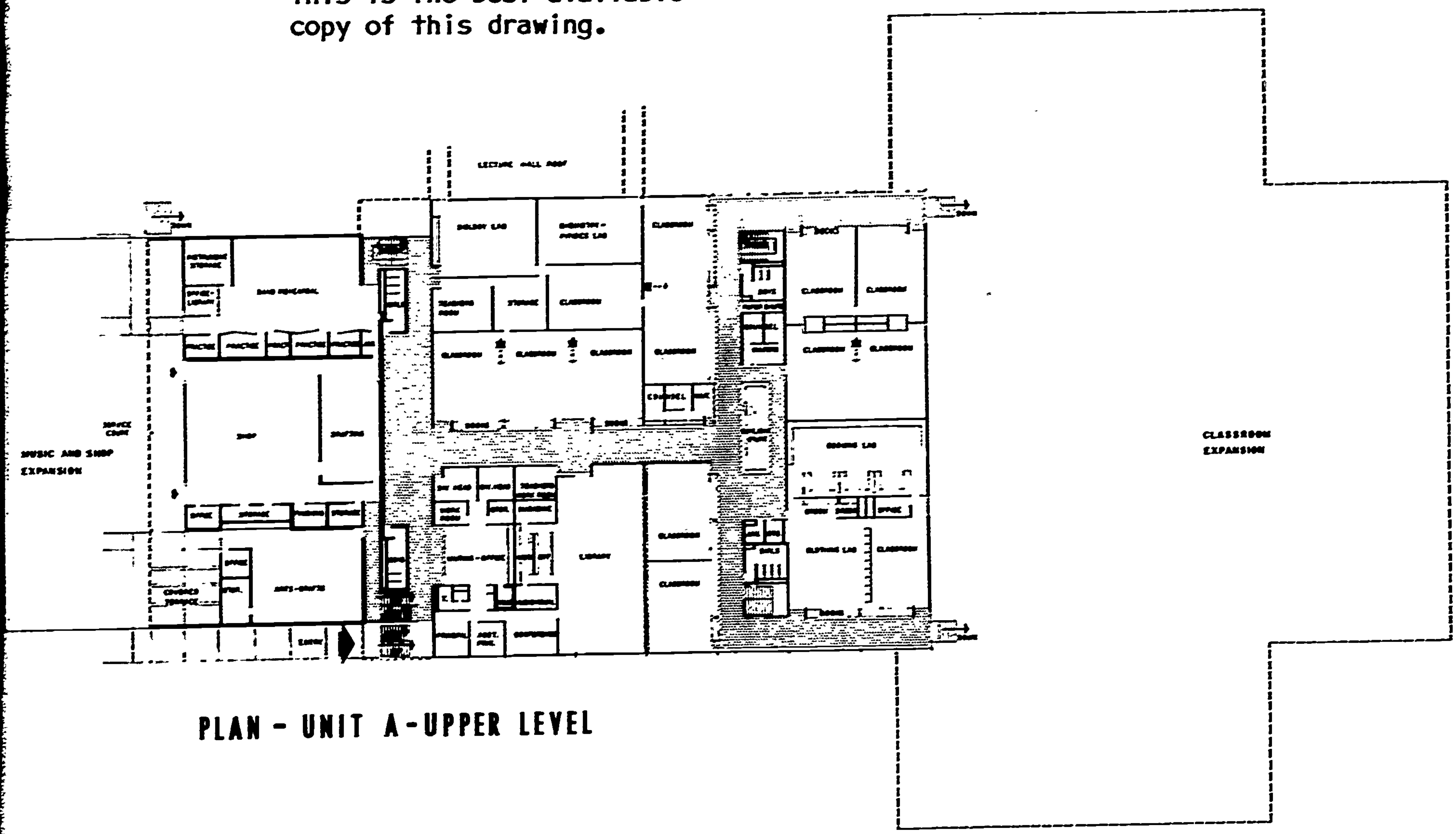
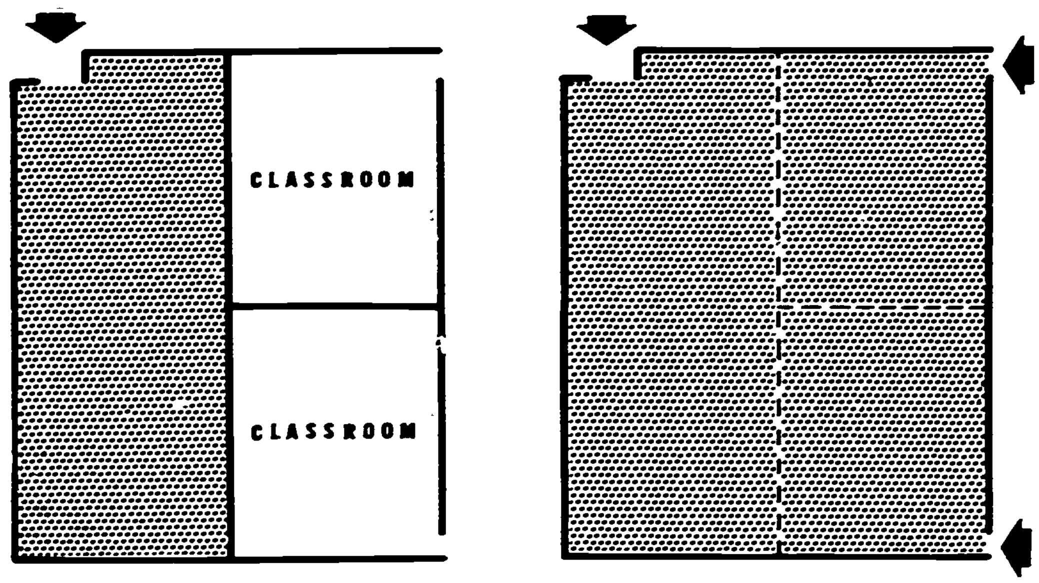


