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TECHNICAL SUPPORT DOCUMENT

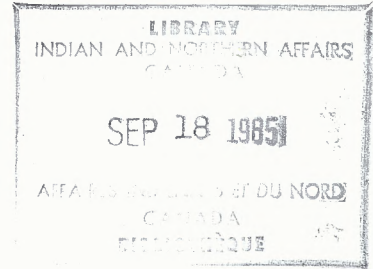
PLUMBING VENTING SYSTEMS

August 1984

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**Technical Services
and Contracts**

**Services techniques
et marchés**

PLUMBING VENTING SYSTEMS

August 1984

Disponible en français

PLUMBING VENTING SYSTEMS

Table of Contents

1.0	INTRODUCTION
1.1	Purpose
1.2	Scope
1.3	Background
1.4	Pre-design Considerations
1.5	References
1.6	General Principles
2.0	APPLICATION
2.1	Types of Buildings
2.2	General Requirements
2.3	Types of Venting Systems
2.3.1	Individual Venting
2.3.2	Stack Venting
2.3.3	Wet Venting
2.3.4	Wet Venting in Multi-storey Buildings
2.3.5	Combined Stack and Wet Venting in Multi-storey Buildings
2.3.6	Circuit or Loop Venting in One-storey Buildings
2.3.7	Common Venting in One-storey Buildings
2.3.8	Circuit or Loop Venting in Multi- storey Buildings
2.3.9	Common or Loop Venting in Multi-storey Buildings
2.3.10	Combination Waste and Vent Systems
2.4	Venting of Floor Drains

APPENDIX

EXAMPLES OF PLUMBING VENTING SYSTEMS IN DESIGNED OR
EXISTING DEPARTMENTAL BUILDINGS

- Stack Venting Systems (examples 1-2)
- Wet Venting Systems (examples 3 -6)
- Combined Stack and Individual Venting Systems (examples 7-10)
- Combined Wet and Individual Venting Systems (examples 11-12)
- Combined Stack and Wet Venting Systems (example 13)
- Combined Stack, Wet and Individual Venting Systems (example 14)
- Venting Systems for Fixture Groups (example 15)

PLUMBING VENTING SYSTEMS

1.0 INTRODUCTION

1.1 Purpose

The purpose of this publication is:

- a. to provide information and direction to departmental designers of plumbing venting systems;
- b. to provide designers with venting-system research results and an analysis of diagrams from various plumbing codes and manuals;
- c. to facilitate a better understanding of venting systems as described in Section 5 of the Canadian Plumbing Code; and
- d. to provide a uniform standard for plumbing venting systems in departmental buildings.

1.2 Scope

This is a technical support document to DRM 10-7/51 Building Design and is intended primarily as a guideline for the following users:

- a. building services design engineers and technologists;
- b. building planners and architects;
- c. field engineering staff; and
- d. engineering consultants.

1.3 Background

This publication conforms with current Canadian plumbing codes, with variations and examples selected for their convenience, economy or practicality.

1.4 Pre-design Considerations

At the preliminary design stage, the location of plumbing fixtures should be discussed with the design coordinator. The guideline layouts should be used where possible, and the ramifications of using a particular system in a given structure should be considered.

1.5 References

The information and technical terms used in this publication are based on the plumbing code, engineering handbooks listed below, and on studies of existing plumbing venting systems in departmental buildings.

- Canadian Plumbing Code.
- Standard Plumbing Engineering Design, Louis S. Nielsen, Associate Plumbing Engineer, New York State Building Code Commission.
- National Plumbing Code Handbook, Vincent T. Manas, Plumbing Engineer and Consulting Engineer.

1.6 General Principles

A plumbing venting system is required for all plumbing installations to prevent excessive variation in the pneumatic pressure of fixture drains, which may break the trap seals, and release gas and disagreeable odours into the buildings.

The venting system protects trap seals by:

- a. equalizing air flow pressures throughout the sanitary drainage system. This results in minimal trap-seal loss due to the pneumatic effects of siphonage or back-pressure conditions; and
- b. permitting drainage system gases and odours to escape in a controlled manner.

2.0 APPLICATION

2.1 Types of Buildings

This guideline applies primarily to the following types of departmental buildings:

- a. residential (for example, staff and native residences);
- b. residential (for example, apartments up to three storeys);
- c. institutional (for example, nursing homes and schools up to three storeys); and
- d. public buildings (for example, community halls up to three storeys).

2.2 General Requirements

The application of the venting systems described in this guideline requires that:

- a. all vent connections shall comply with code requirements respecting developed length, fall and cumulative change of direction of the trap arm;
- b. where local and provincial plumbing codes have more stringent requirements than the Canadian Plumbing Code, they shall take precedence in each particular design situation;
- c. proper sizing of pipe should be obtained from the Canadian Plumbing Code, and local codes or by-laws.

2.3 Major Types of Venting Systems

2.3.1 Individual Venting

- a. Definition:

An individual vent is a vent pipe serving only one fixture.

b. Description:

In an individual venting system each fixture trap is provided with a vent pipe (see Figure 1).

c. Application:

Individual venting may prevail in certain areas where alternative special methods (described later) are not allowed, or for special fixtures such as blowout-type WCs and urinals.

d. Blowout-type fixtures:

During the initial discharge from blowout-type fixtures, heavy surges are created which cause shock effects in the drainage system. An individual vent is connected, therefore, to the fixture drain of each blowout type fixture to minimize the risk of damaging the water trap seals of other types of fixtures connected to the same branch.

e. Examples:

Refer to Appendix A, examples 4A, 7, 8, 9, 10, 11, 12 and 14.

2.3.2 Stack Venting

a. Definition:

A stack vent is a vent pipe that connects the top of a soil-or-waste stack to a header or to open air.

b. Description:

In stack venting, the fixtures are connected independently and directly from their fixture drains. The stack and stack vent provide the only venting (see Figure 2). This system is simple and economical because no extra vents are necessary; however, as noted below, some requirements may preclude its use.

INDIVIDUAL VENTING

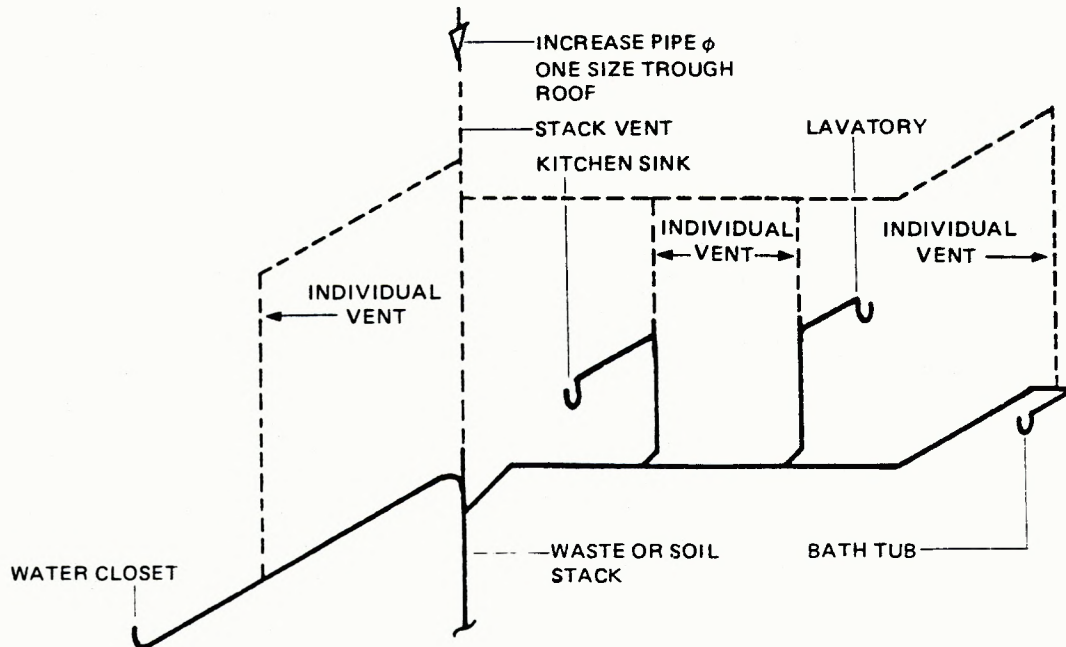


FIGURE 1

STACK VENTING

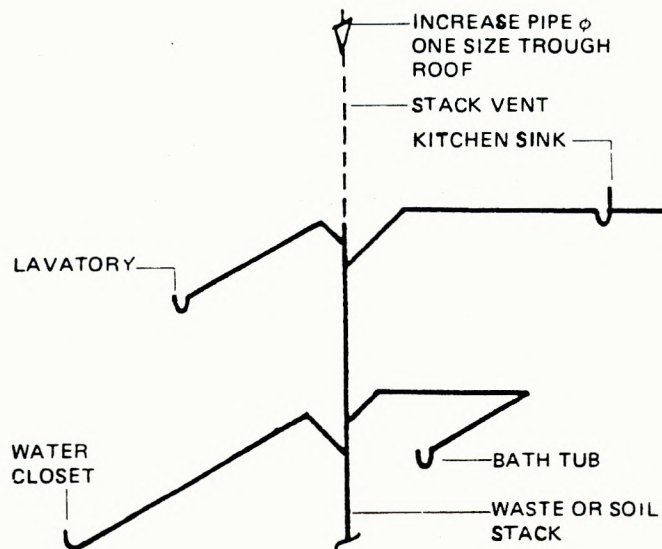


FIGURE 2

c. Application:

Stack venting requires that all the fixtures be on the same floor and that fixture drain connections be made in a particular sequence, as explained below.

