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RESEARCH REPORT



Rural and Native Demonstration Program:
Construction System Development by
Add-On Buildings Ltd.



CMHC—HOME TO CANADIANS

Canada Mortgage and Housing Corporation (CMHC) has been Canada's national housing agency for more than 60 years.

Together with other housing stakeholders, we help ensure that Canada maintains one of the best housing systems in the world. We are committed to helping Canadians access a wide choice of quality, affordable homes, while making vibrant, healthy communities and cities a reality across the country.

For more information, visit our website at [**www.cmhc.ca**](http://www.cmhc.ca)

You can also reach us by phone at 1-800-668-2642
or by fax at 1-800-245-9274.

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RURAL AND NATIVE DEMONSTRATION PROGRAM
CONSTRUCTION SYSTEM DEVELOPMENT
BY ADD-ON BUILDINGS LTD.
REPORT AND CONSTRUCTION MANUAL

Prepared for

Project Implementation Division
Policy, Research and Programs Sector
Canada Mortgage and Housing Corporation

by

ADD-ON BUILDINGS LTD.
Edmonton, Alberta

May 1987

Principal Consultant: Joseph Skvaril

CMHC Project Manager: Terry Robinson

Canada Mortgage and Housing Corporation, the Federal Government's housing agency, is responsible for administering the National Housing Act.

This legislation is designed to aid in the improvement of housing and living conditions in Canada. As a result, the Corporation has interests in all aspects of housing and urban growth and development.

Under Part V of this Act, the Government of Canada provides funds to CMHC to conduct research into the social, economic and technical aspects of housing and related fields, and to undertake the publishing and distribution of the results of this research. CMHC therefore has a statutory responsibility to make widely available, information which may be useful in the improvement of housing and living conditions.

This publication is one of the many items of information published by CMHC with the assistance of federal funds.

DISCLAIMER

This study was conducted by Add-On Buildings Ltd. for Canada Mortgage and Housing Corporation under Part V of the National Housing Act. The analysis, interpretations and recommendations are those of the consultants and do not necessarily reflect the views of Canada Mortgage and Housing Corporation or those divisions of the Corporation that assisted in the study and its publication.

CMHC SUMMARY

Title: RURAL AND NATIVE DEMONSTRATION PROGRAM
CONSTRUCTION SYSTEM DEVELOPMENT BY ADD-ON BUILDINGS LTD.
REPORT AND CONSTRUCTION MANUAL

Background:

Clients under the Rural and Native Demonstration Program are expected to provide the labour required to erect their own houses on a self-help basis. Since their previous experience in construction is often quite limited, such clients may benefit from the use of simplified housing "kits".

Objectives:

To adapt the construction system developed by Add-On Buildings Ltd. to meet the design criteria and budget limitations of the Demonstration Program.

Methodology:

The consultant produced a house plan, a detailed construction manual for use by homeowners, associated shop drawings, and a summary report which includes cost data.

Conclusions:

It would appear to be possible to adapt Add-On's system to meet the restrictions of the Demonstration Program. Consideration should be given to building a small number of units using this system during the remaining years of the Program, in order to evaluate the effectiveness of kit housing in comparison to stick-built forms.

REPORT

RURAL AND NATIVE DEMONSTRATION PROGRAM -
TECHNICAL DETAIL/CONSTRUCTION SYSTEM DEVELOPMENT

Prepared for:

CANADA MORTGAGE AND HOUSING CORPORATION
682 Montreal Road
Ottawa, Ontario K1A 0P7

Contact: Terry Robinson, Project Manager

By:

ADD-ON BUILDINGS LTD.
295, 10149 - 109 Street
Edmonton, Alberta T5J 3M4

Contact: Joseph Skvaril, President

Edmonton, Alberta, Canada
March 30, 1987

I. INTRODUCTION.

ADD-ON Buildings Ltd. feels very honoured to be given the opportunity by the Canada Mortgage and Housing Corporation to adapt its patented system to the rural and native housing developments in northern regions of Canada for the purpose of achieving reasonably good quality housing for the rural and native people there at minimum possible cost.

CMHC's idea to use, in the rural and native developments, a certain package system in which at least the major portion of the work such as the rough structure is premanufactured, is excellent because the high quality and long life span of any wood frame structure lies primarily in its proper assembly.

Since in the costs of a wood frame structure are included not only the costs for the material package and a minimum degree of prefabrication, but also the costs for the supervision of the on site work to be done by the rural and native people, we have chosen to adapt our method of rough structure assembly so as to ensure that all of the most sensitive portions of the work are premanufactured, and that only simple and easy work remains to be done on site. This saves considerable amounts of time.

A typical example of the above is our innovative method of premanufacturing and protection of the vapor barrier on all floor/ceiling and wall components, some of which also include electrical wiring. In this case, the CMHC homeowner is required only to be cautious not to puncture the vapor barrier, and to take care of the joints between the panels.

It is needless to mention that our system is self-controlling in nature, as is obvious from our manual and drawings.

For the convenience of the possible implementation of any project derived from this research work, and in conformity with our contract with the CMHC, we have clearly identified three distinctive but



inseparable parts of our assignment.

1. This Report which is obviously addressed to the management of the Canada Mortgage and Housing Corporation through all the basic facts and potential benefits of this kind of housing development for the rural and native people.
2. Shop drawings for all of the prefabricated components some of which also have installed vapor barrier, electrical wiring and outlets, and possibly even plumbing pipes. The set of shop drawings is a document of compliance of the product with the National Building Code requirements and the standards of performance of the manufacturing work.

List of supplies for the entire house, which describes all prefabricated house components in the package, as well as, the balance of the supply for the completion of the entire house including all finishes, mechanical and electrical components and kitchen.

Packaging scheme for the packages in which the house is shipped. In this demonstration case (82.0 sq.m. 3-bedroom house), the entire house supply is in four separate and relatively small packages, however, the method of packaging and the numbers and sizes of packages can be altered depending entirely on the availability of the means of transportation and on the site conditions.

The above are three inseparable parts of a very simplified house documentation which is an inseparable part of the purchase agreement between ADD-ON Buildings Ltd. or any of its authorized franchisers, and the potential CMHC homeowner. The above documentation defines the legal limit of responsibilities of one party to the other in terms of the ADD-ON Buildings Ltd.'s product specifications and the total price.



3. Do-It-Yourself House Manual is a guide describing a certain step-by-step process which will enable the CMHC homeowner to erect and entirely complete his house by himself.

The Do-It-Yourself House Manual explains to the potential CMHC homeowner:

- what is to be found in the self-containing house packages;
- how to dismantle the house packages;
- how to easily, quickly and safely assemble the preserved wood foundations and the house from the packages containing not only all the prefabricated floor/ceiling components, roof panels and walls with prehung windows and exterior and interior doors, but also the balance of the supply for the entire house; and
- what has to be done to ensure the highest possible quality and long lasting value of the Do-It-Yourself built house.

The manual is designed for those who are not professionals, but who are willing to learn. It is easy to understand even at its initial reading, but is even more comprehensible once related to the physical appearance of the house components during the disassembly of the packages and during the assembly of the house.

II. COST BREAKDOWN FOR THE SELF-CONTAINING PACKAGES FOR THE DO-IT-YOURSELF DEVELOPMENT OF THE 82.0 SQ.M. (883 SQ.FT.) 3-BEDROOM HOUSE.

The following is a reasonably accurate estimate of costs for the supply of a Do-It-Yourself house package(s) including all prefabricated floor and wall components with the prehung double glazed windows and exterior and interior doors, electrical wiring and outlets installed in the walls whenever practical, and also for the supply of the balance material needed for the completion of the entire house.

The cost estimates are F.O.B. Edmonton manufacturing plant, and are



based on a minimum 5-house volume order at once.

The background for this cost estimate is the Supply List.

The cost breakdown is as follows:

1. Preserved wood foundations (EXTRA) including 15% margin	\$ 4,900.00
2. Rough structure components as per shop drawings	\$ 8,600.00
3. Rough exterior finish	\$ 800.00
4. Balance supply for the completion of the entire house finishes	\$ 4,595.00
5. Kitchen cabinets and bathroom vanities, hood	\$ 1,600.00
6. Complete electrical supply including all light fixtures	\$ 700.00
7. Complete mechanical supply including all fixtures, furnace, water heater and special tools for work with plastic pipes	\$ 3,200.00
8. Material and labour for packaging	\$ 500.00

Cost Summary:

Item 1 : Foundations (extra) including 15% margin	
Total for foundations (Extra):	<u>\$4,900.00 (\$ 5.54 per sq.ft.)</u>
Items 2-8: House	\$19,995.00
Overhead + profit (15%)	\$ 2,999.25
	<u>\$22,994.25</u>
Total for house:	<u>\$22,994.25 (\$26.04 per sq.ft.)</u>

The above quotations are valid until June 30, 1987.

Note: As requested, stove (\$600) was excluded from the house supply and attic insulation (\$638), which was not previously included, was added. There is a difference of \$38, but our original price remains. The attic insulation is in 30 additional bags.

Included in the price are the following spare materials:

- 20 - 9.5mm plywood boards (size 1200mm x 2400mm) from disassembling the packages



- 8 m² - 210 asphalt shingle finish
- 50 - economy studs
- 15 L - akrilon paint
- 400 - extra screws and nails (from the package disassembly)

The above materials may be used by the CMHC homeowner for the development of a separate cold storage shed in the yard of the house.

Not included in the price are the following items:

- Shipment of the packages from Edmonton to some remote location. However, shipment of the house components and supply in our patented self-containing packages is the most cost competitive and flexible method of the ground, air and trans-ocean shipment of premanufactured structures in the world.
- Gravel or crush stone for the support of PWF and backfill of excavated space along the perimeter of the foundation walls.

III. THE MERIT OF THE ADAPTATION OF THE ADD-ON BUILDINGS LTD. PATENTED SYSTEM TO THE RURAL AND NATIVE DEMONSTRATION PROGRAM.

We would like to make it clear that the only objective ADD-ON Buildings Ltd. wishes to achieve in this portion of the Report is to objectively evaluate the feasibility of its patented housing structure/packaging system as regards its application to rural and native housing. This will be done through an exact definition of the merits and practicability of the product features which are new and distinctive.

Some of the features are:

1. Cost competitiveness of the house built from the ADD-ON Buildings Ltd. self-containing packages, which include prefabricated components and the balance of house supply,



is obvious from the overall cost breakdown.

The high cost competitiveness of the ADD-ON Buildings Ltd.'s product can be accredited to low overhead cost in the manufacturing of the product and to the system of packaging. The house packages are in fact composed only of the house components and of the plywood covering the outside of the package. The only function of the extra plywood sheets (which may be utilized by the CMHC homeowner for the construction of a cold storage shed) is to help preserve the polyethelene plastic which covers each package and protects it against damages which may be caused by adverse weather conditions.

2. Effectiveness and flexibility of the ADD-ON Buildings Ltd. premanufacturing method in which up to 90% of all potential problems which are often found in homes built by traditional methods are preventively eliminated through the factory controlled precut, squareness of sheathing boards, application of continuous vapor barrier, installation of electrical wires and outlets in some of the panels, etc., while the price of the house packages is very reasonable and the major portion of the finish work can still be delivered by the rural and native people.
3. Our method of house/structure assembly seems to be the best way to bring to the rural and native demonstration program areas more efficient technology and a method of building houses with a certain speed to prevent flooding of excavations or foundations, or of the structure itself such as often occurs during the traditional house building.
4. Finally, the above learning process also shows a new approach to the development of higher quality structures because sooner or later the native and rural people will have to build by themselves not only a more complex infrastructure such as schools and other institutional buildings, but also commercial and industrial facilities.



IV. CONCLUSIONS AND RECOMMENDATIONS.

The terms of reference of the Agreement between ADD-ON Buildings Ltd. and Canada Mortgage and Housing Corporation executed on February 9, 1987 clearly defines the scope of the work.

Frequent discussions between the CMHC Managers in charge of this demonstration project and the writer of the Report on variety of specific design and technical aspects of housing for the rural and native people of the northern regions of Canada were easily converted into an excellent brainstorming which produced new ideas as a result of this effective co-operation.

Furthermore, as a result of all of the above we are absolutely convinced that this innovative method of providing housing to the rural and native people through the supply of complete and self-containing ADD-ON Buildings Ltd. packages will work effectively and, considering our experiences in dealing with housing matters in many countries around the world, we sincerely believe that CMHC is, as regards innovative concepts, ahead of all of their equivalents in other industrialized countries.

There are however some areas of this innovative approach to the supply of low cost houses which can only be proven through a specific housing project (ideally 5 housing units to be built in the same area at the same time). Incorporation of at least some photos of a real package and the entire house assembly would save hundreds of explanatory words.

Furthermore, the CMHC supervisor inspector may find it useful to have a video tape of a pilot project development. This would also be of great service to the regional authorities in their solving problems of social housing for groups other than rural and native people.

After all, had we had more time and a somewhat larger budget, we

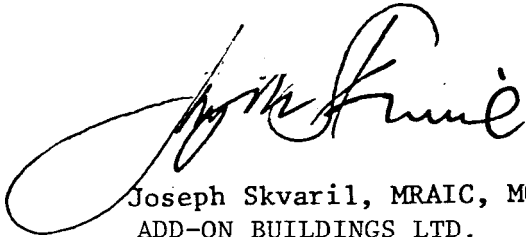


would have been able to reduce the text in the manual to a very limited number of words, and express ideas or technical details mainly through three-dimensional pictures.

At this time, however, we wish to recommend that the CMHC first makes the idea work, in the most economical manner, through a good pilot project, and then considers all other aspects on the basis of the practical results which in our view are very promising.

We wish to thank Mr. Terry Robinson, Project Manager, and Mr. Norbert Koeck, Project Manager, for an excellent co-operation.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Joseph Skvaril". The signature is fluid and cursive, with a large loop at the end.