PLAN - UNIT A-UPPER LEVEL

The academic level of the first stage will contain 13 classrooms, the science laboratories, home economics facilities, the library, and the administrative offices. The practical arts level will contain spaces for music, arts and crafts, and shop. The planners feel that the academic and vocational spaces in this stage will be adequate for the amount of team teaching that will be done in grades 9 and 10 in 1961.

The building, with the exception of the gym and the lecture hall, is composed of repetitive bays of 26 by 32 feet.* The steel columns of the building frame are placed at these intervals, and the frame supports the roof without putting a load on any of the walls. To add the second stage of the school, the contractors have only to remove part of the exterior curtain wall, add additional bays, and connect up ducts and plumbing.

PRESENT LIBRARY UNIT AND EXISTING CLASSROOMS   FUTURE EXPANSION WITH PARTITIONS REMOVED



In 1964, the library will expand into its two neighboring classrooms by the removal of the intervening walls.

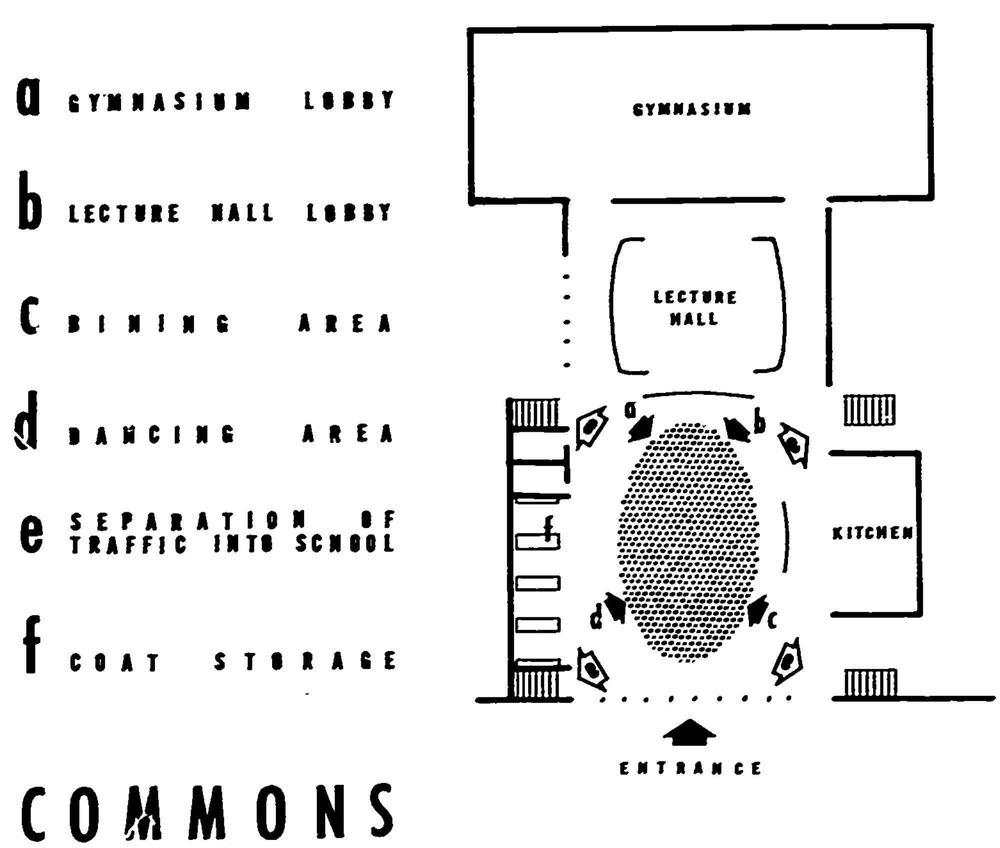
* All spaces running left to right on the schematic drawings are 26 feet or combinations of a 26 foot length and all spaces running from top to bottom are either 32 feet or combinations of a 32 foot length.