Connections shall be made to the stack vertically and in order of "fixture unit" (FU) value; the lowest-rated fixture discharging at the highest position.

For example, in Figure 2 the lavatory (1FU) shall be connected at the highest position on the stack. The kitchen sink (1 1/2 FU), bath tub (1 1/2 FU) and water closet (4 FU) are connected in descending order.

In stack venting, the stack size between two connections shall be larger than that of the upper fixture, and at least as large as the lower fixture drain. Usually, the stack vent diameter remains the same size as the soil stack until it passes through the roof. It is then increased one size (see Figure 2).

Stack venting is permitted when the stack-vented fixtures are installed on the same floor in a one-storey building or on the top floor of multi-storey buildings.

Two fixtures may be connected at the same level through an approved double fitting, if the fittings are available in the required size.

Two fixtures may also be connected to the same stack vent, but at different levels, provided the requirements above are met respecting fixture connection sequence and stack vent sizing.

A group of bathroom fixtures (one WC, one lavatory and one bath tub) as well as a kitchen sink or other wall-mounted fixture may be stack vented, provided:

- (1) the requirements above are met respecting fixture connection sequence and stack vent sizing; and
- (2) fixture drains, other than the WC, are smaller than 50 mm (2 in.) in diameter.

Two WCs and two other wall-mounted fixtures may be stack vented, provided:

- (1) the requirements above are met respecting fixture connection sequence and stack vent sizing; and
- (2) the two WC connections are made with an approved double-wye fitting.

d. Examples:

Refer to Appendix A, examples 1, 2, 7-10, 13 and 14.

2.3.3 Wet Venting

a. Definition:

A wet vent is a soil or waste pipe that also serves as a vent pipe.

b. Description:

A wet vent provides venting for a particular fixture, while simultaneously receiving discharges from other fixtures with low FU ratings (see Figure 3, 4 and 5). Wet vents are used to reduce the vent piping in a given installation.

c. Application:

The wet vent can only serve fixtures located on the same storey. It cannot serve more than four fixtures, including a maximum of two WCs. When fixtures other than WCs discharge downstream from a WC, each fixture connecting downstream shall be individually vented (see Figure 6).

WET VENTING

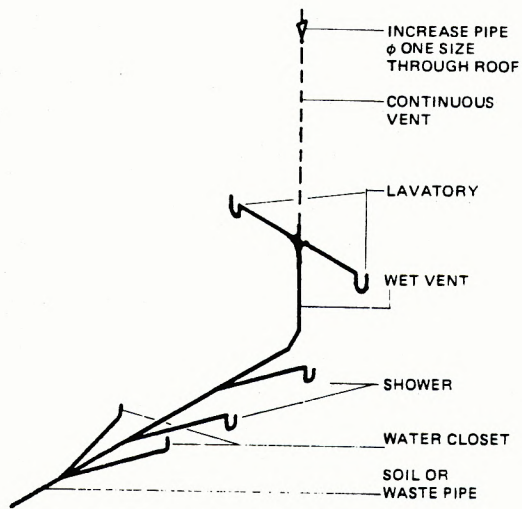


FIGURE 3

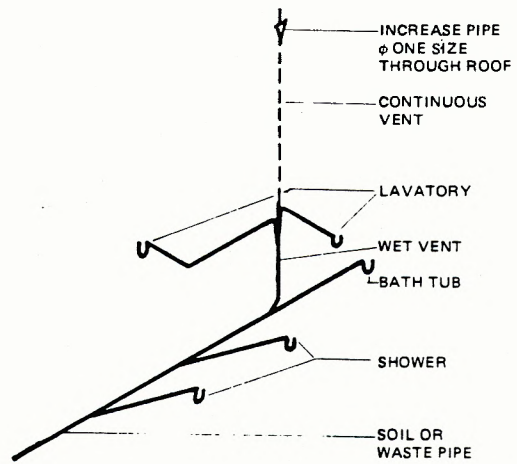


FIGURE 4

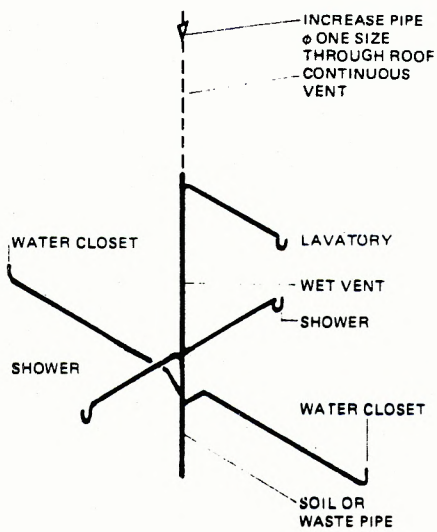


FIGURE 5

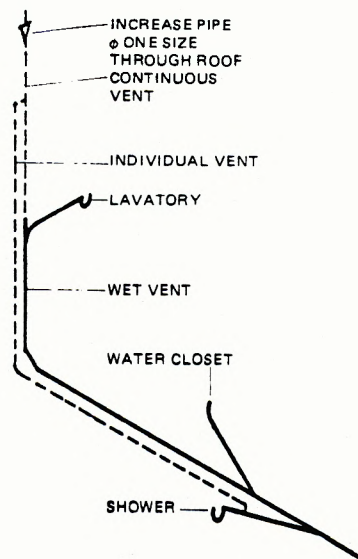


FIGURE 6

One example of wet venting would involve a horizontal branch serving only one sink and one lavatory, or three lavatories (see Figure 7).

A sink and lavatory, or three lavatories, within 2.4 m developed length of a main-vented line, may be connected to a horizontal branch without reventing, provided:

- (1) the branch is at least 50 mm (2 in.) in diameter throughout its length;
- (2) the fixture drains are connected to the side of the branch; and
- (3) the branch leads to its stack connection with a maximum slope of 20 mm per metre (1/4 in. per ft.).

d. Examples:

Refer to Appendix A, examples 3, 4, 4A, 5, 12, 13 and 14.

2.3.4 Wet Venting in Multi-storey Buildings (maximum three storeys)

See 2.3.3c and Figure 8.

2.3.5 Combined Stack and Wet Venting in Multi-storey Buildings (max. three storeys)

a. Description:

Stack and wet venting systems are described in 2.3.2 and 2.3.3.

b. Application:

This system allows a group of bathroom fixtures discharging into the same soil stack to be installed and vented. Figure 9 illustrates a case of upper-floor group fixtures being stack vented, while lower-floor group fixtures are wet vented.

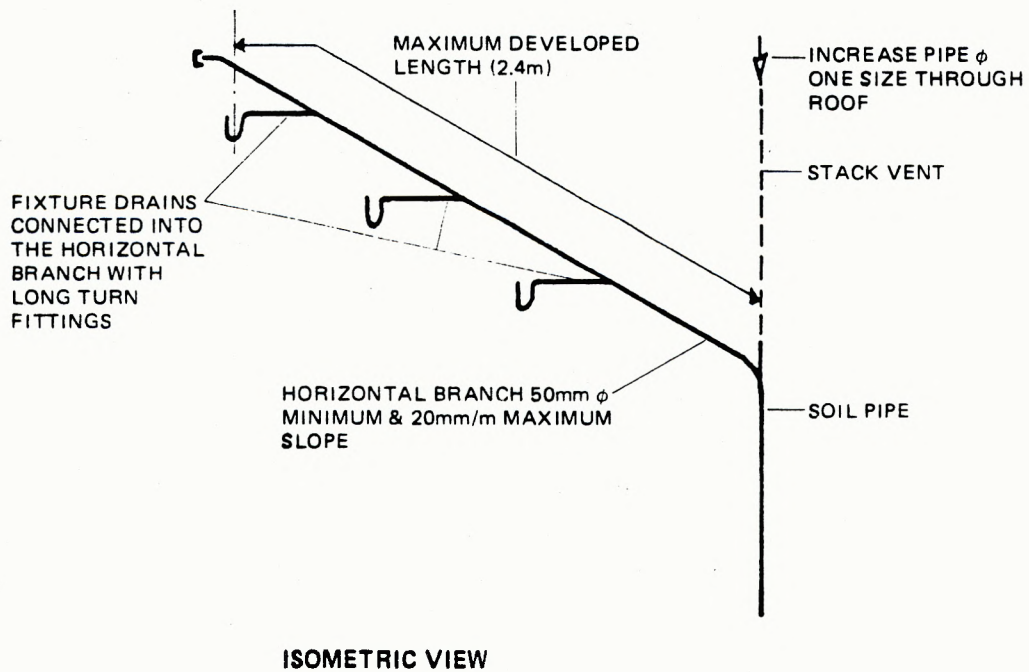
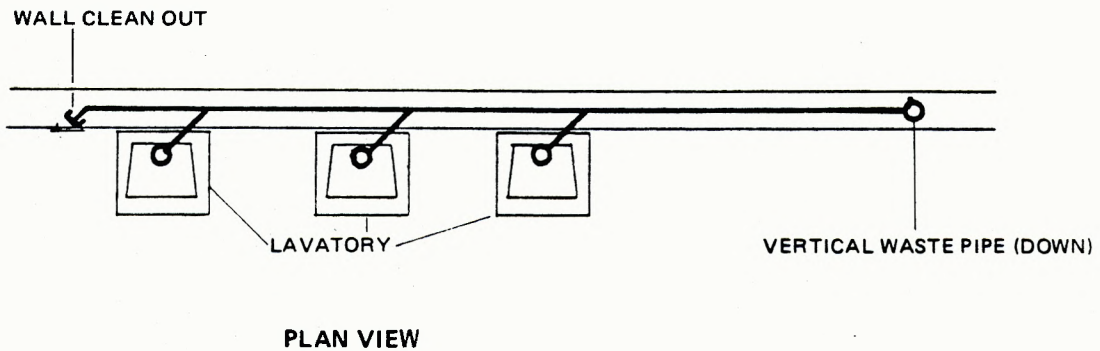
WET VENTING