Joseph Skvaril, MRAIC, MCIP, AICP, SAR, President
ADD-ON BUILDINGS LTD.



MANUAL

FOR THE BUILDING OF

82.0 SQ.M. (883 SQ.FT.) 3-BEDROOM HOUSE

 PATENTED PRODUCTS BY:
ADD-ON BUILDINGS LTD.

Preparation of this manual was sponsored by CMHC

I.

INTRODUCTION.

This is a simple DO-IT-YOURSELF HOUSE MANUAL which will guide the CMHC homeowner in building his three-bedroom home from the ADD-ON Buildings Ltd.'s self-containing packages. The packages contain not only all prefabricated floor/ceiling components and roof panels, walls with prehung windows and exterior and interior doors, but also the balance of the supply for the entire house. The quality of the prefabricated components shall meet the specifications and standards shown on the shop drawings and the quantities are shown on the List of the Supply for this house. Both of the above are inseparable parts of the Purchase Agreement between CMHC and ADD-ON Buildings Ltd.

The quality of the ADD-ON Buildings Ltd.'s product and its fine and unique features are protected by the ADD-ON Buildings Ltd. trademark, and the markets for the structures/self-containing packages are protected by Joseph Skvaril's Canadian, U.S., Australian and other countries' patents. These patents are the sole property of the Inventor, and are exclusively licensed to ADD-ON Buildings Ltd., Edmonton, Canada.

In the amount paid for the ADD-ON Buildings Ltd. house packages are also included fees for a permit issued by ADD-ON Buildings Ltd. or its authorized distributor to the homeowner for the use of ADD-ON Buildings Ltd.'s structure/package system to erect one house in an identified site. The permit shall not, in any manner, be interpreted by the house purchaser or a third party as a permit for any kind of unauthorized manufacturing, marketing and distribution of the product, or any part thereof. The permit is an inseparable part of the purchase contract, and must be presented to the distributor of the product should any claims arise.

Warranties for the quality of the prefabricated components and materials are as specified on the warranty list.

The DO-IT-YOURSELF HOUSE MANUAL is designed to be used by a non-professional homeowner/builder's four-member crew. However, it is expected that at least



one of the crew members will have some basic knowledge of carpentry such as how to do nailing and screwing, and how to cut softwood and plywood. Two other crew members are not required to know anything about carpentry work, but must be willing to learn if they are to be involved in the nailing of the components, since the nailing must be done properly. The fourth crewman is needed only occasionally to help with the pick-up of heavier components. The weight of the heaviest component (large floor panels) does not exceed 195 kg (430 lbs), and the maximum load per person for any pick-up is therefore below 50 kg (110 lbs).

It may be practical for the potential homeowner to read this DO-IT-YOURSELF HOUSE MANUAL first to make sure that he understands the method of assembly of the house prior to his beginning of the erection work. Furthermore, the homeowner should develop a full understanding of the house erection through the identification of the components during the disassembly of the package. Nevertheless, should he have any questions regarding any of the connecting or other details, he is free to contact the distributor.

As the house erection is a self-controlling process, the only thing needed for quick and safe building of a house is that the homeowner and his crew take care of themselves. The owner of the house package shall, therefore, keep ADD-ON Buildings Ltd. free of any liability or responsibility for any injury to the Owner(s) of the house package or to any member of his crew.

This DO-IT-YOURSELF HOUSE MANUAL was sponsored by the Canada Mortgage and Housing Corporation (CMHC).

II.

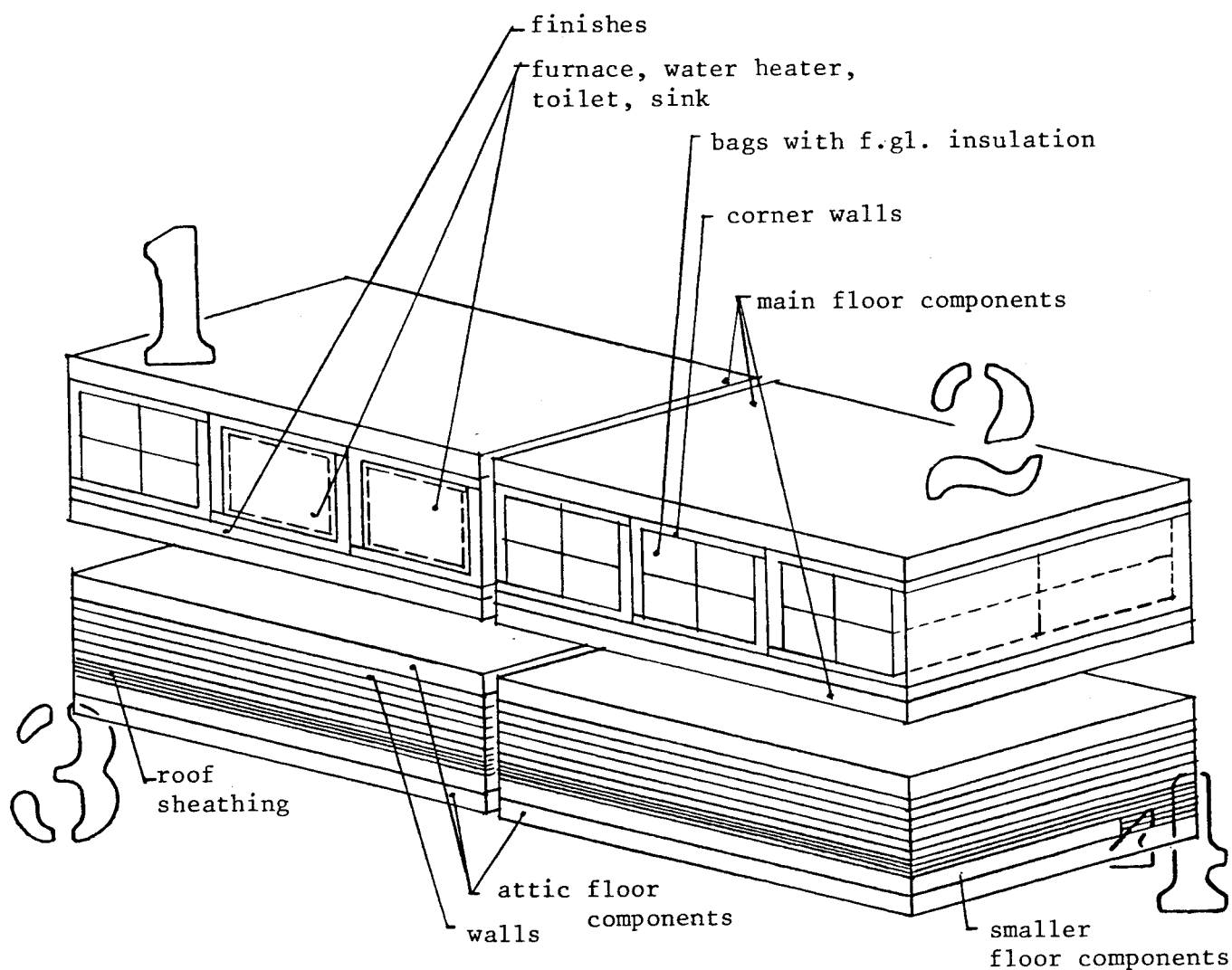
PREFABRICATED COMPONENTS AND THE BALANCE SUPPLY FOR THE 82.0 SQ.M. (883 sq.ft.) HOUSE DEVELOPMENT FROM SELF-CONTAINING PACKAGES - ADD-ON BUILDINGS LTD. SYSTEM.

Once the Purchase Agreement between Canada Mortgage and Housing Corporation and ADD-ON Buildings Ltd. is executed, the prefabricated floor, wall and roof components and the balance of the supply for the entire house are shipped to the site in four small self-containing packages which can be unloaded from the truck manually (no crane).



In disassembling the packages, the first and very easy step is to remove and protect the cover plywood boards. The boards are screwed to the package and the location of the screws is marked in yellow. The next step is to remove the protective polyethelene cover which is stapled to the package. Should the packages be manually dismantled part by part, it is necessary only to remove 2-3 connecting screws from each part.

The sketch below shows the package layout.



Size of packages 1 & 2 : 12'x 8'x 2'-8" (3.6m x 2.4m x 0.8m)

Size of packages 3 & 4 : 12'x 8'x 2'-0" (3.6m x 2.4m x 0.6m)

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III.

THE HOUSE MODEL AND THE SITE.

The one-storey, three-bedroom house of the selected size, shape, and standards has been developed for the Canada Mortgage and Housing Corporation sponsored program for Rural and Native Housing Development in the northern regions of the Provinces across Canada. Drawing #1 shows the selected house model. The basic size of the house is 82 sq.m. (883 sq.ft.). However, with the addition of the extra wall insulation along the house perimeter, the actual dimensions of the main floor plan are approximately 11.5 m x 7.3 m (38 ft. x 24 ft.) which equals 84.7 sq.m. or 912 sq.ft.

Even though the above house structure may be supported by grade beams on piles, or by traditional reinforced concrete foundation walls, or any other technically feasible structure support, the system preserved wood foundations (PWF) has been chosen by ADD-ON Buildings Ltd. in order to demonstrate that company's innovative and cost effective method of supplying housing to the Canadian native and rural people. PWF walls are a part of the ordinary premanufacturing of the entire wood frame structure and can easily be built by the people themselves. This minimizes both the manufacturing and transportation costs.

- The house has two solid core wood doors and all windows are double glazed.
- The insulation values are R.S.I. 3.5 in walls, R.S.I. 7.0 in ceilings and approximately R.S.I. 2.6 in basement walls.
- The depth of the footing plate line depends on site conditions.
- The maximum underground water level must be at least 0.3 m below the footing plate line, or approximately 2.4 m below the grade level.
- The minimum slope of the site should be at least 2 per cent from the



house. However, 3-4 per cent slope from the house is desirable because there will be no storm water discharge service for the site.

- Septic tank will be the most likely means of discharge of sewer.
- It is the assumption that the source of water will be a well.
- Even though the entire house supply is included in the self-containing packages, the potential do-it-yourself CMHC homeowner of this model must have approximately 7.5 cu.m. (260 cu.ft.) of rough gravel or crush stone max. diam. 50 mm (2 inch.) available for the footing plate support and backfilling, and this material has to be available on the site prior to the excavation for foundations.

The following parts of this manual deal with the very easy and creative step-by-step process of building the house. As long as the steps outlined in the DO-IT-YOURSELF HOUSE MANUAL are followed, finished house will be of high quality and will have a very long life span.

IV.

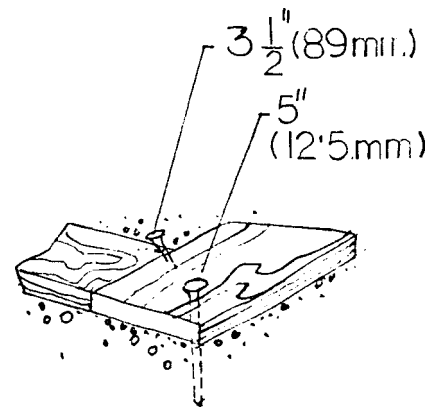
PRESERVED WOOD FOUNDATIONS (PWF).

The excavation work for PWF must be done only after the self-containing packages with the entire house supply, as well as, the rough and fine gravel or crush stone have been delivered to the site because the bottom excavation must be protected against bad weather. The building of the PWF must, therefore, start immediately upon the completion of the excavation.

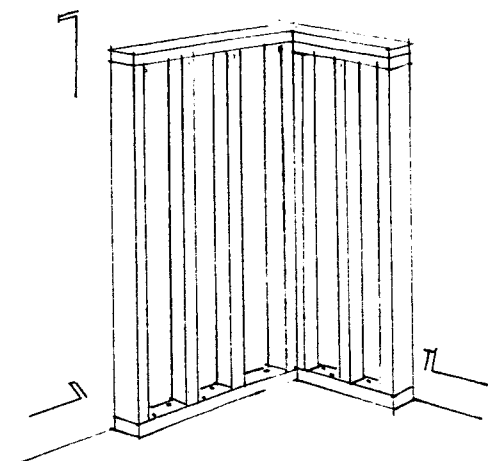
- The initial step is to prepare the footing plate support from rough and fine gravel or crush stone as shown on Dwg. #2 and cross-section detail on Dwg. #5.