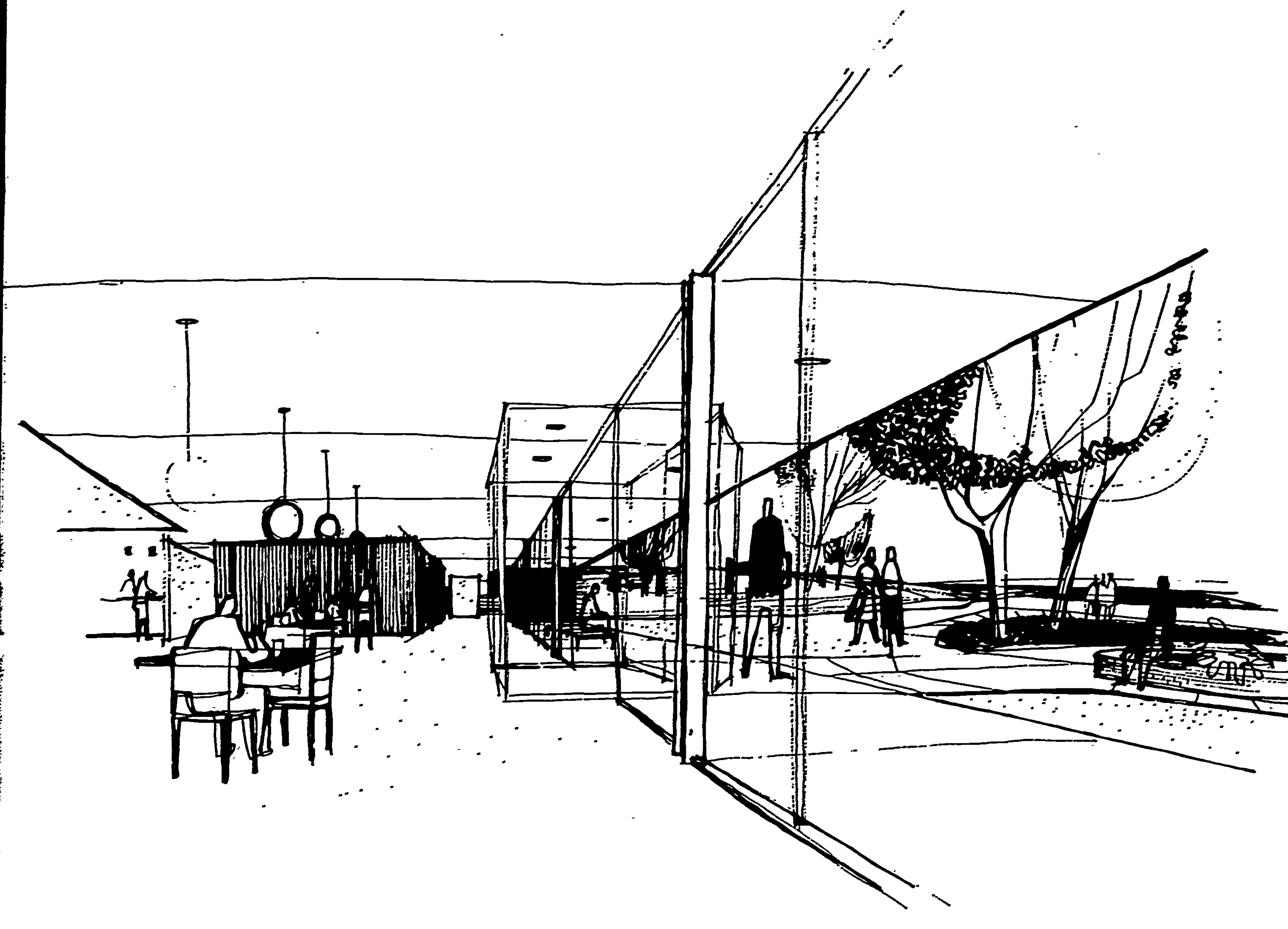
The use of a skeleton steel frame with non-load-bearing walls means that interior walls can be taken down or put up without disturbing the structure of the building. The heating, cooling, and ventilating systems are all either in the ceiling or the exterior walls. The plumbing is beneath the floor. Wall changes will not affect these facilities. The interior walls, with the exception of movable partitions, are metal lathe and plaster. Spaces can be made larger by removing a wall if the educational program should call for larger spaces. Or larger spaces can be reduced to 26 by 32 feet by installing a partition. This interior flexibility will be put to use as the school expands.

The use of standard bays effects saving in the fabrication and erection of the basic building structure because of the repetitive character of these processes. Beams, columns, and girders are the same size and shape. Large quantities of each can be ordered, in most instances at a lower cost. They can be fabricated in the shop and erected on the site easily and quickly, thus saving labor costs.