FIGURE 7

WET VENTING IN MULTI-STOREY BUILDINGS

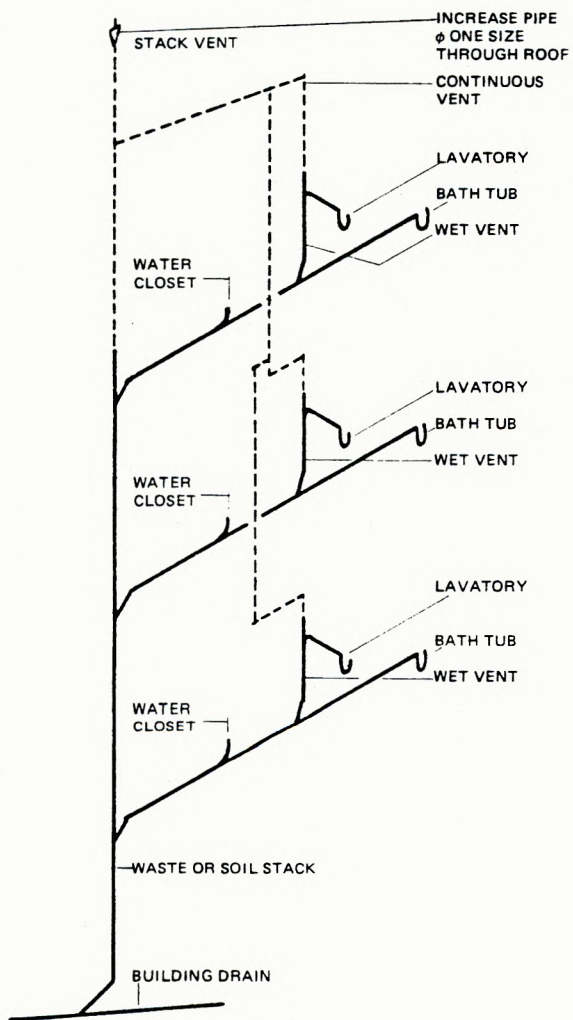


FIGURE 8

COMBINED STACK & WET VENTING IN MULTI- STOREY BUILDINGS

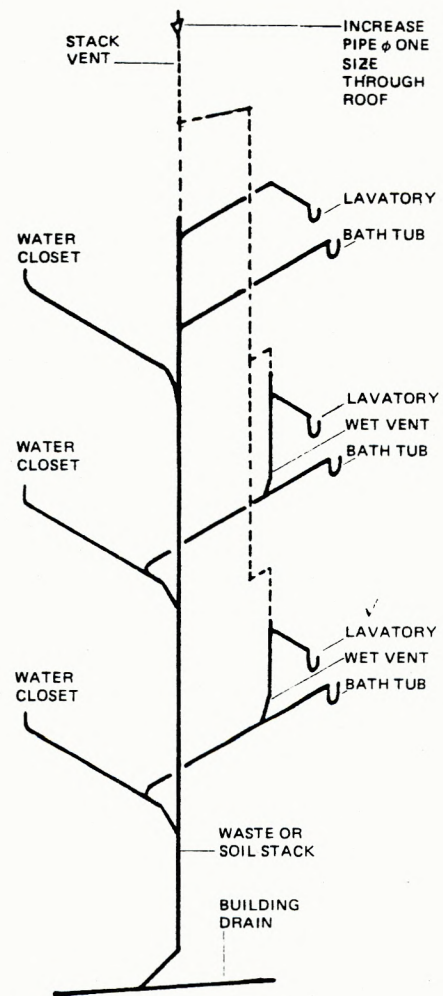


FIGURE 9

If the WC and bath tub from the two lower floors cannot be wet vented, they should be individually vented.

An example of this type of venting involves one fixture or a combination of fixtures (maximum 3 FU) discharging into a soil stack which is a minimum 75 mm (3 in.) in diameter (See Figures 10-13).

Note:

A fixture or combination of fixtures with a maximum of three FU may discharge into the same soil stack (min. 75 mm (3 in.) in diameter) without reventing, provided:

- (1) fixture connections are made above the highest WC connection or bath tub tee wye; and
- (2) the FU rating of the stack is not otherwise exceeded.

2.3.6 Circuit or Loop Venting in One-storey Buildings

a. Definition:

A circuit or loop vent is a vent pipe that serves a number of fixtures and connects to the fixture drain of the most upstream fixture.

b. Description:

In this system, several fixtures can be circuit or loop vented when they are connected in battery to a branch soil or waste pipe, with the vent taking off in front of the last fixture connection. The battery can include from two to a maximum of eight WCs, pedestal urinals, trap standards to floor, shower stalls or floor drains (see Figure 14).

Note:

Blowout-type WCs must be individually vented. (Refer to paragraph 2.3.1. d.).

COMBINED STACK AND WET VENTING IN MULTI-STOREY BUILDINGS

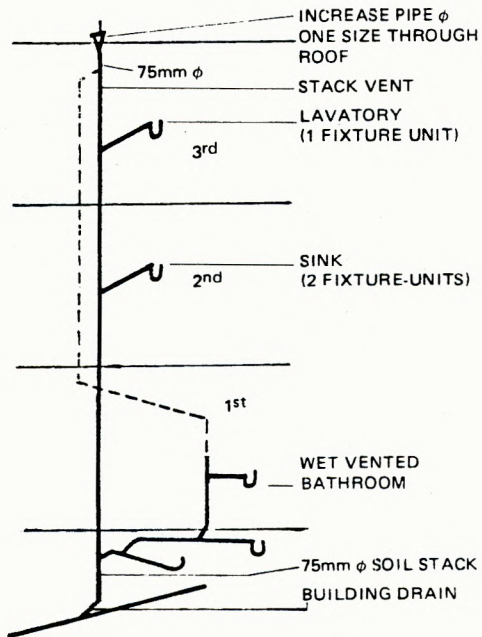


FIGURE 10

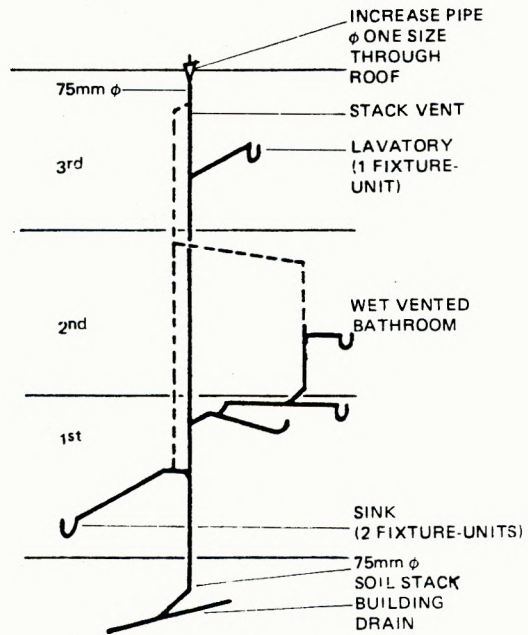


FIGURE 11

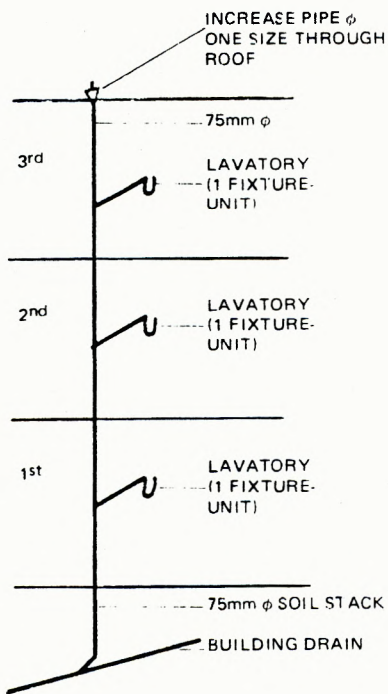


FIGURE 12

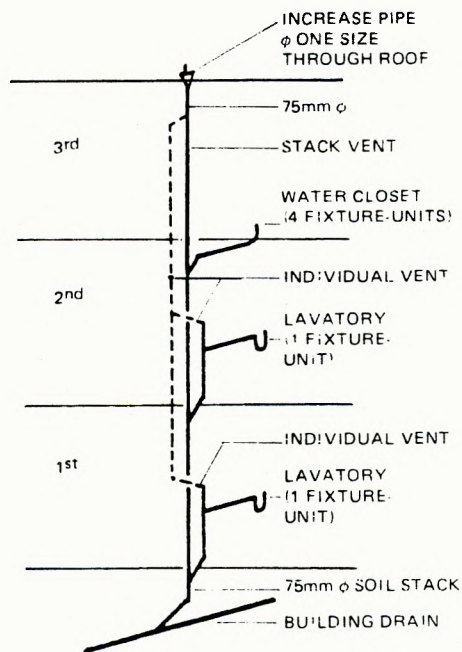


FIGURE 13

Circuit or loop venting, like other systems described, minimizes piping. As shown in Figure 14, WCs can be placed upstream from the other fixtures.

c. Application and special considerations:

When lavatories, sinks or wall urinals discharge into the top of branches (described in b. above), each vertical part of the fixture drain shall be extended as a continuous vent (see Figure 15).