- Once the footing plate support is properly levelled, the footing plates (1), (2) are laid as shown on Dwg.#2.
- In order to prevent the footing plates from moving during the erection of the foundation wall, each plate shall be anchored at each end by a long nail into the gravel.
- Where the crawl space is sufficiently deep, it may be practical to place main floor panels on the crawl space ground as shown in (a) provided that this does not obstruct the backfilling work. Alternatively, main floor components could be moved across the PWF walls at lines A and B as explained in (b) on Dwg.#2, or in (c) and (d) on Dwg.#3.
- Prior to the erection of the foundation wall, the outer dimensions of the footing plate perimeter and also of the foundation wall perimeter shall be re-checked, and the corner points shall be clearly marked. Check by measuring the rectangular diagonals shall also be made.
- All nails used for the PWF shall be 82 mm long galvanized nails.
- The corner walls (3) shall be erected first. The corner position of each of them shall be secured by a nail at the bottom plate, as close to the corner as possible, and by two other nails at the bottom plate, each being close as possible to the end stud and to the sheathing.
- Erection of PWF walls (4) and (5) follows.



typical corner of footing plate

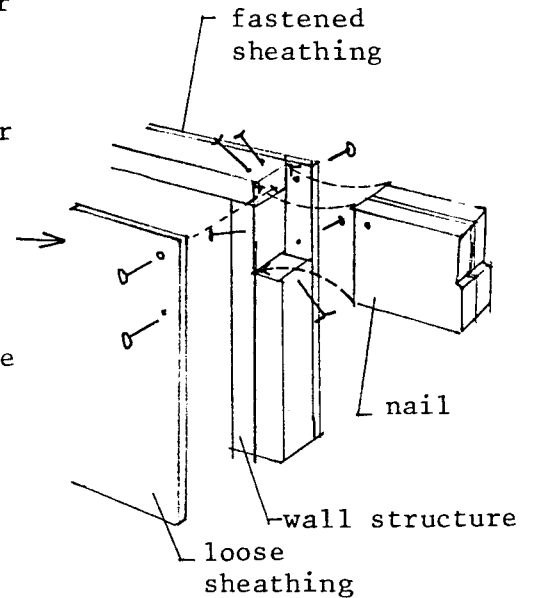


erection of corner wall does not require bracing



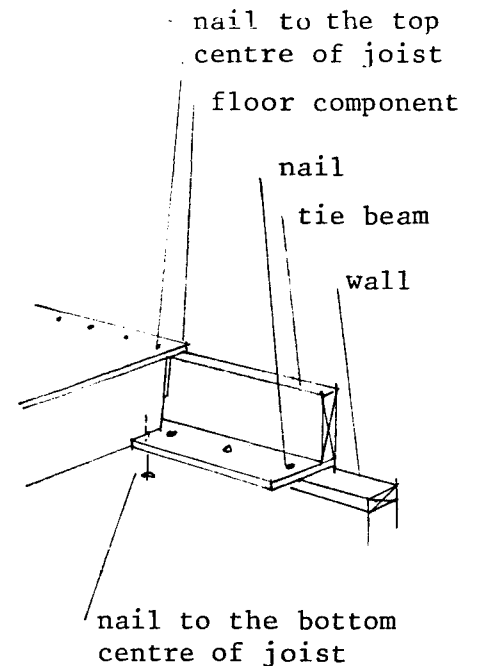
- Each PWF wall shall be secured to the corner wall (3) by a nail at the top of the end stud and two nails at the bottom plate, each being as close as possible to the end stud.
- All other exterior PWF walls (6) and (7) and interior PWF walls (8) and (9) shall be erected in similar manner.
- The lintels (10) shall be secured to the interior PWF walls (8) and (9) by 57 mm nails to the wall sheathing and by 82 mm nails to the end studs.
- Because of the length of the PWF walls at lines A, B, C, temporary bracing is needed prior to the completion of further erection work.
- Rather than bracing, it may be more practical to erect one end of the crawl space entirely. This would include PWF corner wall (3) and PWF walls (4), (5) and (6) as shown on Dwg.#2, one exterior tie beam (12a) at line A and another interior tie beam (13a) as shown on Dwg.#3, as well as, two main floor components (14) as shown on Dwg.#3. This approach does not necessitate any temporary bracing of the PWF walls.
- Once all PWF walls have been erected as per Dwg.#2, the remaining nails shall be applied. Spacing of nails at plates between the end studs is 400 mm (16 inches).
- Three continuous top plates as shown on Dwg.#3 shall be applied above the double top plates of walls (8) and (9) as shown on Dwg.#2. Spacing of top plate nails is 200 mm (8 inches); however, one nail shall be applied on each side of the

typical wall-lintel
nailing scheme



joint between the two different walls underneath the continuous plates.

- Visual re-check of the level of the top plates of the PWF walls is recommended.
- Backfilling in the inside and also along the perimeter of the exterior PWF walls shall only be done after the main floor components are fully and securely fastened to the wall floor tie beams which in turn must be fastened to both the PWF walls and to the bottom floor joists.
- Prior to backfilling, the CMHC homeowner shall ensure that 150u (6 Mil.) vapor barrier along the perimeter of the house foundations is not punctured.
- Backfilling material in contact with the foundation walls shall be very soft fine gravel within the first 0.3 m (1 ft.) from the foundation plate line, and the balance of the material shall be natural backfill material.
- Any backfill work above the foundation plate line must be done simultaneously from the inside and outside of the house perimeter. The maximum distance between the layers of the backfill material shall not exceed 300 mm (1 ft.).



The above precaution must be taken because in this case the PWF walls are designed for taking the structure load rather than to resist the natural earth pressure.



V.

ASSEMBLY OF THE HOUSE STRUCTURE.

The erection of the house above the top plates of the PWF walls is self-controlled.

- Prior to the erection of the main floor, the end beam ties (12a) and (12b) at lines A and C, and interior beam ties (13a) and (13b) at line B as shown on Dwg.#3 and Dwg.#5 must be secured to the foundation walls by 76 mm nails (a) on Dwg.#5, spaced at 300 mm and with additional nails on each side of the joint between the two different wall plates.
- The correct positioning of the floor components (14), (15a) and (15b) as shown on Dwg.#4 is also self-controlled as shown on Dwg.#5 which explains how the components are to be erected and how the structure is to be assembled.
- It is important to ensure that, after its correct positioning, each panel is secured to the tie beam by one 65 mm nail (b) on Dwg.#5 at each end of the panel. Once all the panels are positioned, the balance of the nailing work shall be completed. Spacing of the nails is 200 mm with additional nails applied at each side of the joint between any two components, and also at each side of the joint between two tie beams underneath the subfloor of the component.
- Prior to any further erection work, one 65 mm long nail (c) as shown on Dwg.#5 shall be used to secure the bottom plate of the beam ties (group 12) and (group 13) to the joist of the floor components (14)



and (group 15) as shown on Dwg.#4 and Dwg. #5.

- The next practical step is to put attic floor components (51) and (group 52) as shown on Dwg.#7 and Dwg.#9 on the main floor as shown on Dwg.#4 (use two 2x4 (38mm x 89mm) studs underneath the first floor components).
- The erection of the walls on the main floor is similar to the erection of the PWF; corner walls (16) are to be erected first, filler walls (18) and (19), interior wall (20), exterior window walls (21) and (22) as shown on Dwg.#6 should be erected next.
- At this level of the house erection, first two attic floor components (51) as shown on Dwg.#7 should be secured to the above walls so that the bracing of the main floor structure is ensured. Nails to be used as shown on Dwg.#9 are 65 mm long and spacing is 200 mm (8 inches). Additional nails shall be applied on each side of the joint between two walls underneath the ceiling sheathing of the panel.
- Filler wall (26), entrance door wall (28), bathroom window wall (29) and partition (47) as shown on Dwg.#6 shall be erected next (no temporary bracing is needed).
- Interior partitions (32) and (34) and lintel (33) should be secured to partitions (41) and (42), then partition (43) should be erected and plumbing wall (44) and partitions (45) and (46) should follow.



- Erection of attic components (51) and (52a) should follow immediately.
- Other partitions (34), (35), (36), (37), (38), (39) and (40) should be erected prior to erection of the space closing attic floor components (51) and (52b).
- The erection of the balance of the attic floor is obvious.
- All tie beams (group 12) as shown on Dwg.#9 are easy to secure to the joists of the attic floor panels (51) and (52).
- Small roof support wall (53) shown on Dwg.#9 is in the package premanufactured and the roof top support wall (60) as shown on Dwg.#8 is easy to assemble and easy to brace by one 1x4 (19mm x 89mm) board.
- For the convenience of the ground transportation over long distances, and also for the economy of packaging, the roof panels have, in this particular case, been split as shown on Dwg.#9. Furthermore, for the purpose of a possible demonstration project, these components for the house will be shipped in a disassembled form. The assembly of the roof components may easily be done on any of the house floor components conveniently placed on the site because the plywood headers (61) and (62) and fascia (12) as shown on Dwg.#9 have marks indicating the spacing of the rafters. On any flat surface such as on one of the floor components, it is easy to nail the plywood headers and the fascia to the rafters of the roof panels, and then to apply sheathing as shown on Dwg.#9.



- The assembled roof is shown on Dwg. #10.

- With regards to the the exterior finish work, in this house concept, the 2x2 straps are nailed to the studs (spacing of 82N is 150 mm). The space between the straps is filled with extra insulation and the exterior sturdi-wood panels are precut and repainted for the final exterior akrilon application as shown on Dwg.#5.

Since the scope of this work is to explain the method of assembly of the house from the premanufactured components and from the balance material supplies which are included in the self-containing packages, this DO-IT-YOURSELF HOUSE MANUAL does not deal with technical details of finishes, nor with specific details of mechanical and electrical installation. These items are best described in the CMHC book on CANADIAN WOOD-FRAME HOUSE CONSTRUCTION (NHA 5031 M 08/84) which is available throughout Canada, and which will be included in the package.



VI.

CONTENT OF THE HOUSE COMPONENT PACKAGES FOR THE 82.0 SQ.M. (883.0 SQ.FT.) HOUSE MODEL FOR THE CMHC SPONSORED RURAL AND NATIVE HOUSING DEMONSTRATION PROGRAM AS SHOWN IN THE ADD-ON BUILDINGS LTD. DO-IT-YOURSELF MANUAL DRAWINGS.

The prefabricated floor and wall components with prehung doors and windows, precut members, the balance of this house building supply, including complete plumbing, heating and electrical supply and preserved wood foundations are folded into four ADD-ON Buildings Ltd. self-containing packages for shipment. The dimensions of the four packages combined are 2.45 m x 7.22 m x 2.75 m (8' x 12' x 9').

List of items in the packages:

PART 1 - PRESERVED WOOD FOUNDATIONS

Note: Refer to Drawing #2.

<u>Code</u>	<u>Description</u>	<u>Quantity</u>	<u>Dimensions</u>
1	2"x 10"(38 x 234) footing plates	15	2306 mm long
2	2"x 10"(38 x 234) footing plates	4	3365 mm long
3	prefabricated corner walls	6	800mm x 1200mm
4	prefabricated walls	2	2755 mm long
5	prefabricated walls	2	2045 mm long
6	prefabricated walls	4	2743 mm long
7	prefabricated walls	2	3600 mm long
8	prefabricated walls	4	815 mm long
9	prefabricated walls	2	1560 mm long
10	2 - 2"x 8" lintels	2	1310 mm long
11	top plates	3	3000 mm long
-	150 u (6 mil.) poly	9 rolls	
-	2"x 4" (38 x 89) trims	50	2400 mm long
-	2"x 2" (38 x 38) straps	50	2400 mm long
-	nails for footing plates	60	140 mm long



<u>Code</u>	<u>Description</u>	<u>Quantity</u>	<u>Dimensions</u>
-	nails for PWF framing	2800	82 mm long
-	15 kg of R-12 f.gl. insulation	12	
-	15 kg of R-40 f.gl. insulation	22	

Note: Prefabricated PWF walls also include loose exterior sheathing.

PART 2 - ROUGH HOUSE STRUCTURE WITH PRE-HUNG DOORS AND WINDOWS

Note: Refer to Drawing #3 and Drawing #5.

<u>Code</u>	<u>Description</u>	<u>Quantity</u>	<u>Dimensions</u>
12a	tie beams for exterior walls	6	2800 mm long
12b	tie beams for exterior walls	2	3000 mm long
13a	tie beams for interior walls	3	2800 mm long
13b	tie beams for interior walls	1	3000 mm long

Note: Refer to Drawing #4.

14	floor components	8	2400mm x 3600mm
15a	floor component	1	1800mm x 3600mm
15b	floor component with 2 double straps for crawl space hatch	1	1800mm x 3600mm
-	1" x 4" braces	10	2400 mm long

Note: Refer to Drawing #6

16	corner walls	6	800mm x 1200 mm
17	kitchen window wall (el. wiring & outlet(s) instl.; window size 900x900)	1	2400 mm
18	filler walls (el. wiring and outlet(s) installed)	2	1645 mm
19	filler wall (el. wiring and outlet(s) installed)	1	2755 mm
20	interior wall (el. wiring and outlet(s) installed)	1	1690 mm



<u>Code</u>	<u>Description</u>	<u>Quantity</u>	<u>Dimensions</u>
21	exterior window wall (el.wiring instl.; window size 1350x1200)	1	1600 mm
22	exterior window wall (el.wiring instl.; window size 900x1200)	1	1200 mm
23	filler wall	1	800 mm
24	living room window wall (window size 2000 x 1200)	1	2000 mm
25	filler wall (el. wiring and outlet(s)installed)	1	945 mm
26	filler wall (el. wiring and outlet(s)installed)	1	3600 mm
27	filler wall (el. wiring and outlet(s)installed)	1	1800 mm
28	entrance door wall (2'-8"x 6'-8" solid core wood)	2	1003 mm (rear door wall with 200 filler)
29	bathroom window wall (window size 400 x 900)	1	3000 mm
30	interior partition wall assembly (el. wiring and outlet(s)installed)	1	3200 mm
31	2 - 2" x 6" lintel	2	952 mm
32	2" x 6" interior partition with ladder	1	700 mm
33	2-2"x 8" + ½" continuous plywood lintel	1	2439 mm
34	interior partition with pre-hung 2'-6"x 6'-8" (750 x 2032) door	3	966 mm
35	partition (el. wiring and outlet(s)installed)	1	600 mm
36	partitions	2	590 mm
37	partition	1	1599 mm
38	partition	1	1005 mm



<u>Code</u>	<u>Description</u>	<u>Quantity</u>	<u>Dimensions</u>
39	partition (el. wiring and outlet(s) installed)	1	1977 mm
40	partition (el. wiring and outlet(s) installed)	1	2545 mm
41	partition	1	1107 mm
42	partition	1	874 mm
43	partition	1	2225 mm
44	plumbing wall (el. wiring & outlet, pipes installed)	1	2357 mm
45	partition (el. wiring and outlet(s) installed)	1	1000 mm
46	bathroom door partition (prehung bathroom doors 710 x 2302)	1	862 mm
47	partition with electrical control panel (el. wiring and outlet instl.)	1	796 mm
48	partition	1	900 mm
49	partition (el. wiring and outlet(s) installed)	1	820 mm
50	partition	1	1005 mm

Note: 150u (6 Mil) poly vapor barrier in exterior walls shall be built into the components. Factory controlled pre-wiring whenever indicated above. Top plates and sturdi-wood sheathing on one side of the walls (except corner walls) are loose, but easy to identify (marked).