The Multiple Use of Space

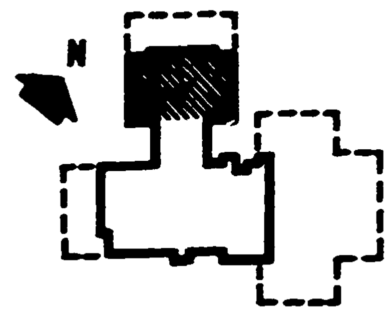
Many of the areas in the Olympia Fields school will serve a number of different purposes so that no space will be unused for long periods.



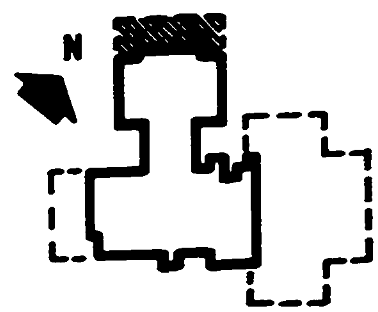


The cafeteria-commons room looks out on a landscaped patio entrance to the school.

The little theater-lecture hall will be used for plays and concerts and will also be used as a large classroom for films, lecture-demonstrations, or television. There is no formal auditorium. The theater-lecture hall will fulfill many of the conventional functions of an auditorium, and the gymnasium can be set up with bleachers and chairs for larger gatherings.

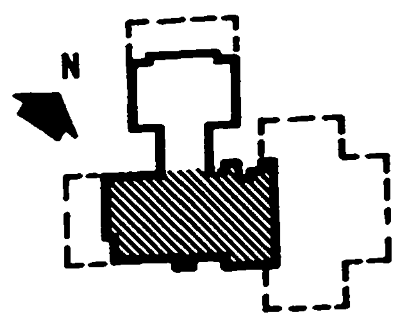


When not used for meals, the cafeteria-commons room will be a lounge where students can relax or hold committee meetings, and the nearby faculty dining room will convert to a snack bar.



When the theater-lecture hall is used for after-school or community activities, concerts, or summer theater, the cafeteria will serve as a lobby for the theater or for gatherings held in the gym.

The aim in the school is to use every space 100 per cent of the time. This goal may never be reached, but the staff expects to come as close as 90 or 95 per cent in contrast to the norm of 80 per cent in most high schools.



Teaching Aids

A further step in the direction of efficiency and better instruction is the use of television.

The plans in Rich Township call for a closed-circuit system linking both high schools and for open-circuit reception to feed in programs from other sources, such as the midwest program on airborne television instruction.*

Television is intended to supplement regular teaching with films and demonstrations. On special occasions, outstanding material worked up by the classes can be seen by the whole school via television.

The school will also be equipped with a complete language laboratory designed, built, and installed by faculty members of the school at Park Forest.

The Air Conditioned School

The trend in Rich Township, and throughout the country, is to use school buildings all year. Advanced and remedial summer programs are now offered in the Park Forest school. About one-quarter of the high school faculty is paid on a 12-month basis rather than for a traditional 9½-month school year. But the summer program at Park Forest, while educationally successful, is hampered because the building is uncomfortable.

In the early days of the process of designing Olympia Fields the possibility of making the school truly usable in summer through air conditioning was considered by the planners.

The idea of air conditioning was given a further push because the compact design of the school resulted in a low perimeter building with many windowless interior rooms. The temperatures

* Programs transmitted from a plane flying over Montpelier, Indiana, and produced by the Midwest Council on Airborne Television Instruction at Purdue University, are scheduled to begin in September, 1961.

in the interior rooms will not be so affected by variations in outside temperature or direct solar heat as rooms on the building's perimeter, especially rooms with large expanses of glass. The interior rooms will, however, be more affected by heat generated by occupants and lights.

The consulting engineers for the school estimate that these interior rooms, when occupied, will need cooling most of the year. On very cold days they will demand less heat than the outside rooms; the heat produced by occupants and lights will help heat the rooms, and once heated they will tend to retain heat. The different heating and cooling demands in the perimeter and interior rooms pointed to the need for a system which could heat and cool at the same time.

Alternate bids were asked for mechanical equipment. Bids for the heat pump system were lower than for other systems which included cooling.

Total Cost of School including Mechanical Equipment

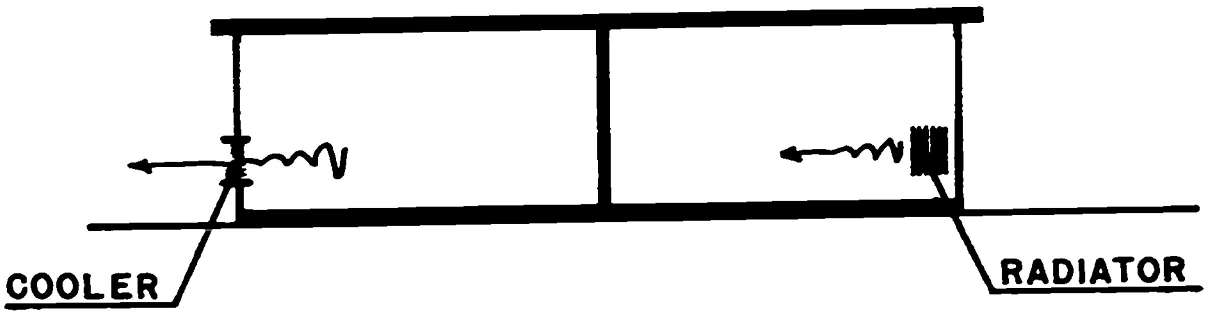
Simultaneous heating and cooling:

Heat Pump System	$1,550,800
Conventional or Four-pipe system	$1,589,410

Heating and cooling, but not simultaneously:

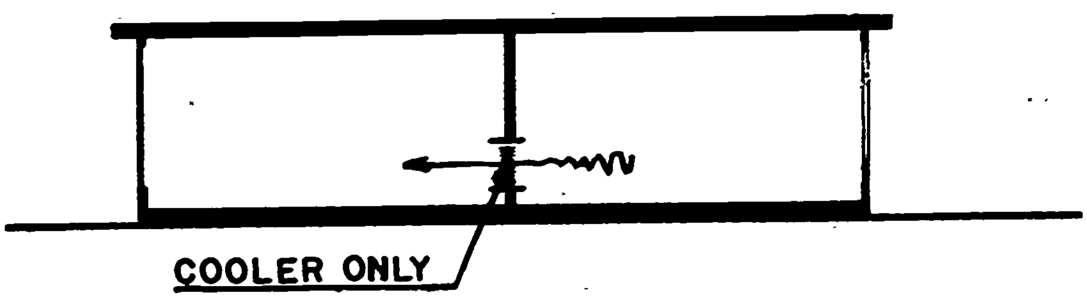
Conventional or Two-pipe system	$1,573,240

In addition, the heat pump system of simultaneous heating and cooling will cost Olympia Fields less to operate than would the conventional four-pipe system of simultaneous heating and cooling. In the four-pipe system, heat is obtained by running a boiler, and cooling is obtained by running separate refrigeration equipment. If, at the same time, some rooms require heating and others cooling, the boiler and the refrigeration units both run, and the school system has to pay for running both units. Heat is taken out of overheated rooms, sent out of the school, and wasted, while the boiler runs to heat rooms which are too cold.



The four-pipe system may be compared to running a cooler to remove heat from rooms which need cooling and turning on a radiator in rooms which need heating.

The heat pump uses conventional refrigeration equipment (the same type as used in summer air conditioning systems) for both heating and cooling. Whenever a refrigeration unit runs, both heating and cooling effects are produced, i.e., cold air or water is obtained by removing its heat. The heat pump uses this to heat rooms in winter. On days when some rooms need cooling and others need heating, the heat pump takes heat from the warm rooms for transfer to the cold rooms.



The heat pump system may be compared to using a cooler to transfer heat from overheated rooms to rooms which are too cold. Assuming that the amount of heat one room lacks is equal to the excess heat in the other room, only one unit will be necessary to equalize the temperatures in the rooms.

The heat pump system at Olympia Fields depends upon an unrestricted supply of mineral-free water obtained from a well drilled near the school. The well water, which is 53 degrees in both summer and winter, is pumped into the heating-cooling system. Heat taken from this water is used to heat rooms, and rooms are cooled by giving up their heat to chilled well water.* (If large quantities of pure water were not available, other heat pump systems, such as those using air as a source of heat, might have proven practicable.)

In addition to a relatively unrestricted source of heat, the economy of a heat pump's operation, in comparison with that of a conventional heating and cooling system, will depend on climate, building design, the cost of electricity (used to run the refrigeration unit), and the cost of different fuels used to run a boiler. At Olympia Fields these factors balanced in favor of the heat pump system - the consulting engineers estimate that the heat pump will save the Olympia Fields school 10 per cent on operating costs.

Cost

The first stage of the school is the only part of the building for which contracts have been signed. This stage contains 98,966 square feet of space and will cost $1,550,800. This is for a 700-pupil, completely air conditioned school which includes all of the basic facilities required for the final 1,500-student school. This stage will cost $15.67 per square foot and $2,215 per pupil.

The architects estimate that the second stage of the school will cost only $10 per square foot - in terms of today's prices. If the complete school were built now, the architects expect that the square foot cost for the fully air conditioned school housing 1,500 students would be about $14.

*For a detailed explanation of the heat pump's operation, see appendix, page 19.