Blowout-type WCs and blowout-type urinals shall be individually vented. (Refer to paragraph 2.3.1 d. and Figure 15)

A relief vent is required:

- (1) when more than six FUs discharge into a soil-waste pipe from above the branch connection (see Figure 16);
- (2) when the cumulative horizontal change in direction in the branch or building drain between vent pipes exceeds 45 degrees (see Figure 17);
- (3) when more than eight wet-vented fixtures are connected to the branch or building drain between vent pipe connections (see Figure 18); and
- (4) for each branch at a point between the two most distant WCs when parallel horizontal branches serve a total of eight WCs; four on each branch (see Figure 19).

Note:

When fixtures other than WCs discharge above the horizontal branches, each fixture shall be individually vented. And this individual vent may serve as a relief vent to two or more groups of circuit-vented fixtures (see Figure 20).

CIRCUIT OR LOOP VENTING IN ONE-STOREY BUILDINGS

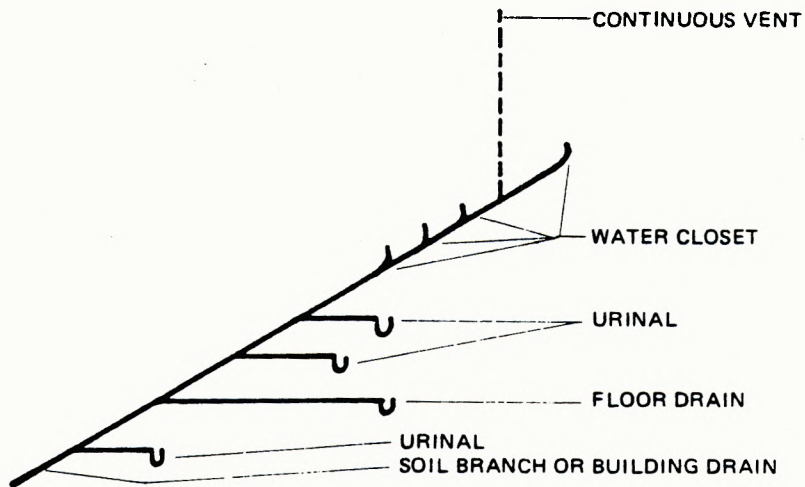


FIGURE 14

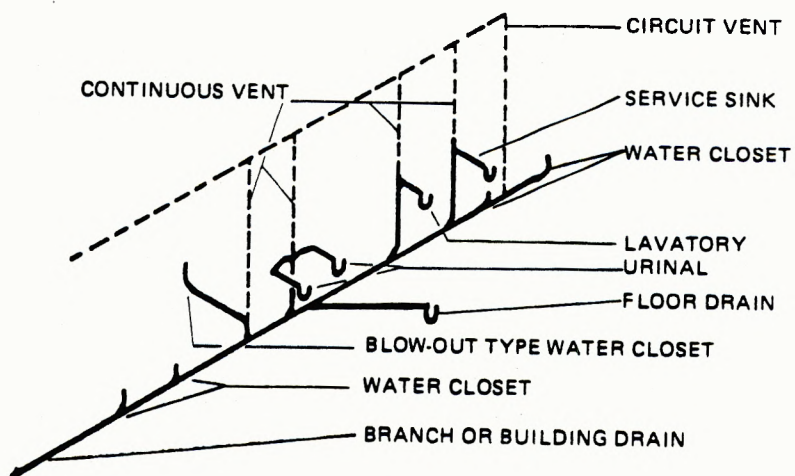


FIGURE 15

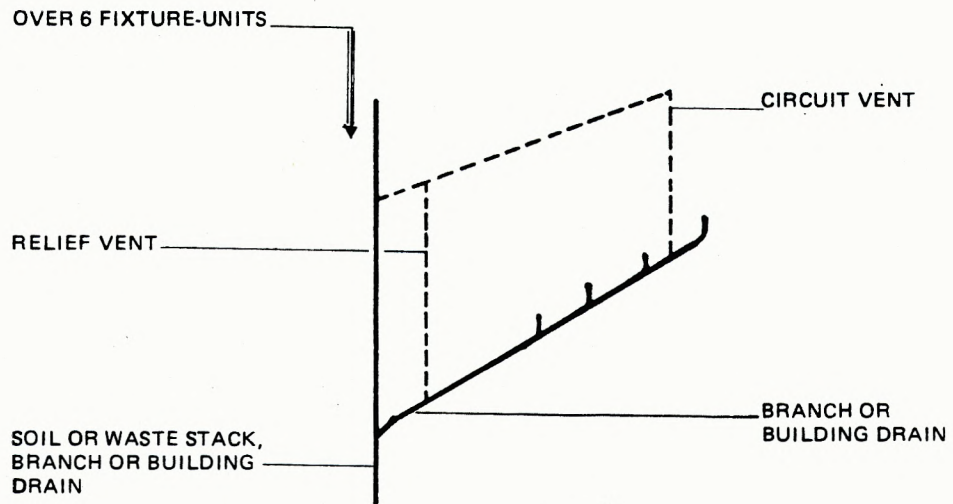
CIRCUIT OR LOOP VENTING IN ONE-STOREY BUILDINGS

FIGURE 16

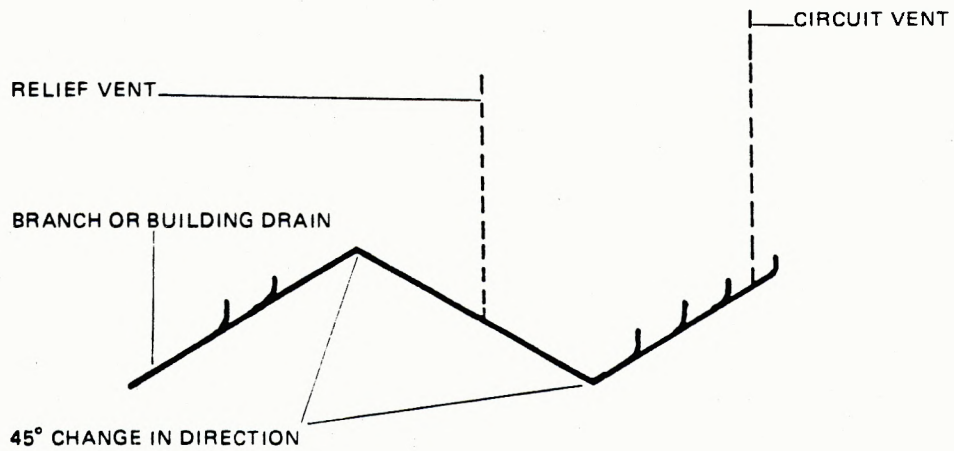


FIGURE 17

CIRCUIT OR LOOP VENTING IN ONE-STOREY BUILDINGS

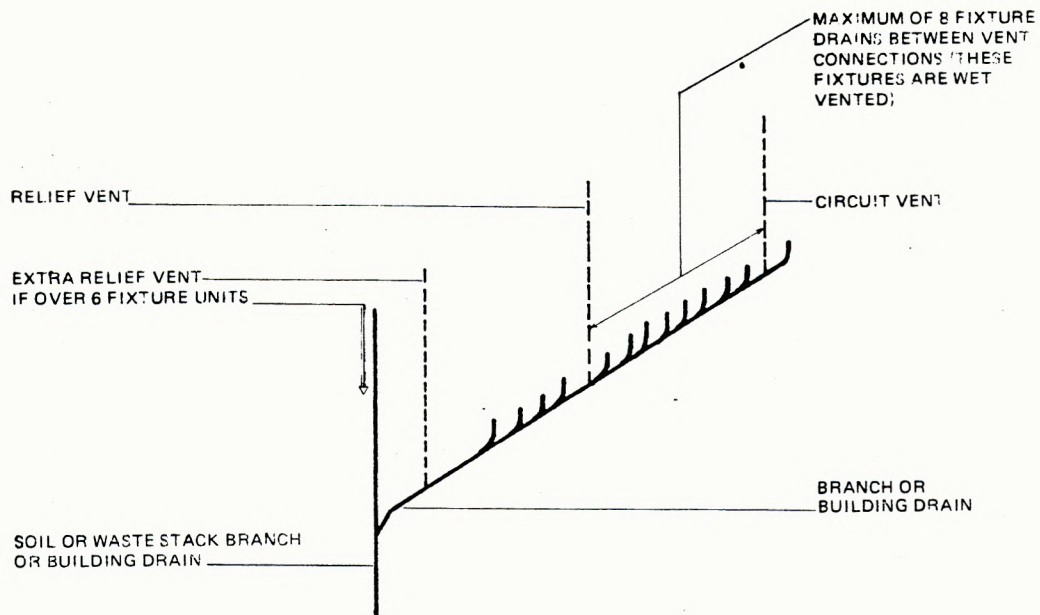


FIGURE 18

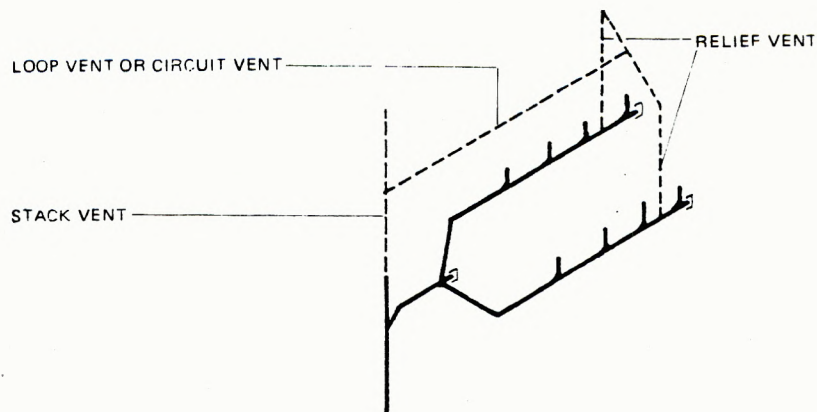


FIGURE 19

d. Examples:

Refer to Appendix A, example 15.