For attic floor components refer to Drawing #7 and Drawing #9.

51	attic floor component	8	2400 x 3600
52a	attic floor component	1	1800 x 3600
52b	attic floor component with hatch 2"x 8" strap for attic-hatch incl.2	1	1800 x 3600
53a	roof support wall	2	2800 mm



<u>Code</u>	<u>Description</u>	<u>Quantity</u>	<u>Dimensions</u>
53b	roof support wall	2	3000 mm
53c	roof support wall incl. 300 overhang	4	3100 mm
Note: Refer to Drawing #8			
54	pre-cut sturdi-wood sheathing		
55a	pre-cut sturdi-wood sheathing		
55b	pre-cut sturdi-wood sheathing		
56	2"x 8" (38 x 184) fascia boards	10	2400 mm
57	3" (9.5 mm) sturdi-wood fascia 8 boards	4	4430 x 200
58a	attic arrow wall right	2	
58b	attic arrow wall left	2	
59a	9.5mm sturdi-wood fillers right	2	
59b	9.5mm sturdi-wood fillers left	2	
60a	roof top support wall	1	1800 mm
60b	roof top support wall	2	2400 mm
60c	roof top support wall incl. 300 overhang	2	2700 mm
61	plywood header (refer to Dwg. #9)		
62	plywood header (refer to Dwg. #9)		

For tie beams refer to Drawing #7 and Drawing #9.

Tie beams for attic floor:

12a	tie beams at exterior walls	2	2800 mm
12b	tie beams at exterior walls	2	3000 mm
12c	tie beams at exterior walls	4	3100 mm
13a	tie beams at the center	1	2800 mm
13b	tie beam at the center	1	3000 mm
13c	tie beam at the center	2	3100 mm



Part 3 - INSULATION AND ROUGH EXTERIOR FINISH STRUCTURE (Dwg.#11)

The exterior walls of the house are insulated by two layers of fibreglass; one is to be installed in the walls and the other in the 2" x 2" (38 x 38) furring.

The inside of the tie beam is also well insulated R.S.I. 3.5. There are twelve additional 15 kg bags with R.S.I. 2.4 batt insulation and eight additional bags with R.S.I. 1.4 which shall be applied within the 2" x 2" (38mm x 38mm) strapping during the construction.

In this system, the 2" x 2" (38 x 38) furring members are nailed to the studs, tie beams and end joists by 82mm long nails spaced at 300 mm. 9.5 mm sturdy-wood exterior finish sheathing shall be nailed to the 2" x 2" furring by 65 mm long nails spaced at 300 mm.

Part 4 - BALANCE SUPPLY FOR THE COMPLETION OF THE ENTIRE HOUSE STRUCTURE.

<u>Description</u>	<u>Quantity</u>
- 12' (3600 wide) rolls of vinyl (7 yards each)	4 rolls
- vinyl baseboards	80 m
- caulking	60 tubes
- water resistant 12.5 mm drywall boards size 1200 x 2400	4
- 15.9 fire-rated drywall boards, type "X" size 1200 x 2400 (extra f.r. if stove is used)	4
- 9.5 soffit boards (size 524 x 2400) 1/300 opening with screws	16
- 2" x 2" (38 x 38) straps	20
- 82 mm nails	2500
- 65 mm nails	3600
- interior tile panel boards 1200 x 2400	6
- Bapco interior wall paint (3 coats)	140 liters
- exterior akrilon paint (2 coats)	173 liters



<u>Description</u>	<u>Quantity</u>
- fine burlap 40 mm wide for joints between exterior plywood panels for akrilon application	60 m
- 1050 wide - 210 asphalt shingle rolls; 6.1 m each	40 rolls
- eavestroughs	22.8 m
- vinyl carpet for entrance landing and steps	8 sq.m.
- exterior preserved wood landing and steps	

Part 5 - KITCHEN.

- hood with light	300
- Britco Industries or Carousel standard kitchen cabinets	1080

Part 6 - ELECTRICAL SUPPLY (Dwg. #12)

- Balance of the electrical supply includes a complete package of rough-in wiring which interconnects the junction boxes located at the tie beams with the main breaker and switch panel; conduit, straps; meter socket; entrance; all in the order which will allow a licensed electrician to complete the balance electrical installation quickly and in accordance with the above Dwg. #12. Economy standards electrical fixtures are included in the package.

Part 7 - MECHANICAL SUPPLY; FORCED AIR HEATING SCHEME (Dwg. #13);
WATER AND SANITARY SERVICE SCHEME (Dwg. #14).

- Complete polybutylene piping package
- Min. BTU 75,000 furnace
- 40 gallon water heater
- 5 ft. (1520) standard bath tub



- shower fixture
- tub/shower valve
- toilet
- toilet paper and soap holder
- bathroom sink
- kitchen sink
- tools such as poly-lock ratchet wrench set, poly-lock pipe cutter, poly-lock depth gauge

Part 8 - PACKAGE MATERIAL.

- | | |
|------------------------------|----------|
| - 9.5 mm plywood 1200 x 2400 | 20 pcs. |
| - 6 mil. poly 3600 wide | 25 m |
| - 75 mm screws | 300 pcs. |



VII.

CONVERSION TABLE
(for dimensions used in this report).

1. Studs and Boards

$$2'' \times 2'' = 38 \text{ mm} \times 38 \text{ mm}$$

$$2'' \times 4'' = 38 \text{ mm} \times 89 \text{ mm}$$

$$2'' \times 6'' = 38 \text{ mm} \times 140 \text{ mm}$$

$$2'' \times 8'' = 38 \text{ mm} \times 184 \text{ mm}$$

$$1'' \times 4'' = 19 \text{ mm} \times 89 \text{ mm}$$

$$\frac{3''}{8} = 9.5 \text{ mm}$$

$$\frac{1''}{2} = 12.5 \text{ mm}$$

2. Nails

$$54 \text{ mm} = 2\frac{1}{4}''$$

$$65 \text{ mm} = 2\frac{1}{2}''$$

$$75 \text{ mm} = 3''$$

$$82 \text{ mm} = 3\frac{1}{4}''$$

3. General

$$0.3 \text{ m} = 1 \text{ ft.}$$

$$2.4 \text{ m} = 8 \text{ ft.}$$

$$200 \text{ mm} = 8 \text{ inch.}$$

$$300 \text{ mm} = 12 \text{ inch.}$$



Explanations:

mm = millimeter

m = meter

" = inch

ft. = linear foot

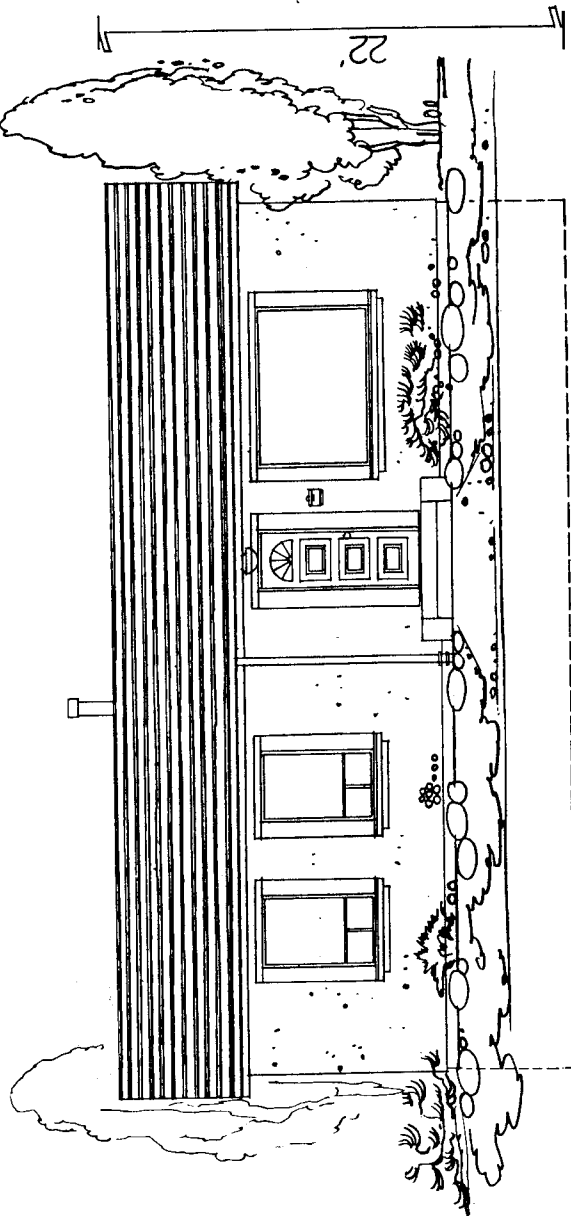
1 inch = 25.4 mm

1 foot = 305 mm

1 yard = 0.91 m (910 mm)



912 sq. ft. - 38' x 24' house plan
 or 883 $\frac{82m^2}{sq. ft.}$ - 11400 x 7200 house plan
SIZES



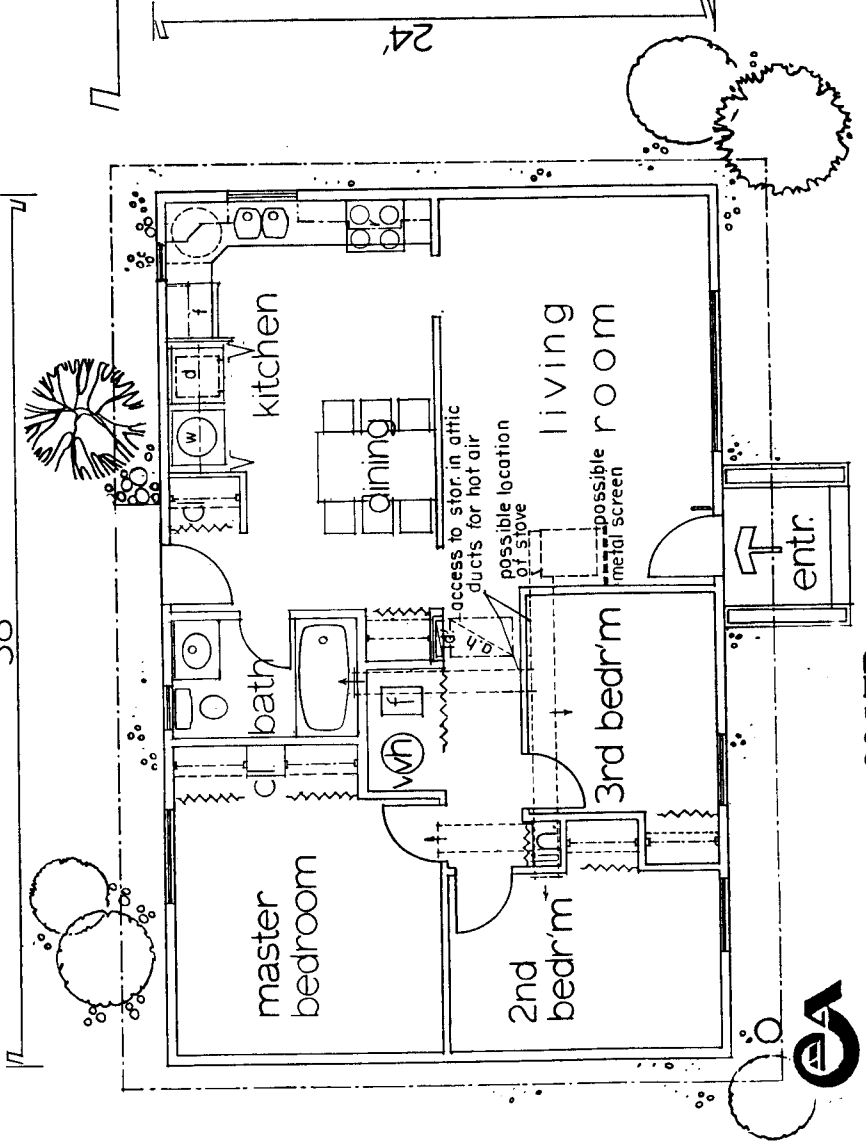
elevation

scale 1:50
 photo red. 1:100

house in small self-containing

PACKAGES

plan area



VOLUME

house 20976 cu. ft.
 package 1728 cu. ft.