Rich Township High School

Site Work and Excavation	$ 88,393.00
Caissons	16,500.00
Waterproofing and Dampproofing	7,500.00
Concrete	154,375.00
Reinforcing Steel and Mesh	14,000.00
Set Reinforcing Steel and Mesh	4,861.00
Corruform	6,000.00
Structural Frame	177,000.00
Roof Deck	27,350.00
Roofing, Sheet Metal and Insulation	17,442.00
Skylights	4,100.00
Masonry	107,505.00
Quarry and Ceramic Tile	4,500.00
Terrazzo	1,700.00
Aluminum Doors	2,464.00
Glass and Glazing	18,900.00
Carpentry	53,876.00
Wood Floor	23,150.00
Millwork	38,500.00
Thermal Isulation	15,833.00
Hollow Metal Doors and Frames	23,800.00
Folding Partitions	5,669.00
Metal Toilet Partitions	1,800.00
Wire Mesh Partitions	850.00
Lathing and Plastering	93,600.00
Caulking	4,000.00
Hardware	13,800.00
Painting	24,831.00
Resilient Floor Covering	12,700.00
Jalousie Windows	335.00
Plumbing	91,416.00
Heating and Ventilating	324,620.00
Electrical	117,014.00
Miscellaneous Equipment (built-in)	19,536.00
Contractors Job Overhead	32,880.00
Total	$1,550,800.00

Appendix - The Heat Pump

The Refrigeration Process

The name heat pump is commonly applied to any year-round air conditioning* system employing refrigeration equipment for both heating and cooling. The system must have a source of heat and a heat absorber. At the Olympia Fields school these are two wells drilled near the school - the supply well (heat source) and the recharge well (heat absorber). In effect, heat is taken from the water in the supply well when heating is required and heat is given up to the water in the recharge well when cooling is required. Water from the supply well, a constant 53° F, is fed through pipes in the condenser and the chiller of the refrigeration unit.

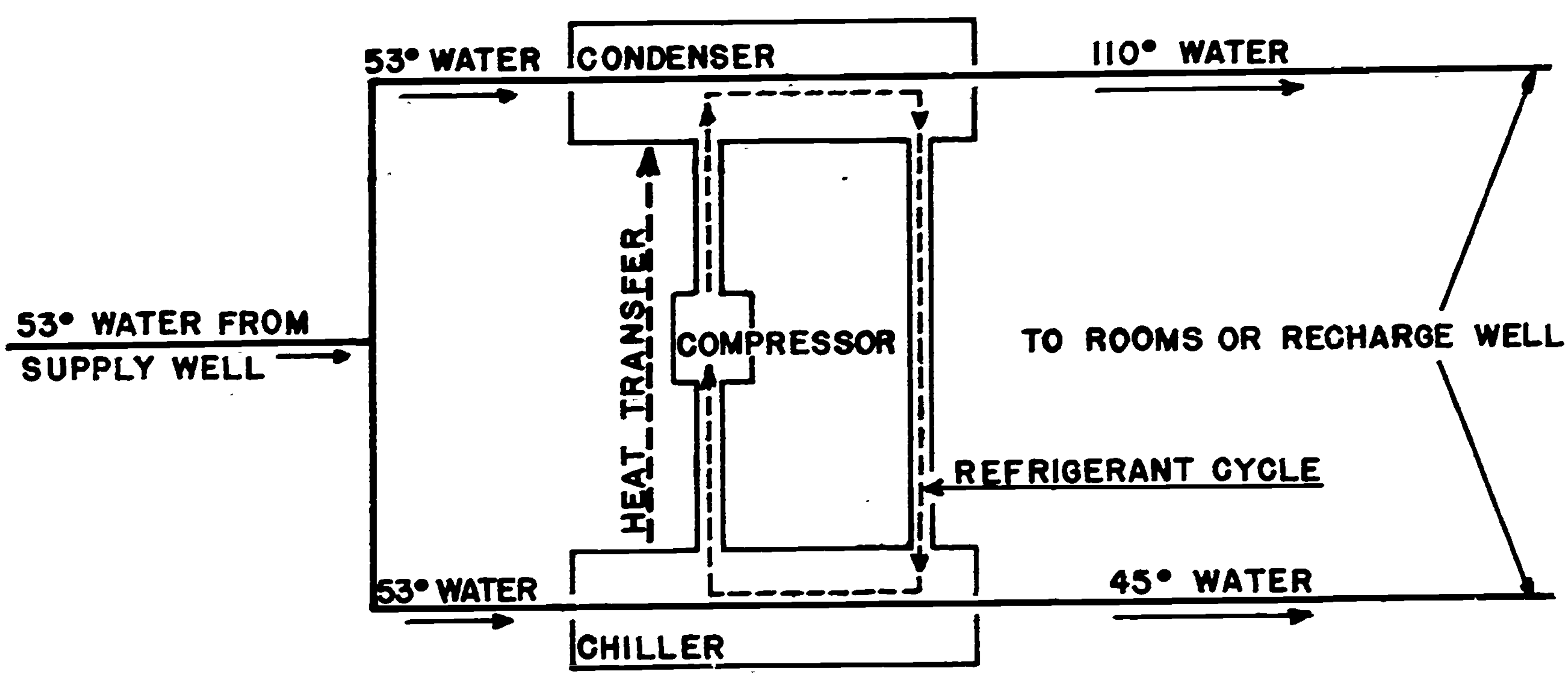


Diagram of the refrigeration process

* Air conditioning can mean either heating or cooling. It is "The process of treating air so as to control simultaneously its temperature, humidity, cleanliness, and distribution to meet the

A refrigerant makes a closed circuit from compressor to condenser to chiller and back to compressor. The refrigerant picks up heat from the 53° water circulating through the chiller and gives up heat to the 53° water circulating through the condenser. The temperature of water passing through the condenser is raised to 110° F. The temperature of water passing through the chiller is lowered to 45° F.