2.3.7 Common Venting of Fixtures-Back-to-Back in Battery
(one-storey buildings)

a. Definition:

A common vent is a vent connecting at the junction of two fixture drains and serving as a vent pipe for both fixtures.

b. Description:

When two fixtures are connected back to back or side by side, they can be commonly vented, provided both fixture drains connect at the same level with their common vertical drain.

c. Application:

When fixtures of the same type are connected to one horizontal branch through a double wye or a sanitary tee in a vertical position, a common vent for each set of two fixtures (back to back or double connection) shall be provided. The common vent shall be installed in a vertical position as a continuation of the double connection (see Figure 21).

When mixed fixtures are installed on the same horizontal branch, blowout-type WCs or blowout-type urinals may be vented by a common vent, when back to back (see Figure 22).

2.3.8 Circuit or Loop Venting in Multi-storey Buildings
(maximum three storeys)

a. Description:

Circuit or loop venting is described in 2.3.6.

b. Application:

This system allows a group of fixtures in a row to be vented (see Figure 23).

CIRCUIT OR LOOP VENTING IN ONE-STOREY BUILDINGS

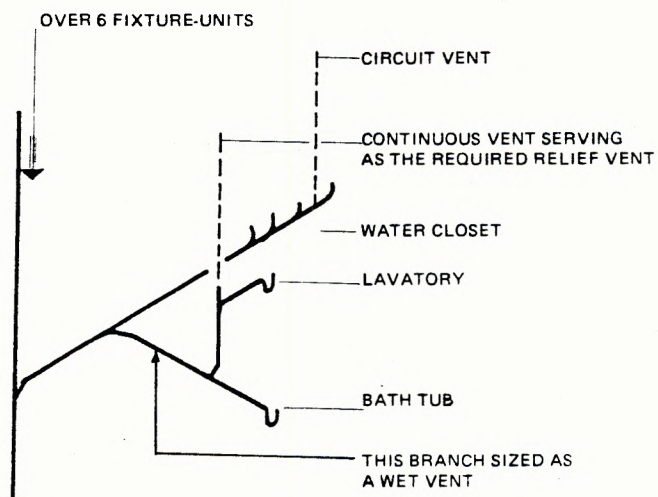


FIGURE 20

COMMON VENTING OF FIXTURES-BACK-TO-BACK IN BATTERY

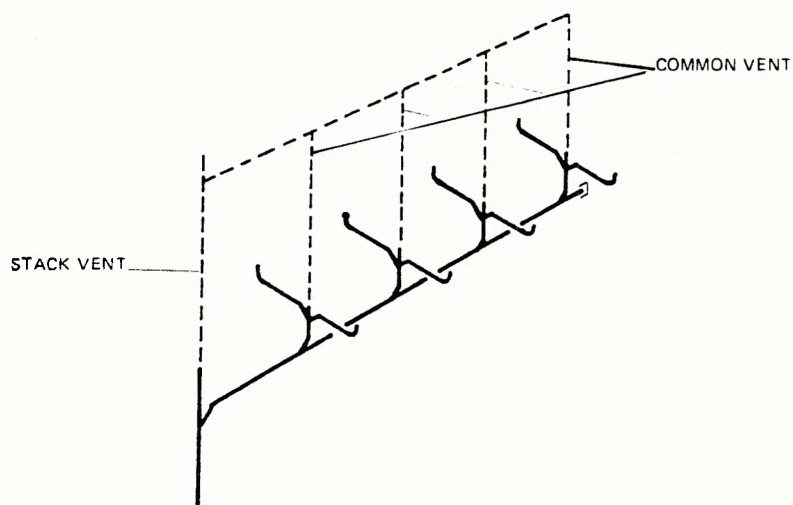
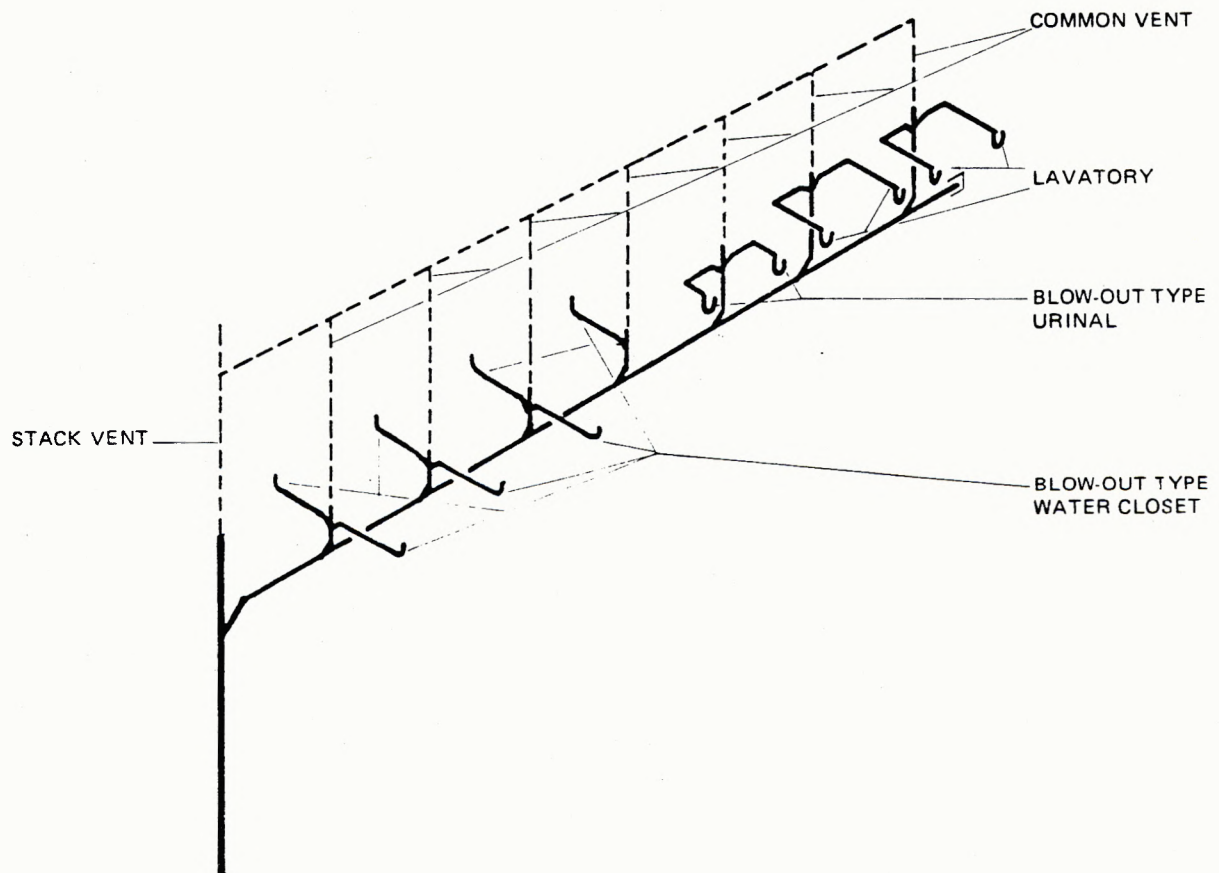