CAMIC

sponsored project

"technical detail/construction system development"

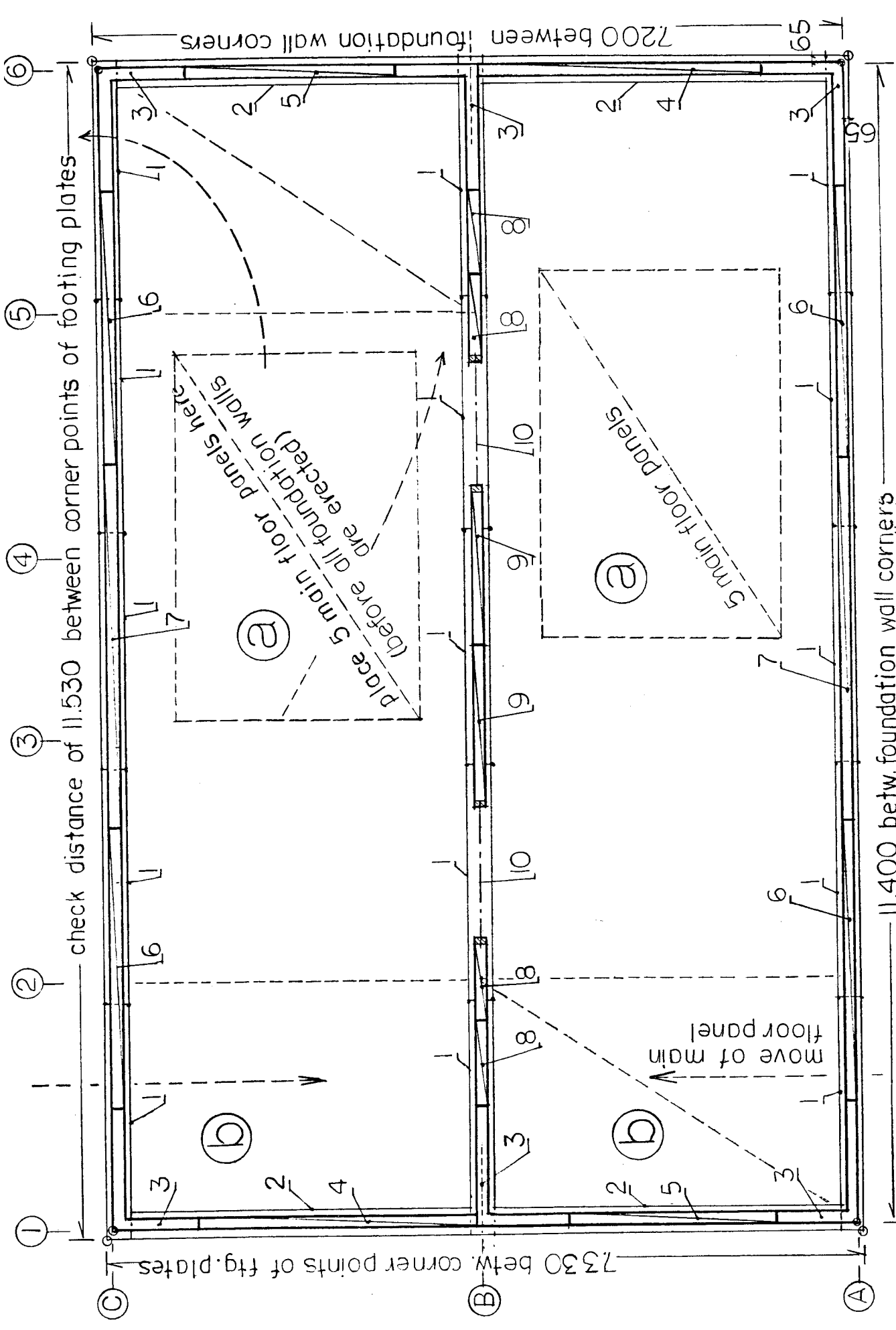
ADD-ON BUILDINGS LTD., dwg 8703062

Joseph Kane 6.3.87.

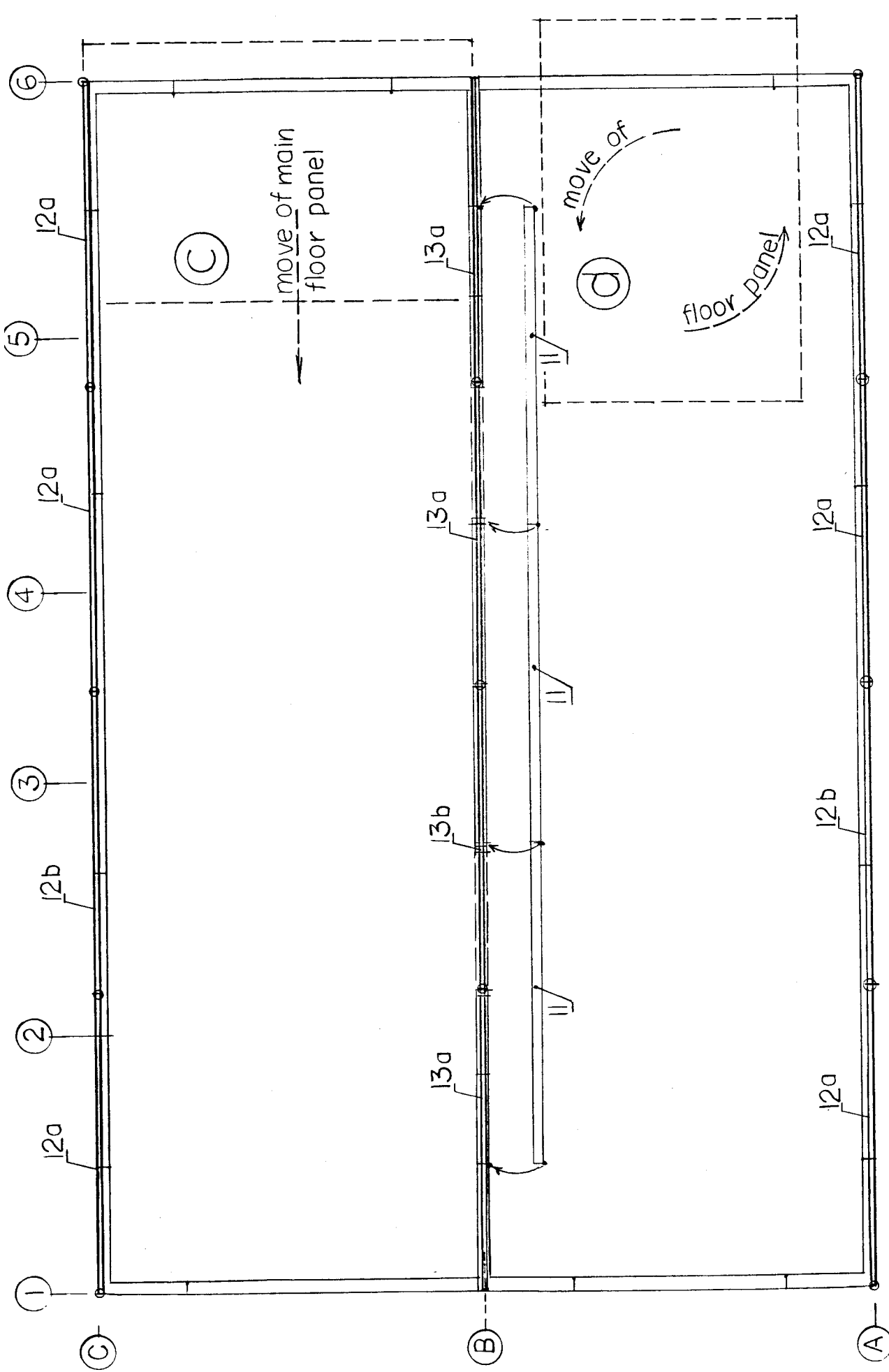
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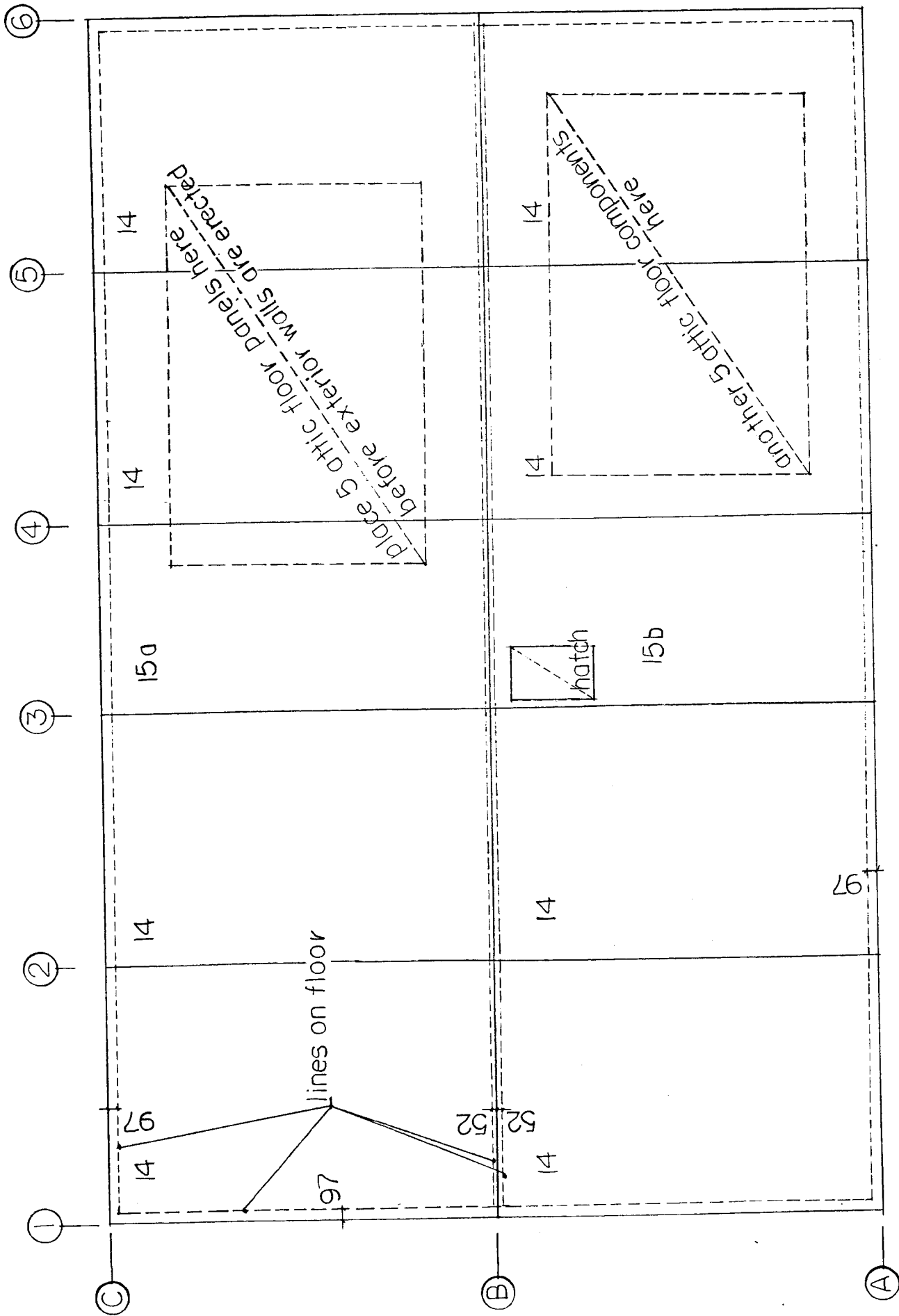


11400 betw. foundation wall corners
(outer surfaces of stud walls)



ADD-ON BUILDINGS LTD. Wall-floor tie beam layout. ©1987

Joseph Skemil/16.3.87, **3**
 dwg. no.