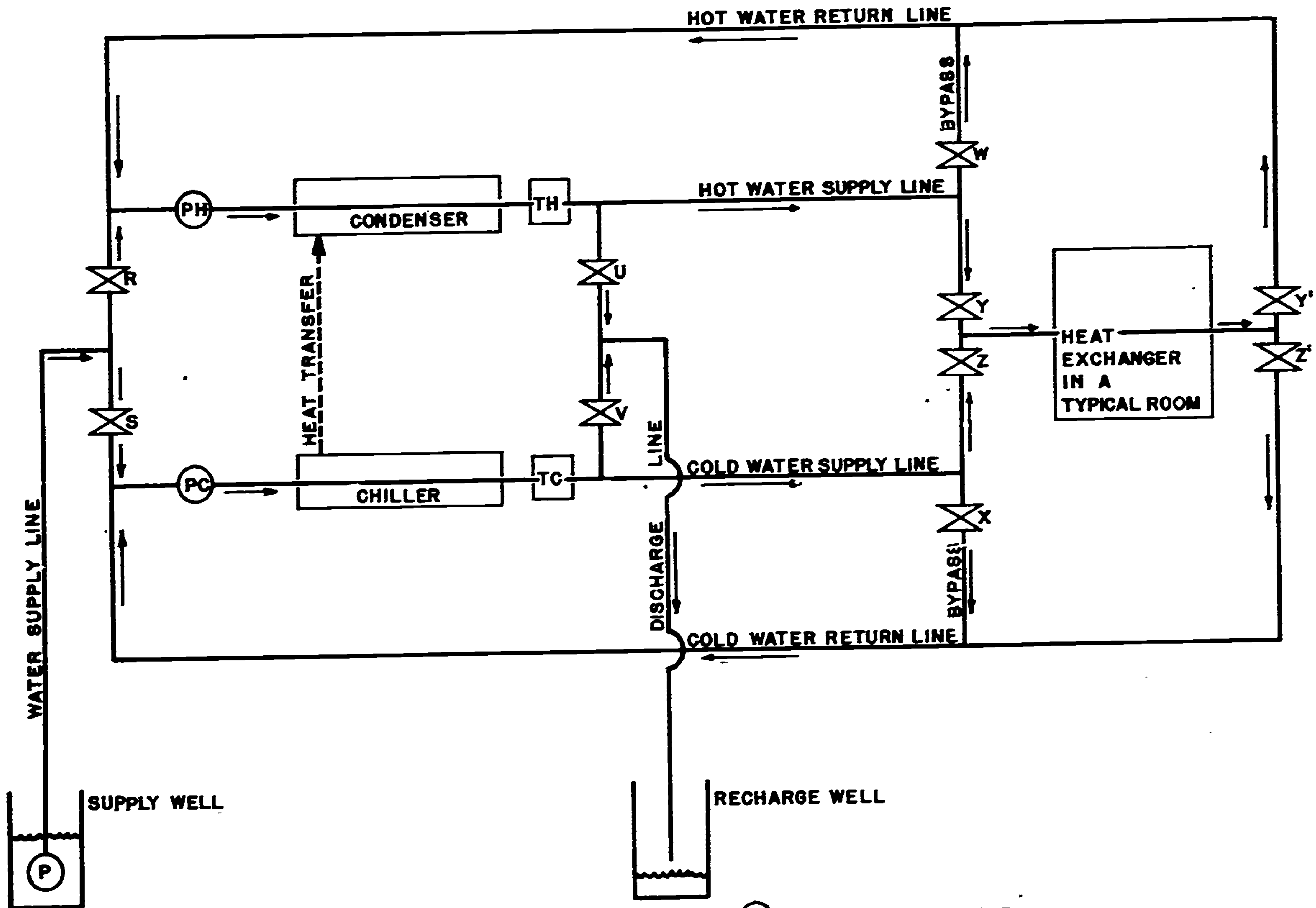
The 110° water leaving the condenser is used for heating. If no heat is necessary, the water leaves the school and goes to the recharge well. The 45° water leaving the chiller is used for cooling. If no cooling is necessary, this water goes to the recharge well.

The Heat Pump

If water passing the thermostat (TH) in the hot supply line is not 110°, or if water passing the thermostat (TC) in the cold supply line is not 45°, the refrigeration equipment will be activated and (except in a perfect balance of heating and cooling) valves allowing water to enter and leave the school will be opened.