FIGURE 21

COMMON VENTING OF FIXTURES-BACK-TO-BACK IN BATTERY**FIGURE 22**

CIRCUIT OR LOOP VENTING IN MULTI-STOREY BUILDINGS

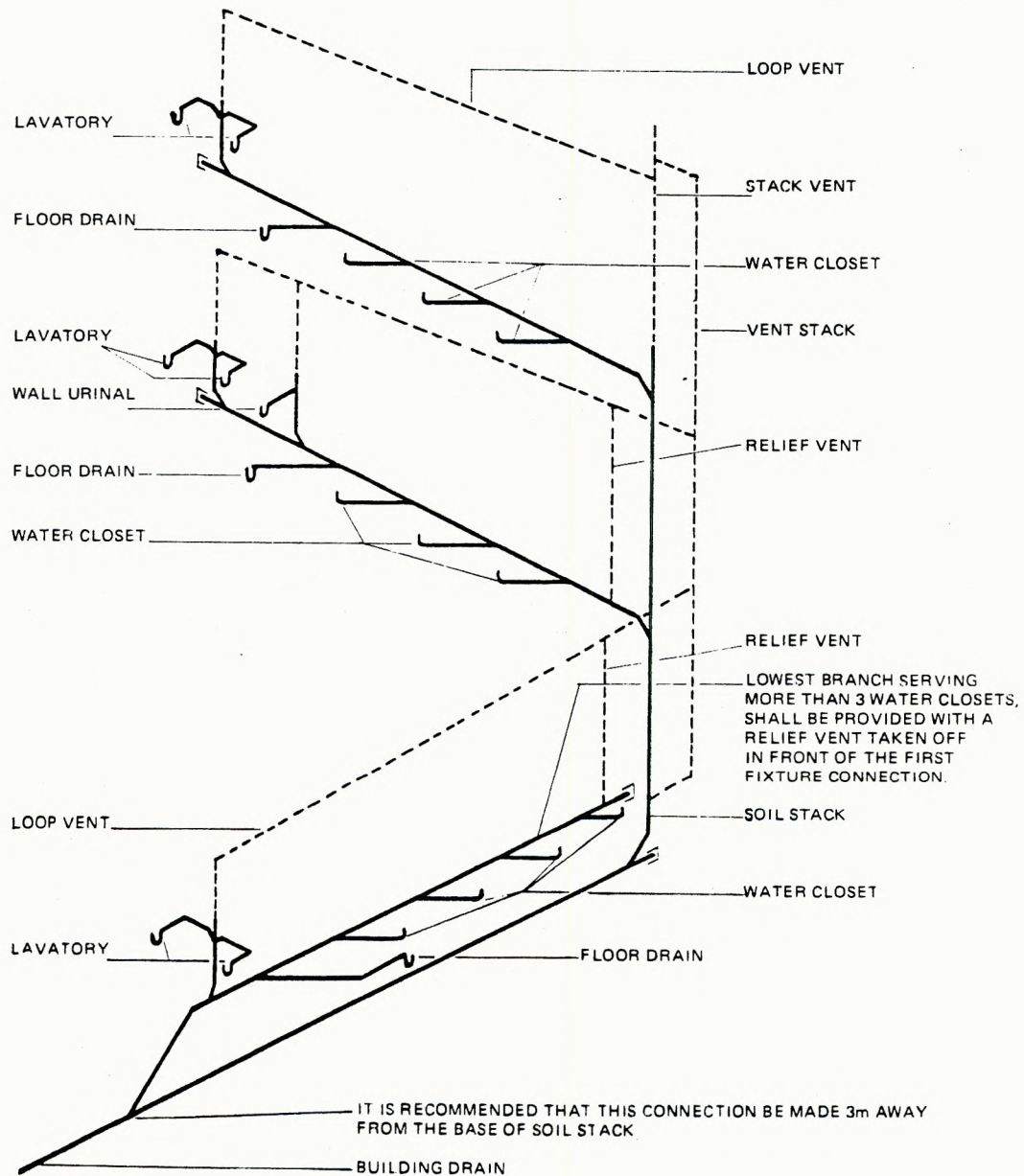


FIGURE 23

2.3.9 Common and Loop Venting in Multi-storey Buildings (max. three storeys)

a. Description:

Common and loop venting is described in 2.3.6 and 2.3.7.

b. Application:

This system provides several venting variations for multi-storey buildings:

1. A group of fixtures back to back in battery may be vented as shown in Figure 24.
2. A group of fixtures installed on the same horizontal branch may be vented as shown in Figure 25.
3. A group of fixtures draining in parallel branches may be vented as shown in Figure 26.

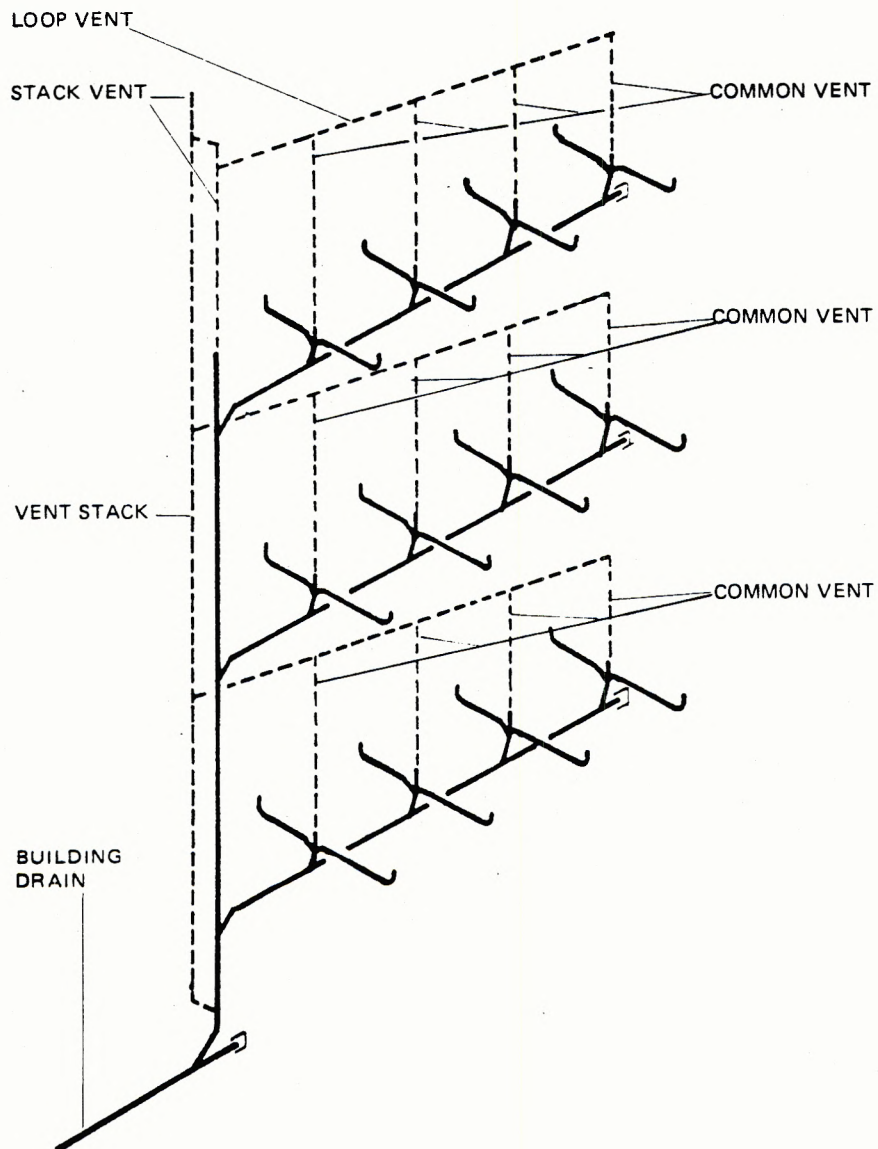
2.3.10 Combination Waste and Vent Systems

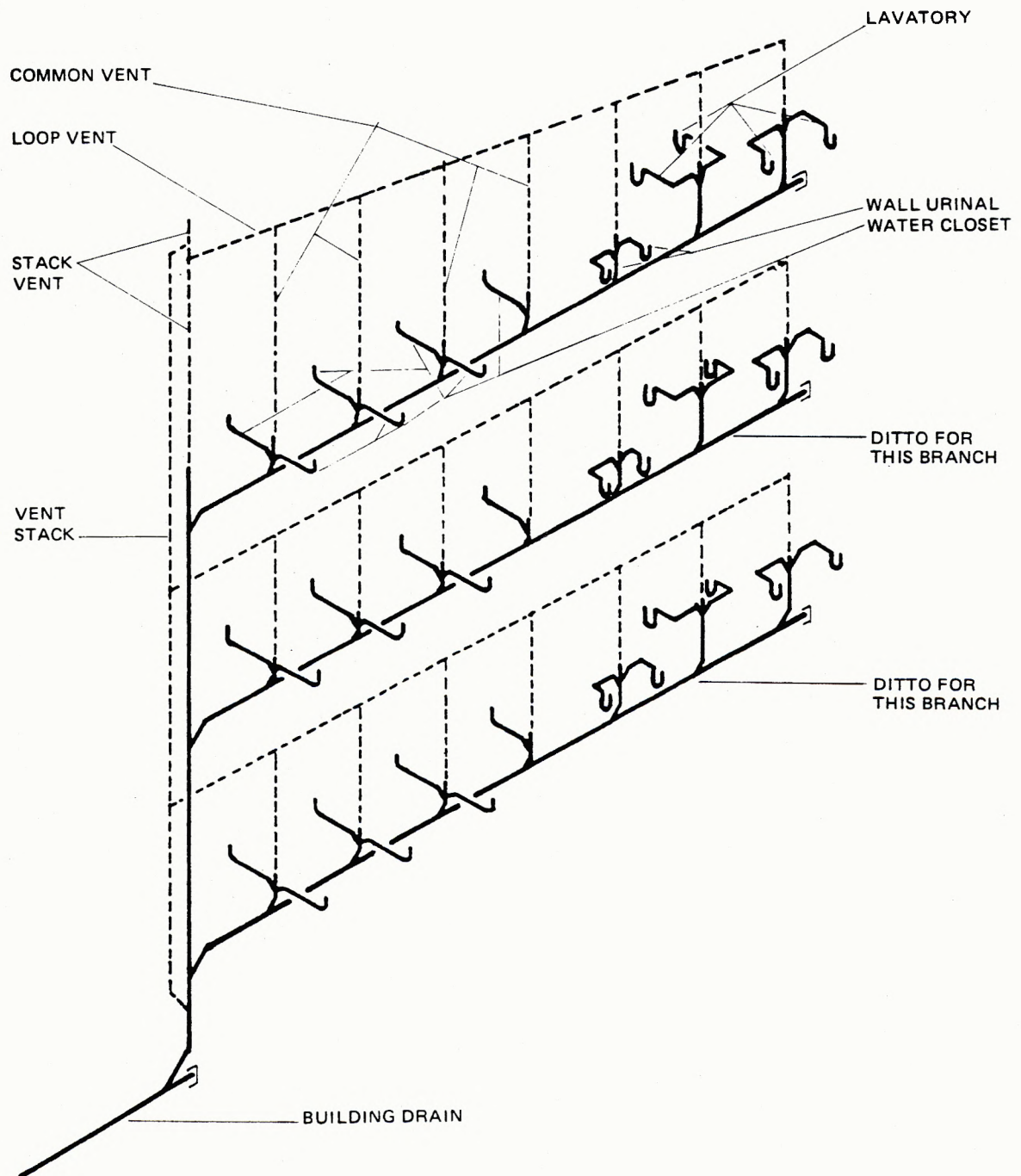
a. Description:

This is a special type of wet venting system. It consists of waste piping in which the trap of the fixture is not individually vented. Every waste pipe and trap should be at least two pipe sizes larger than the size normally required to provide free movement of air above the flow of waste in the drainage line.

b. Application:

This system may be used only under the following circumstances:

COMMON AND LOOP VENTING IN MULTI-STOREY BUILDINGS**FIGURE 24**

COMMON AND LOOP VENTING IN MULTI-STOREY BUILDINGS**FIGURE 25**

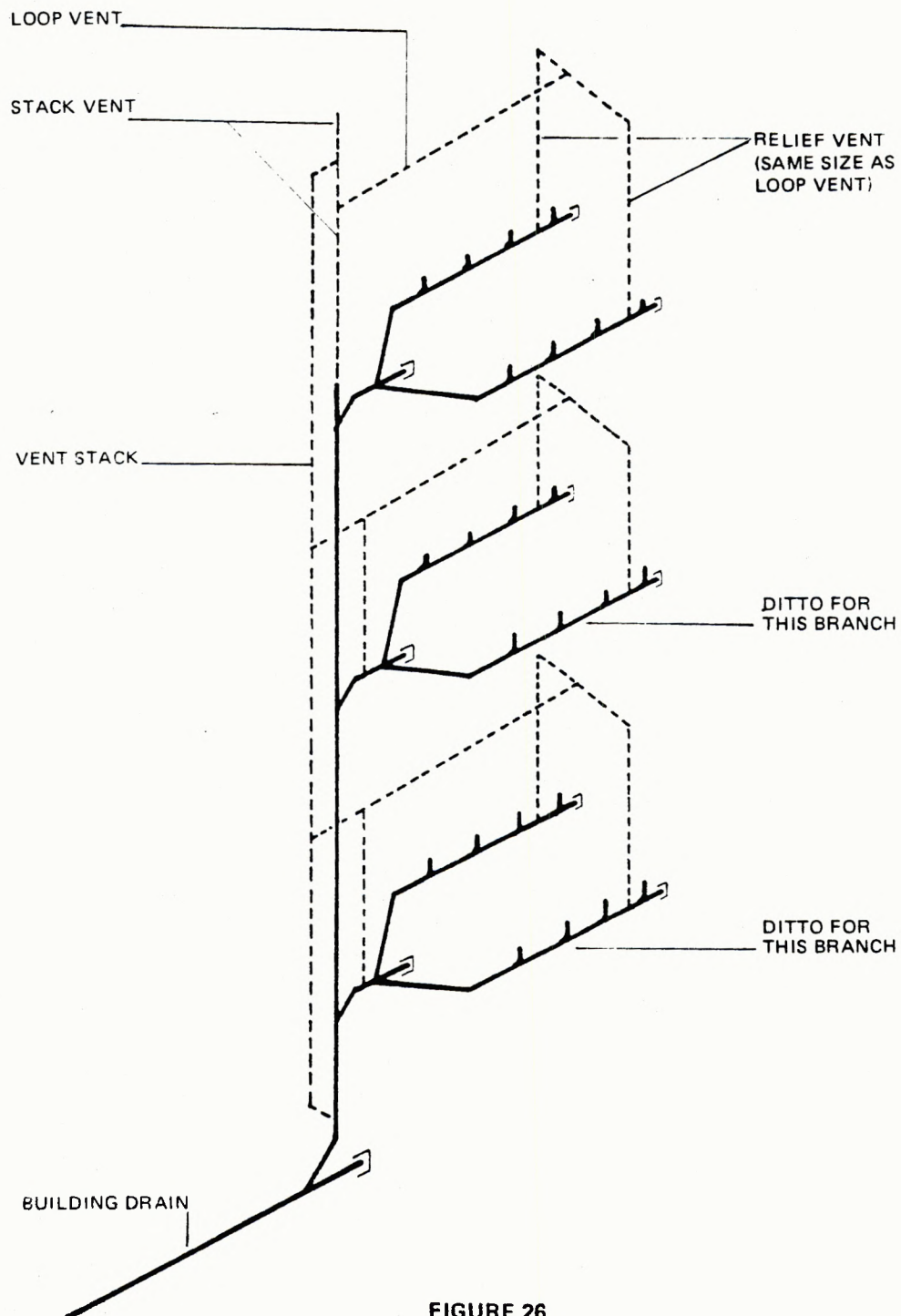
COMMON AND LOOP VENTING IN MULTI-STOREY BUILDINGS

FIGURE 26

- (1) where structural conditions preclude the installation of a conventional venting system (see Figures 27 and 28); and
- (2) where the street sewer is above the drainage system being installed, and where it is necessary to install a receiving sump, and discharge it by mechanical means (sewage ejector) (See Figure 29).

Note:

A combination waste and vent system is limited to floor drains and sink traps. Other plumbing fixtures should be roughed-in the usual way. Their discharge is to be carried separately to the building sewer or, it may be connected to the building drain on the sewer side of the combination waste and vent.

2.4 Venting of Floor Drains

A floor drain must be vented only if:

- a. the trap diameter is smaller than 75 mm (3 in.);
- b. the length of the fixture drain is less than 0.45 m (18 in.);
- c. the fall on the fixture drain exceeds its size and it is not loop vented.

Therefore, by choosing the correct diameter, length and fall of the fixture drain, a floor drain may not require any venting. Where possible, follow the recommendations in Figure 30, particularly when the floor drain has to be installed near a soil stack.

Note:

When a heavy flow occurs in the stack, an abnormal positive pressure develops at the turn into the horizontal section. The closer a floor drain is to the stack, the greater the disturbance, and the trap seal might be siphoned. Recommendations in Figure 30 would be less apt to cause trap seal disturbance.

Refer to Appendix A, examples 10, 13 and 15.

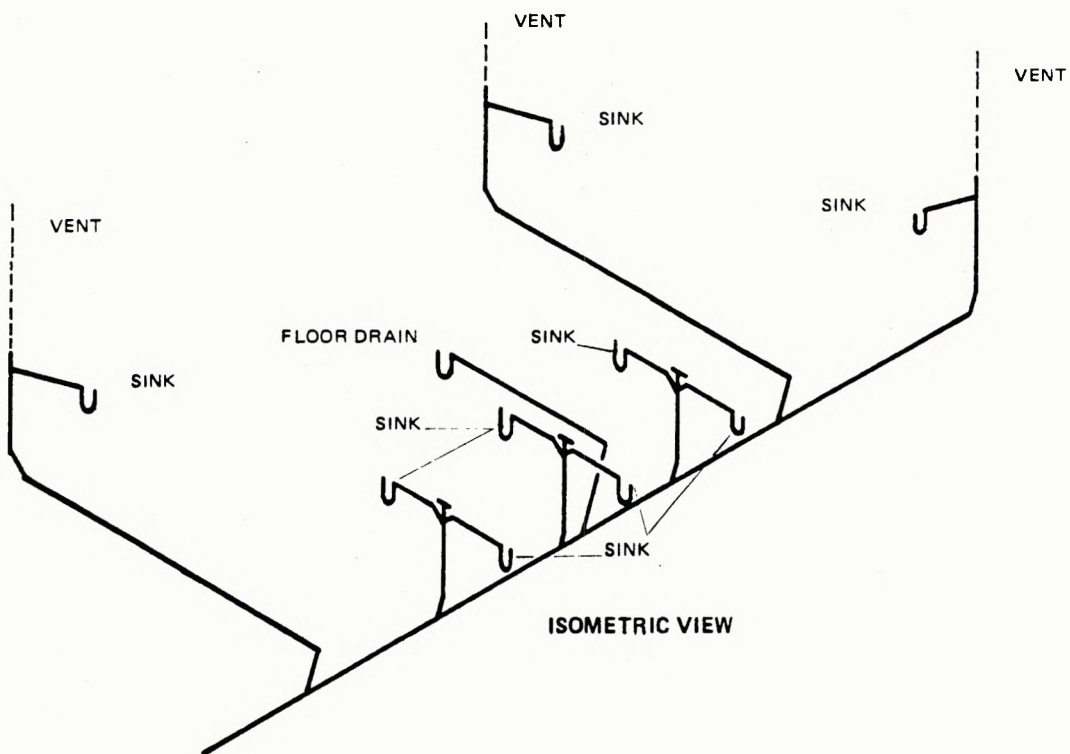
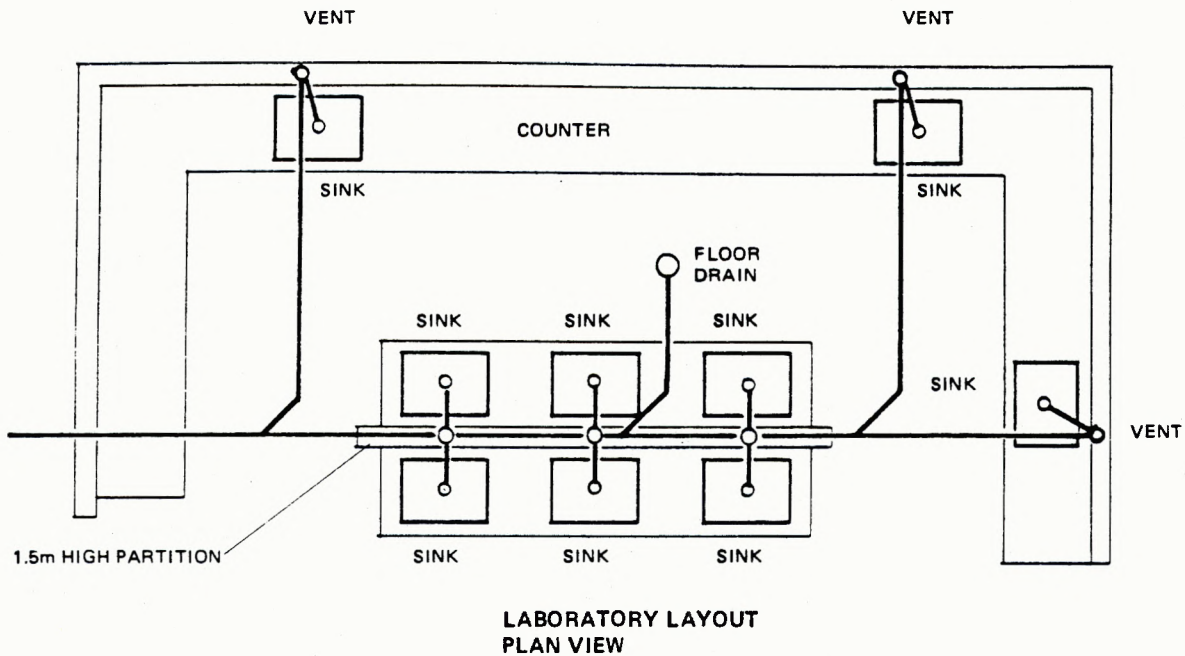
COMBINATION WASTE AND VENT SYSTEMS