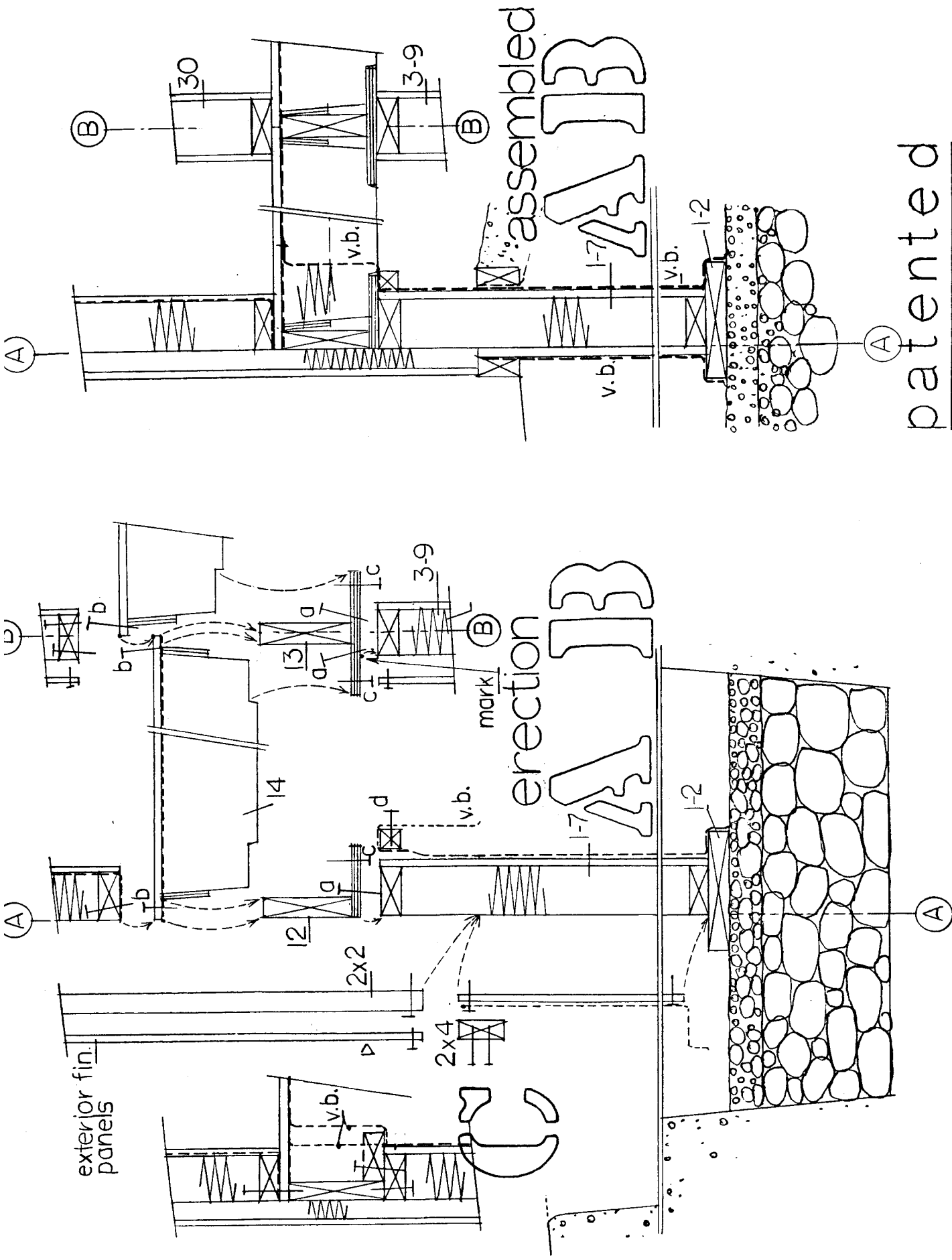
Joseph S. Stone / 16.3.87

dwg. no. 4

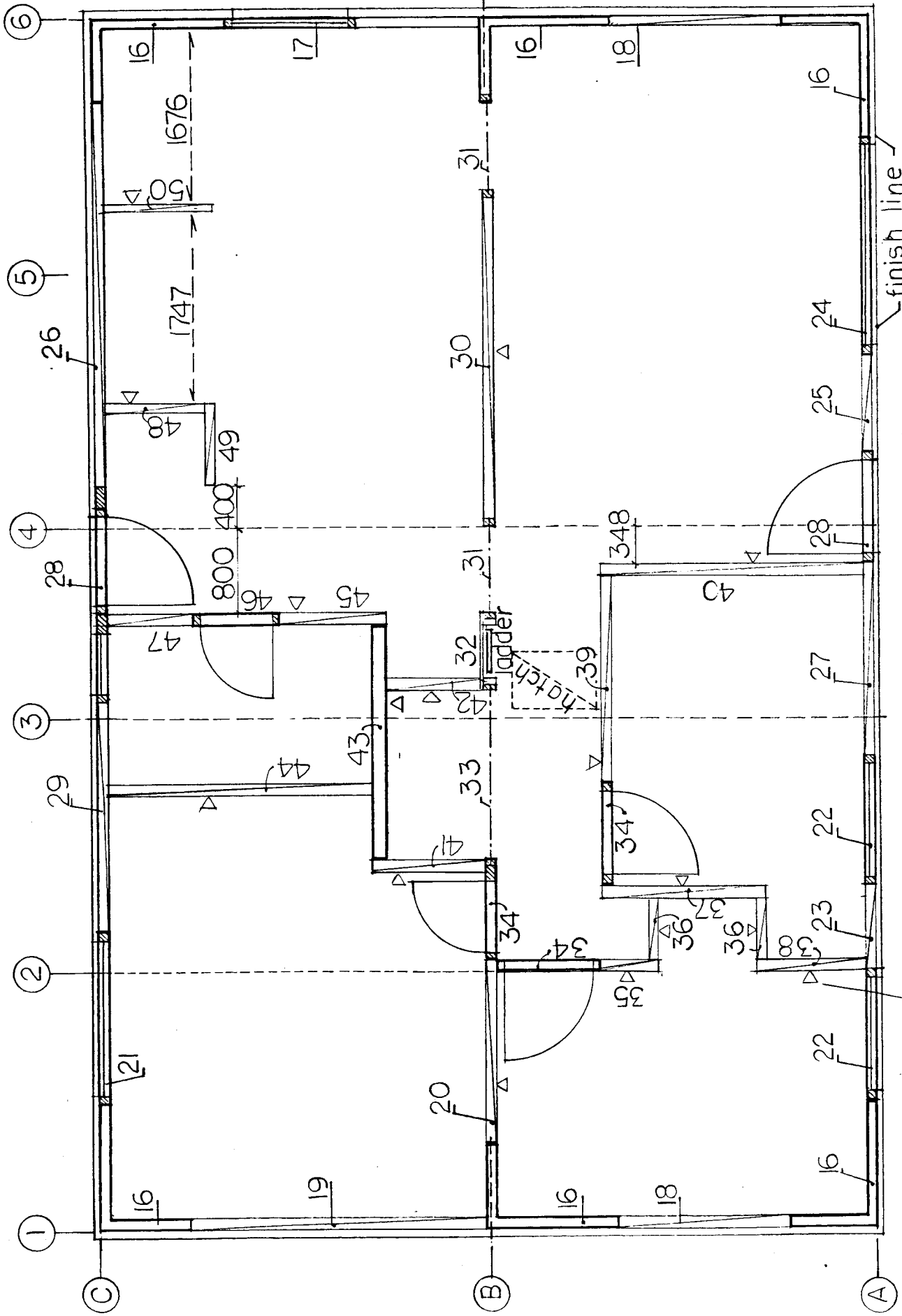
© 1987

EA
ADD-ON BUILDINGS LTD.

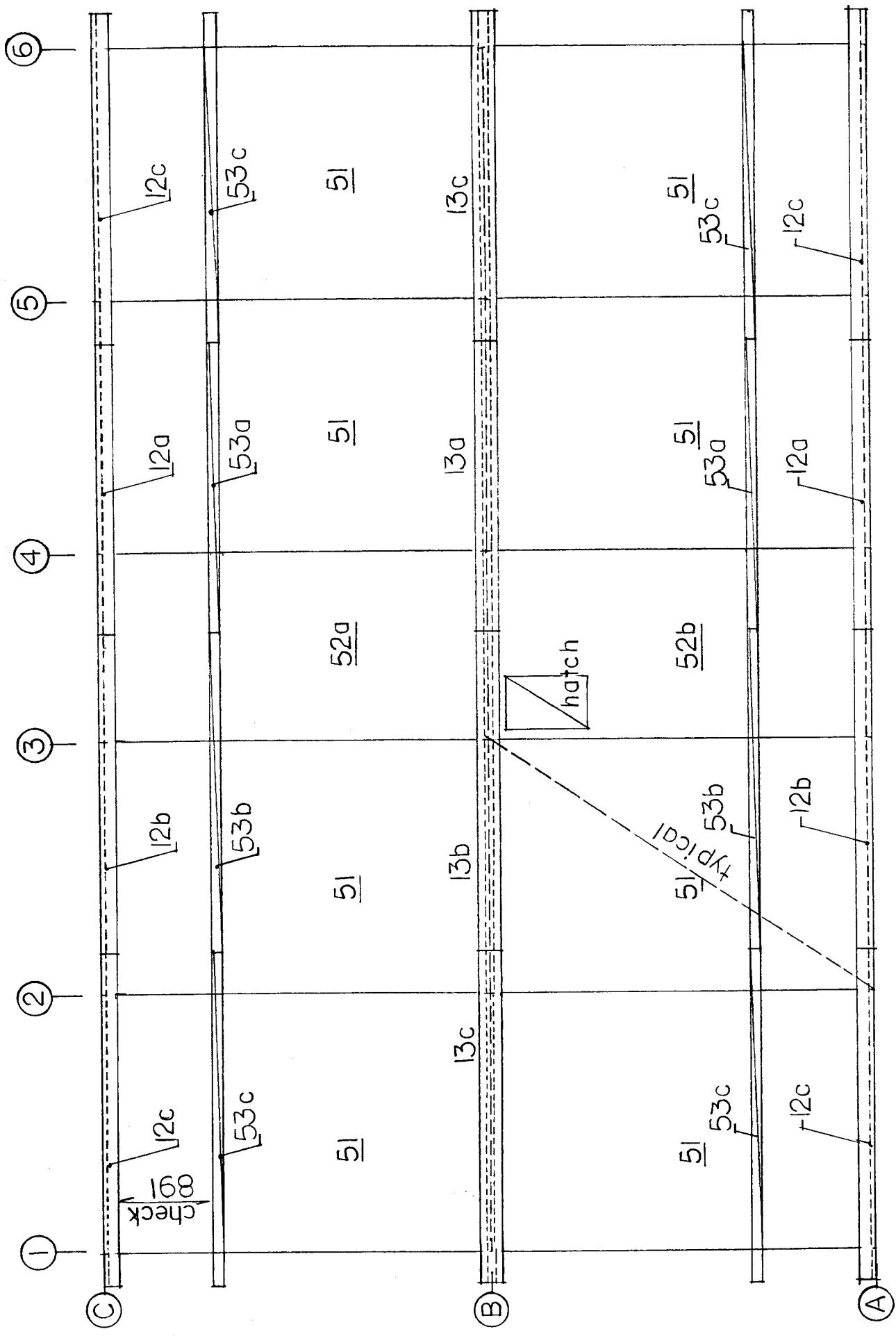
main floor component layout



patented



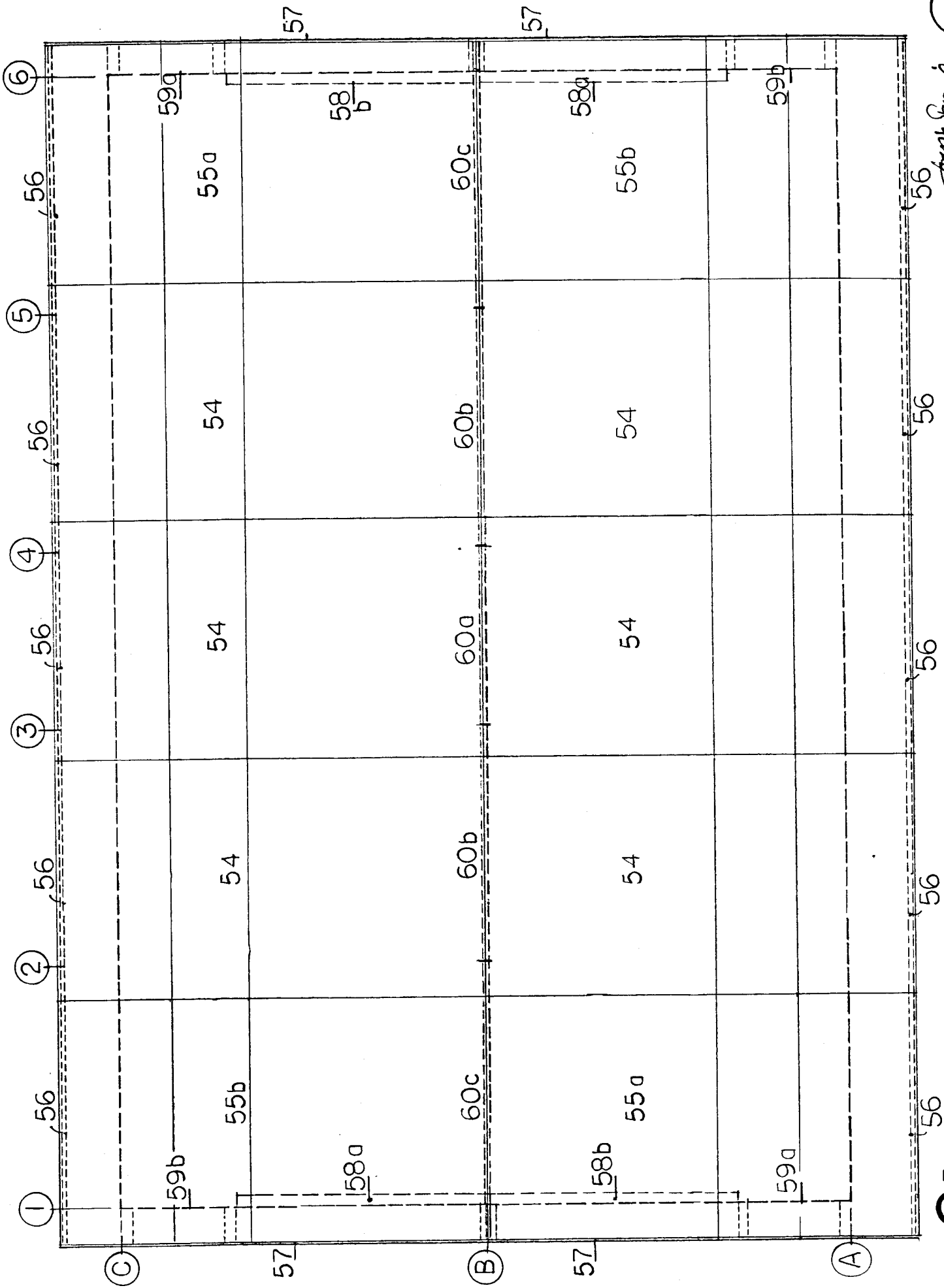
note - ▽ means loose interior wall sheathing on this side



Joseph Skerwin 16.3.87. dwg. no.