The system is first filled with well water through valves R and S. Once water enters the hot circuit (through valve R) or the cold circuit (through valve S), it remains in that circuit until it leaves the school through valve U or V.

requirements of the conditioned space." Heating Ventilating Air Conditioning Guide 1958, New York: American Society of Heating and Air Conditioning Engineers, Inc., page 1.



P WATER SUPPLY PUMP

PH HOT WATER PUMP

PC COLD WATER PUMP

VALVES
R, S, U, V, Y, Z CONTROLLED BY THERMOSTATS
W, X CONTROLLED BY PRESSURE

TH HOT WATER SUPPLY THERMOSTAT

TC COLD WATER SUPPLY THERMOSTAT

NOTE: HEAT EXCHANGER DOES NOT SHOW VENTILATING & AIR FILTERING EQUIPMENT

DIAGRAM OF THE HEAT PUMP

The heat pump system is controlled by temperature changes. When temperatures in rooms are too high or too low, thermostatically controlled valves, leading to heat exchangers in the rooms, will open to allow rooms to be heated or cooled.

On a very cold day when all rooms demand heat, only the heating effect of the refrigeration unit is used:

The 53^{o} well water is pumped into the chiller, by the cold water pump (PC), and the condenser, by the hot water pump (PH), of the refrigeration unit, where the heat transfer takes place. Because all rooms demand heat, the thermostatically controlled valves Y and Y' entering and leaving the heat exchangers are automatically opened. The 110^{o} water leaving the condenser flows through the hot supply line, through valve Y to these heat exchangers where the water gives up its heat to the room air, goes out of valve Y' to a hot return line, and once again through the hot water pump into the condenser.

Since none of the rooms needs to be cooled, valves Z and Z' at heat exchangers are closed and the 45^{o} water leaving the chiller is dead-ended in the cold supply line. Pressure builds up in this line, and this pressure opens valve X to the cold water by-pass line. The 45^{o} water flows through this line and returns directly to the chiller.

Water in the hot circuit must be kept at 110^{o} to heat the rooms. If water in this circuit, passing thermostat TH is below 110^{o}, TH signals the refrigeration equipment to run to maintain the 110^{o} temperature by transferring heat from water passing through the chiller. At this rate, water in the cold circuit giving up heat in the chiller, would soon freeze. Therefore, if water passing thermostat TC is below 45^{o}, TC opens valves S and V, below 45^{o} water leaves the school (this water goes to the recharge well), and 53^{o} water is admitted to the cold circuit through valve S.

On a very hot day when all rooms demand cooling, only the cooling effect of the refrigeration equipment is used:

The 53° well water is pumped into the chiller and the condenser and heat transfer takes place. Because all rooms need cooling, valves Z and Z' are open. The 45° water leaving the chiller flows through the cold supply line through valve Z to the heat exchanger, where heat is picked up from the room air. The water then goes out of valve Z' to the cold return line, once again through the cold water pump into the chiller where it gives up the heat it has picked up.

Valves Y and Y' are closed and the 110° water from the condenser is flowing through the by-pass line back to the condenser to pick up heat again. To maintain a temperature of 110° in the water in the hot circuit, above 110° water will go to the recharge well via valve U and 53° water will enter the condenser through valve R.

During most of the year, when some rooms must be heated and others cooled, both the heating and cooling effects of the refrigeration equipment are used:

Because the demand for heating or cooling is thermostatically controlled at the rooms, some water in each supply line will flow to heat exchangers with open valves and the rest of the water from that supply line will enter the by-pass line of its system.

If the demands for heating and cooling at any time are the same, half the water in each circuit will flow to heat exchangers, and half will by-pass. In contrast to situations in which only heating or cooling is necessary, not so much heat is given up to rooms by water in the hot circuit, and not so much heat is picked up at the rooms by water in the cold circuit, so temperatures at TH and TC will be less affected, the refrigeration equipment will run half time, and heat transfer within the refrigeration equipment will maintain water temperatures of 45° and 110° with water neither leaving nor entering the system. To the extent that the demand for heating or cooling is out of balance, some water will leave and enter the school.

The more often the situation of perfect balance between heating and cooling demands is approached, and the more often cooling demands are greater than heating demands, the more likely it is that the heat pump system will cost less to operate than the conventional four-pipe system. The operating cost of the four-pipe system over the period of a year will depend on the cost of fuel necessary to run the boiler for heat plus the cost of electricity used to run the refrigeration equipment for cooling. The operating cost of the heat pump system over the period of a year will depend on the cost of electricity used to run the refrigeration equipment for heating and cooling.

The amount and therefore the cost of cooling will be the same for both systems. Operating economy will depend on heating - the cost of fuel for the four-pipe system as opposed to the cost of running the refrigeration equipment for heating in excess of the amount of cooling needed at that time.

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