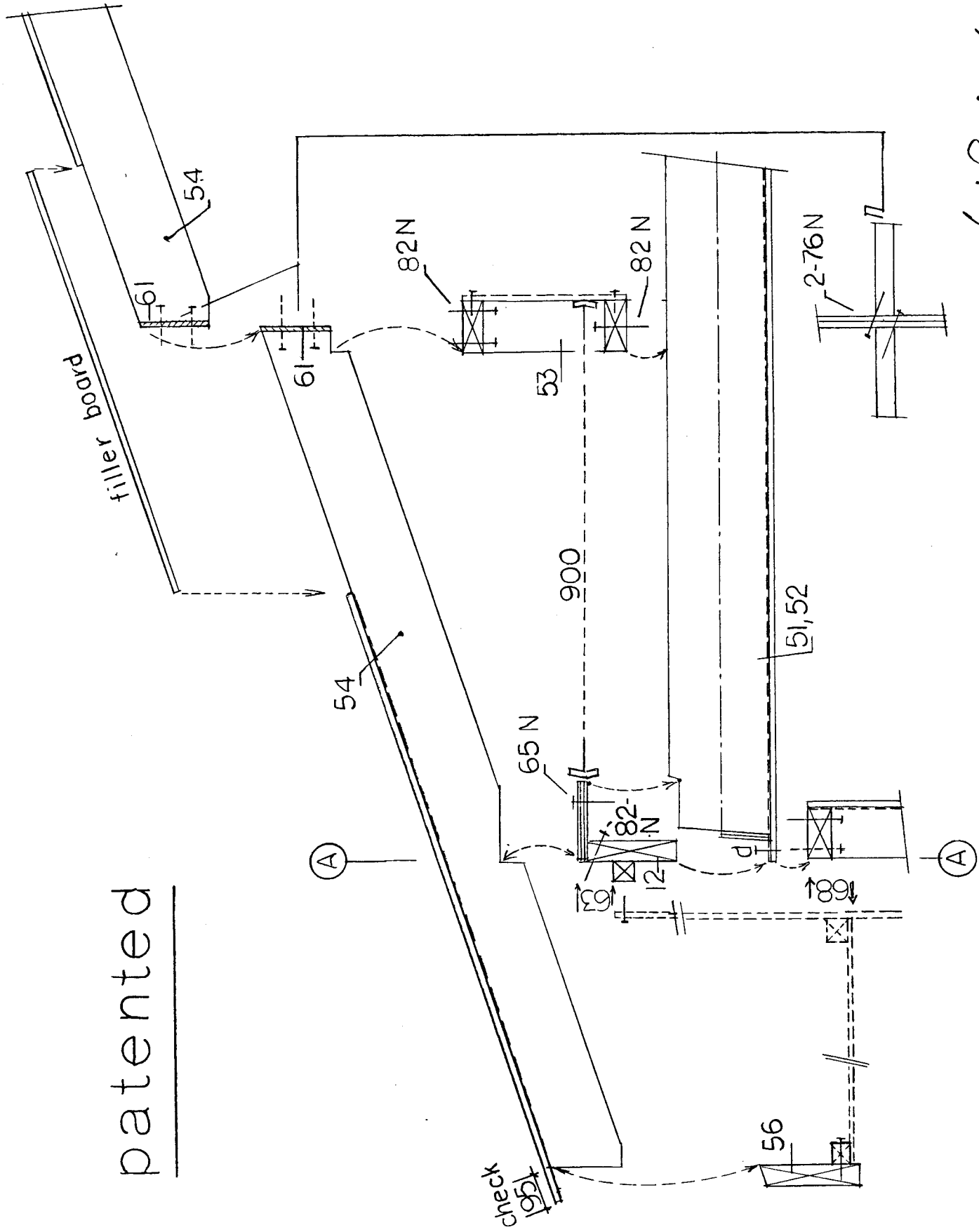
7

attic floor component layout ©1987



Joseph Standa
16.3.87
dwg. no. 8

patented



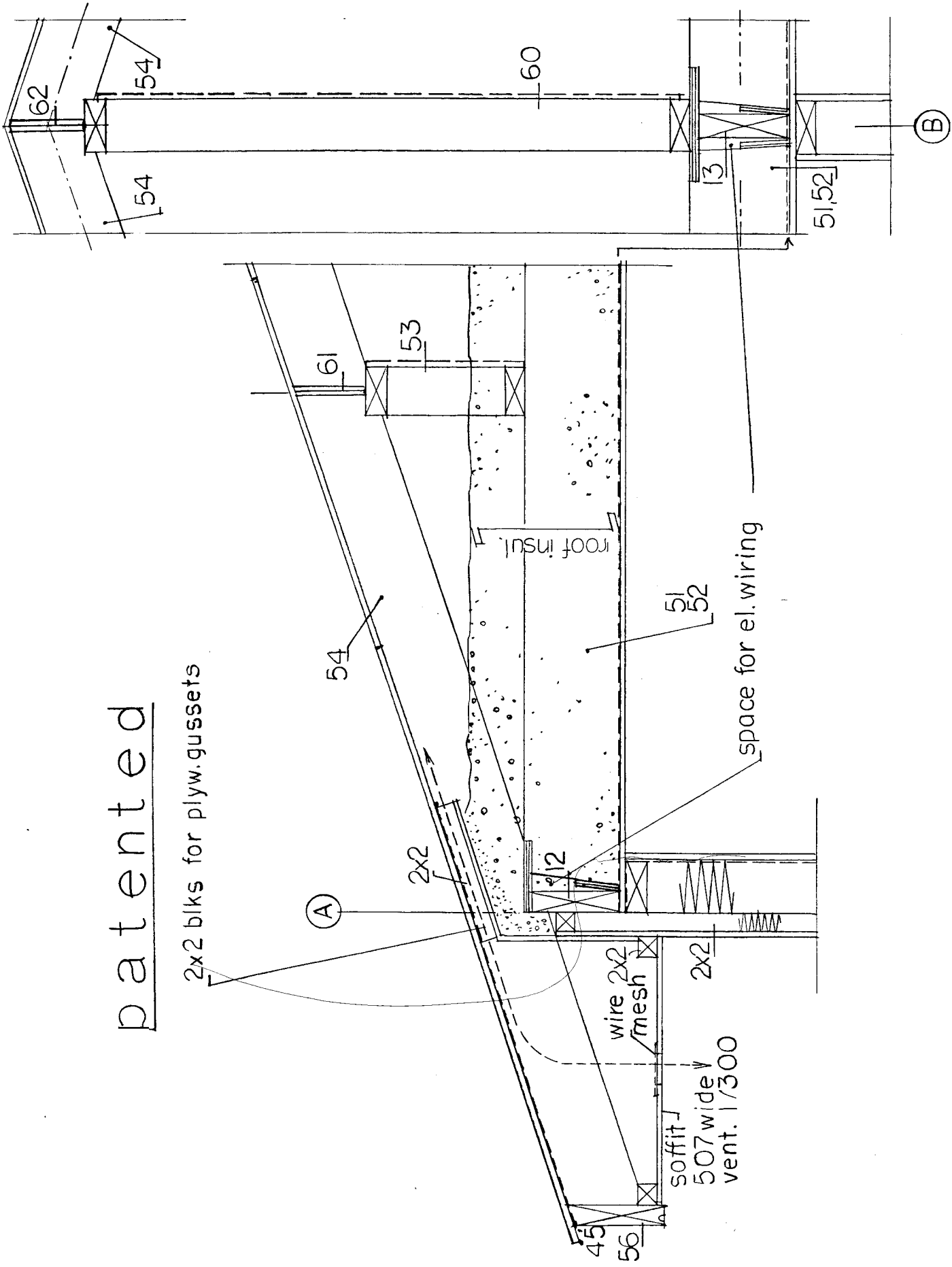
Jayph Scavé 16.3.87.

attic-roof components - ©1987 - dwg.no. 9

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2x2 blks for plyw.gussets



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roof-attic structure.

Joseph Savani 16.3.87,

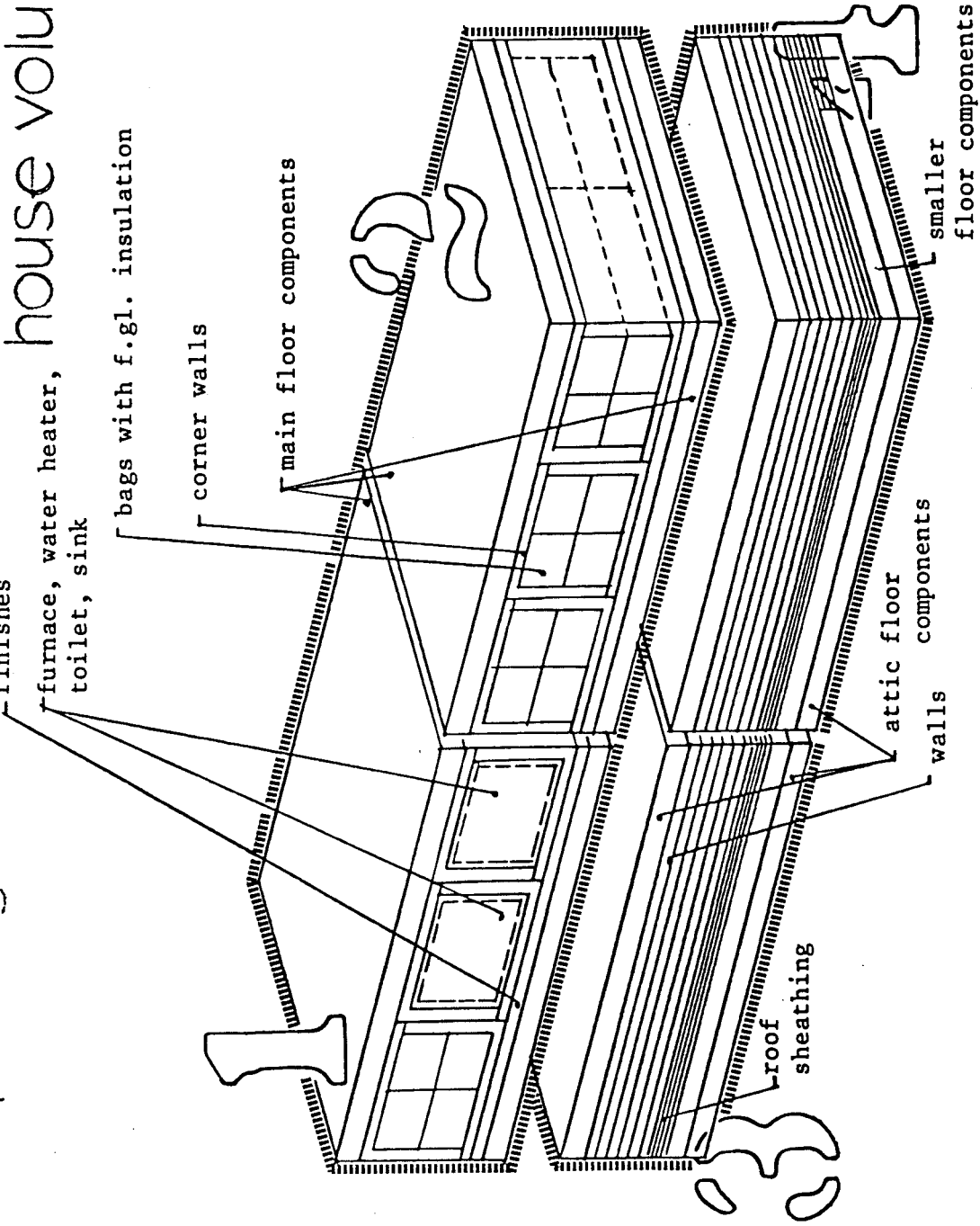
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dwg.no. 10



4 packages

total volume - 9% of house volume



Size of packages 1 & 2 : 12'x 8'x 2'-8" (3.6m x 2.4m x 0.8m)

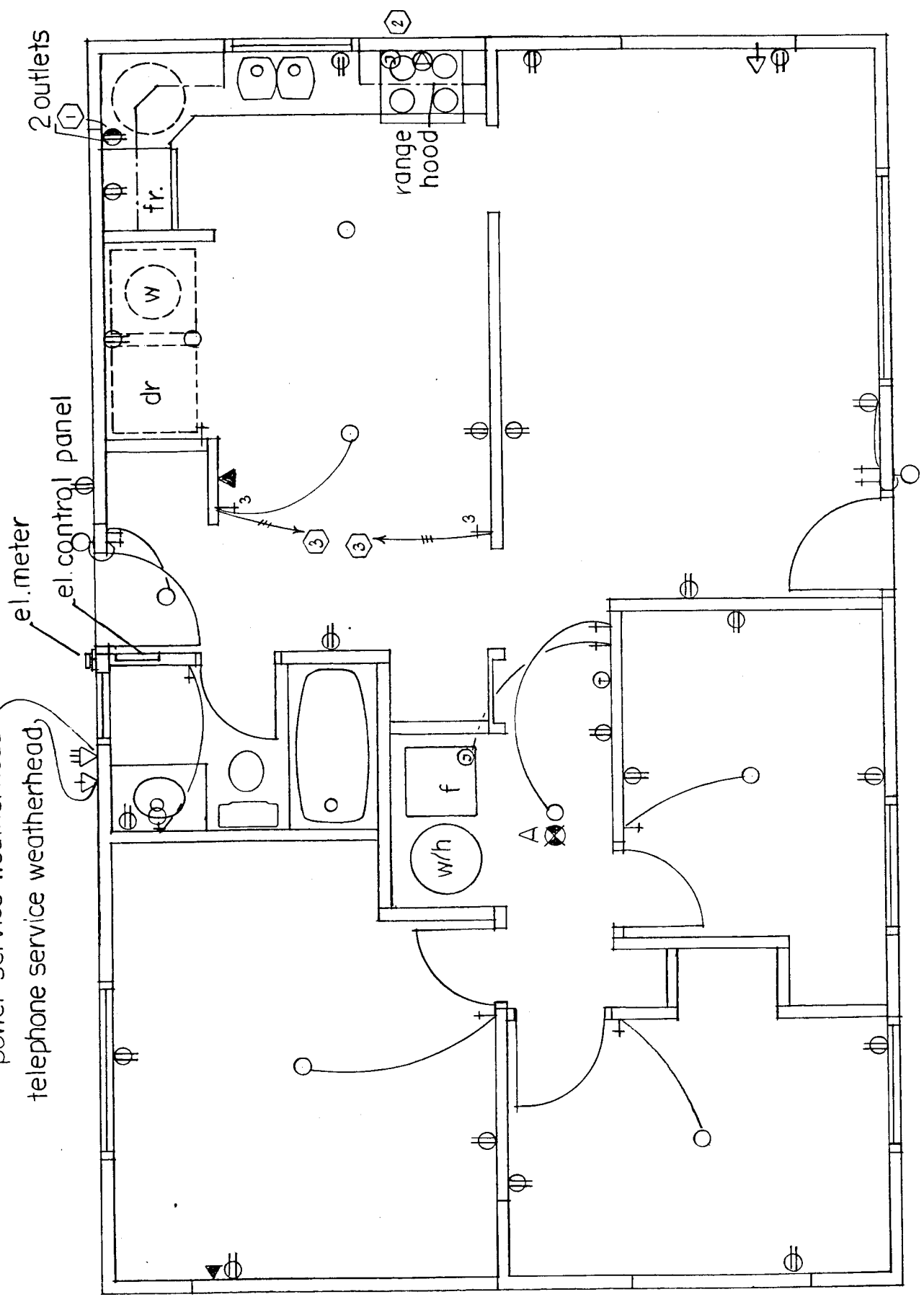
Size of packages 3 & 4 : 12'x 8'x 2'-0" (3.6m x 2.4m x 0.6m)


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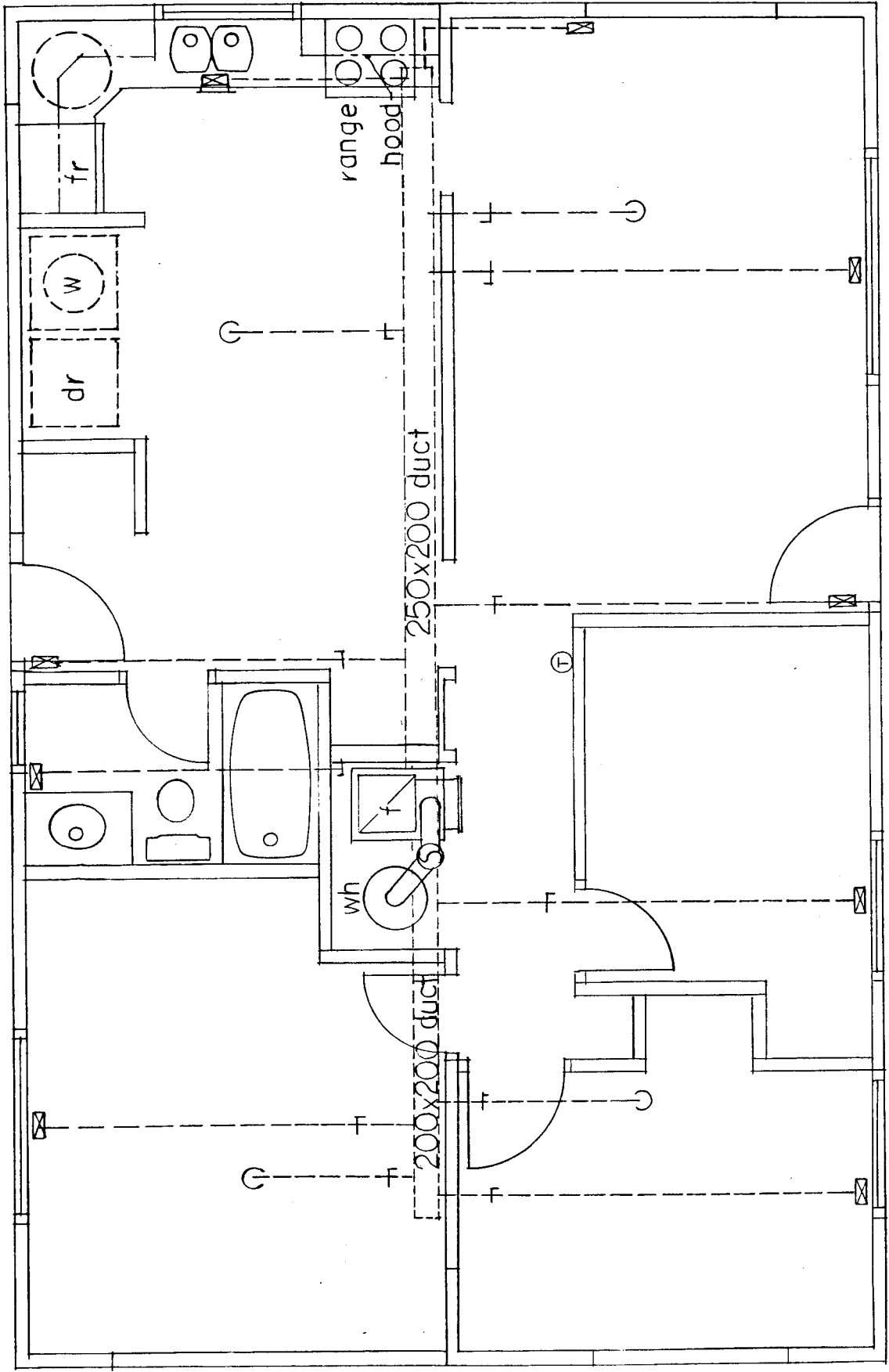
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power service weatherhead
telephone service weatherhead



 ADD-ON BUILDINGS LTD. ©1987. sub-consultant - TWS Engineering Ltd. electrical service scheme

dwg.no. 12

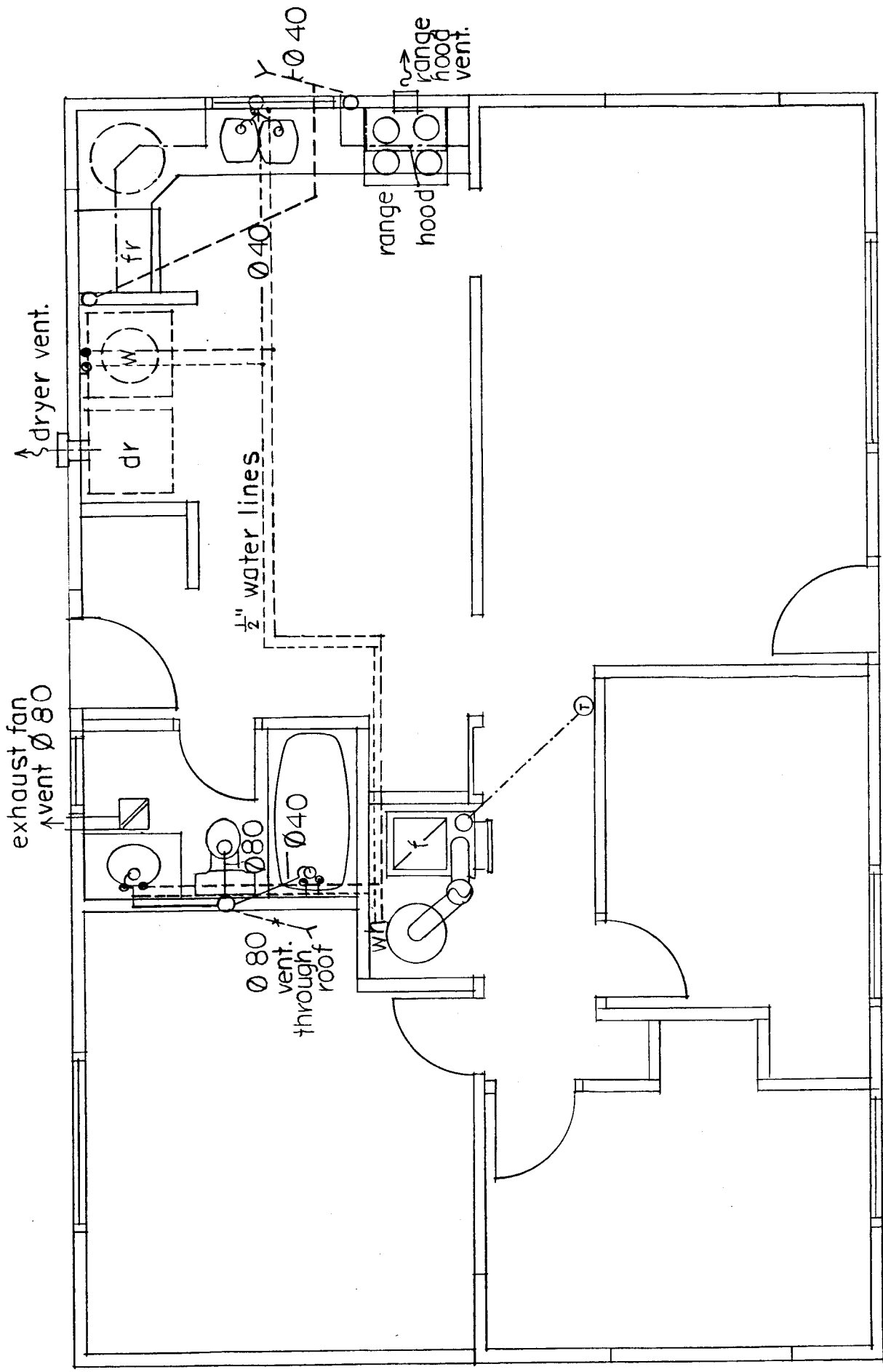


note - Ø 125 ducts

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EA ADD-ON BUILDINGS LTD. forced air heating scheme

dwg. no. 13

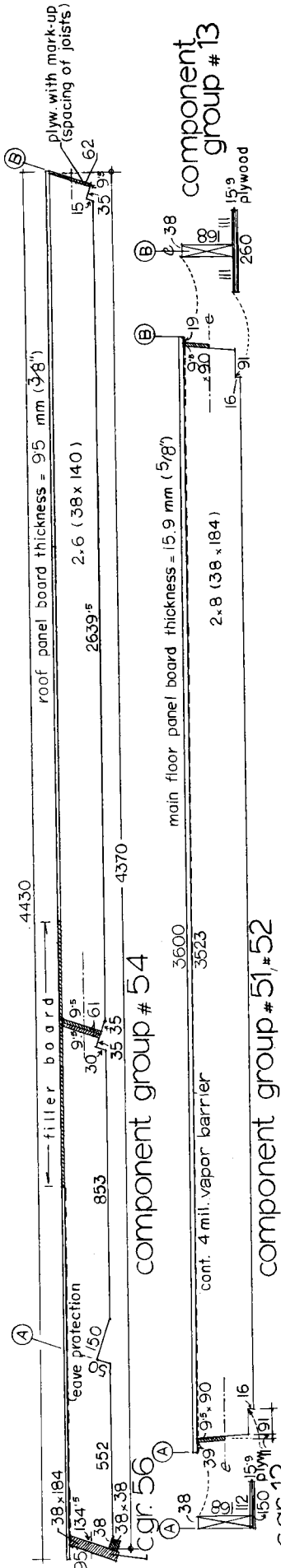


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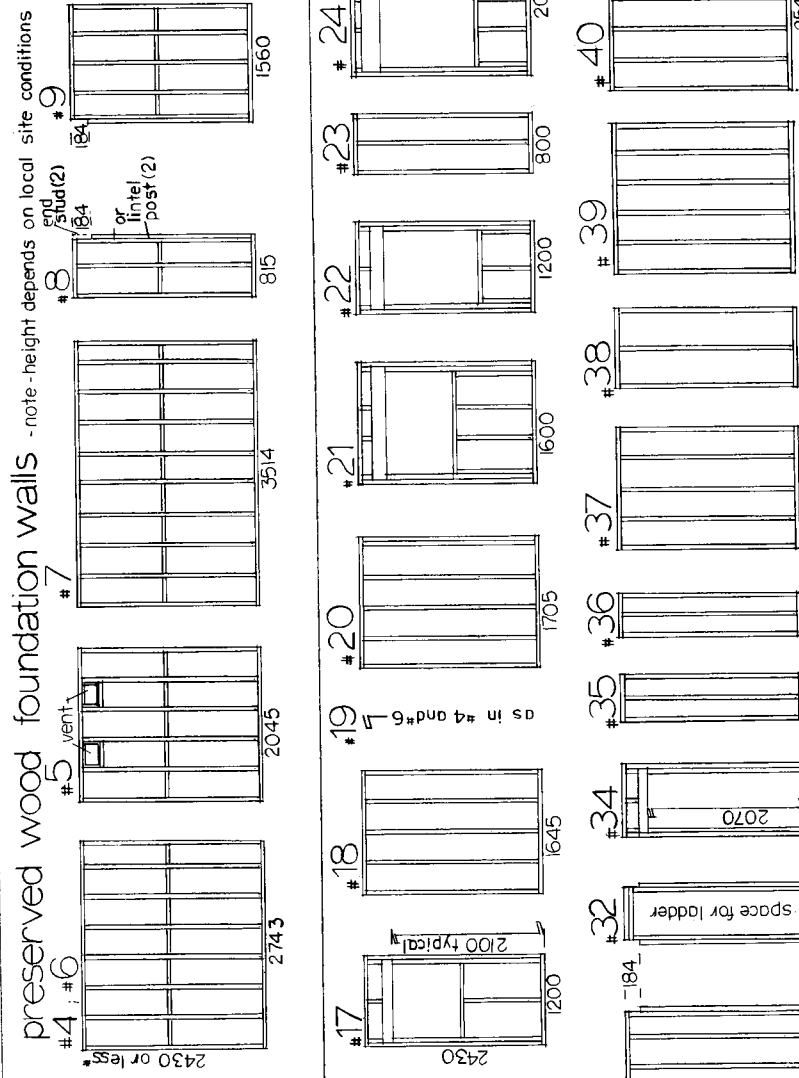
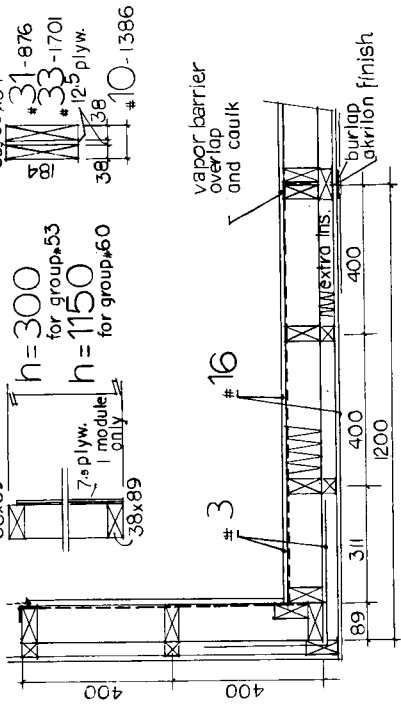


ADD-ON BUILDINGS LTD. water and sanitary service scheme 14



Scale 1:10

preserved wood foundation walls - note: height depends on local site conditions



other walls
 47 - 796
 48 - 900
 49 - 820
 50 - 1005
 1:50