FIGURE 27

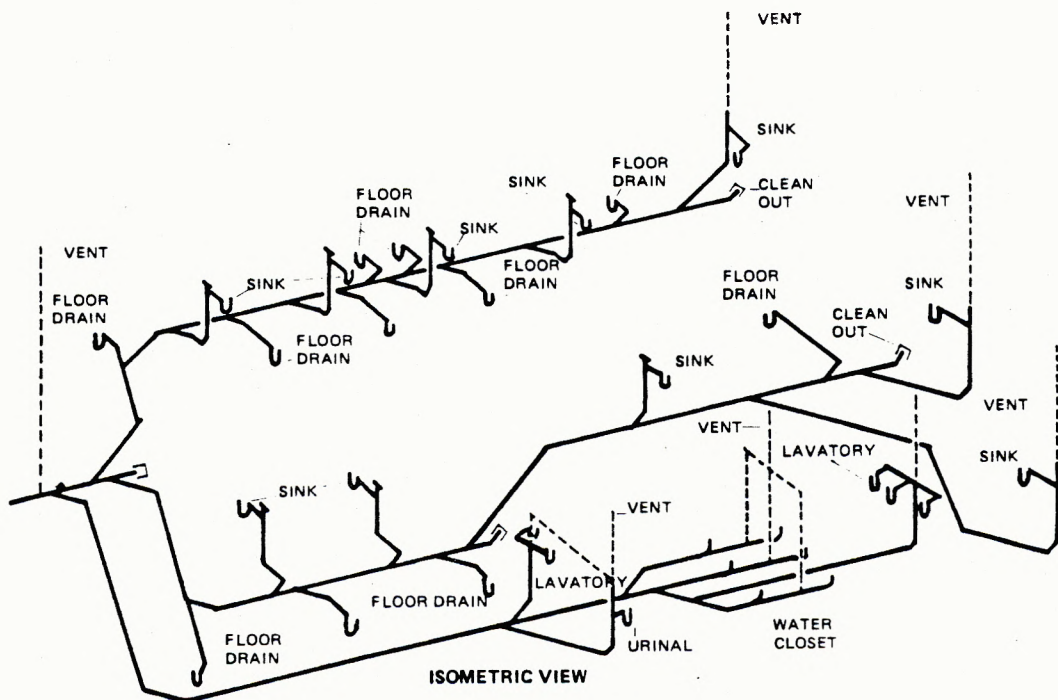
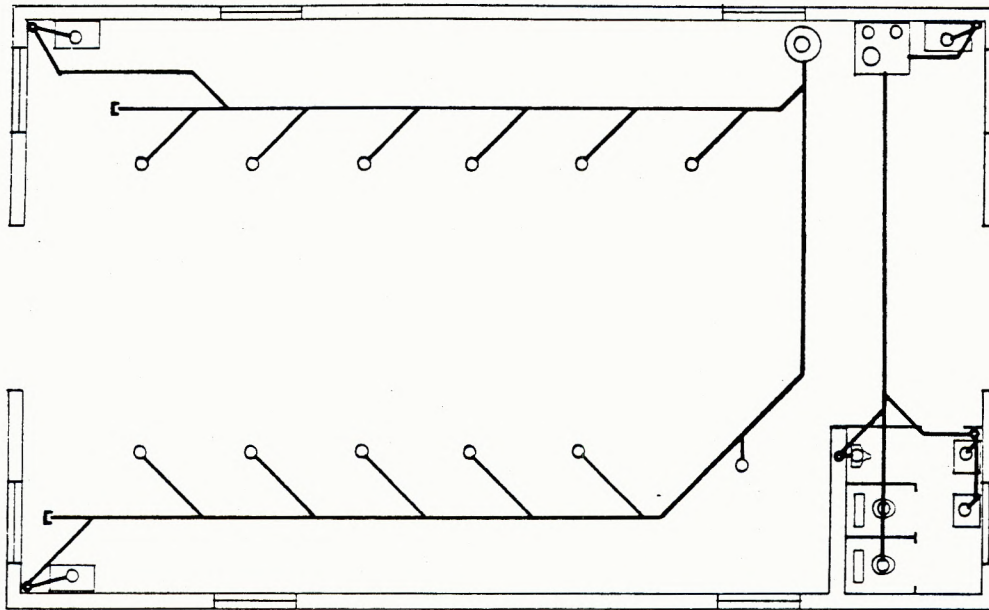


FIGURE 28

COMBINATION WASTE AND VENT SYSTEMS

PLAN VIEW

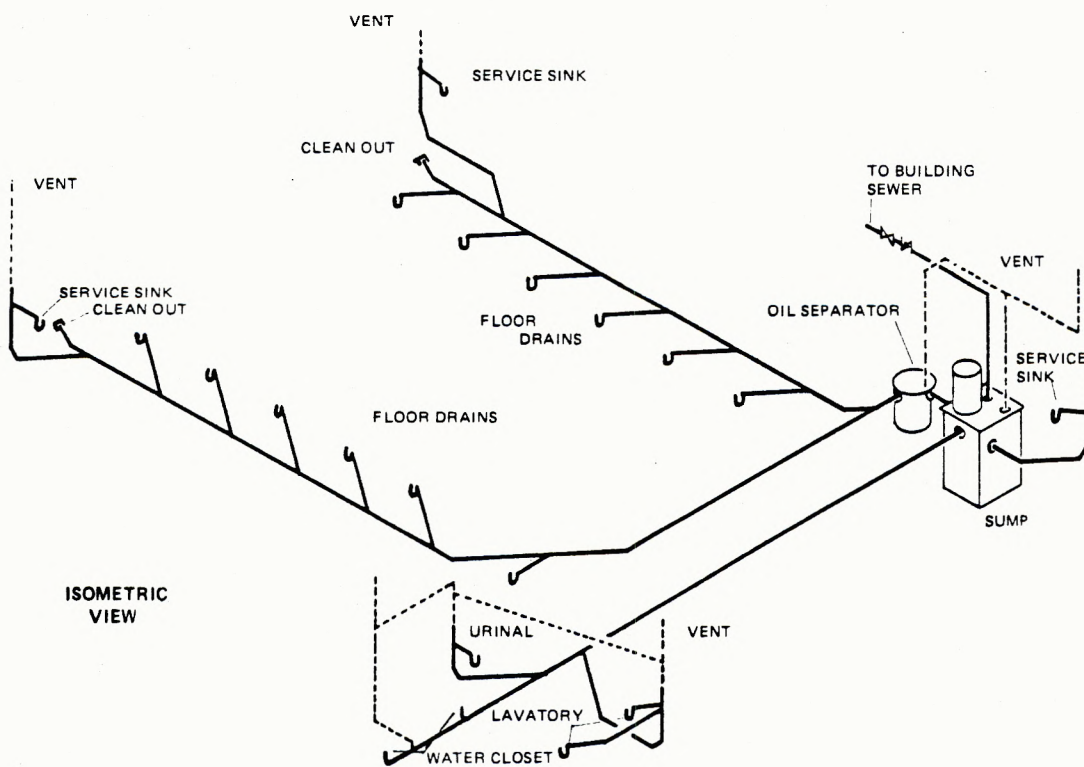
ISOMETRIC
VIEW

FIGURE 29

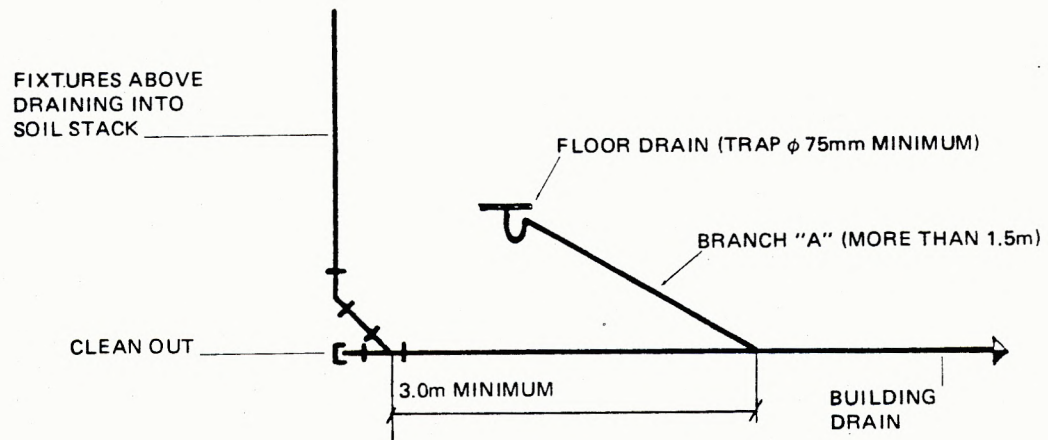
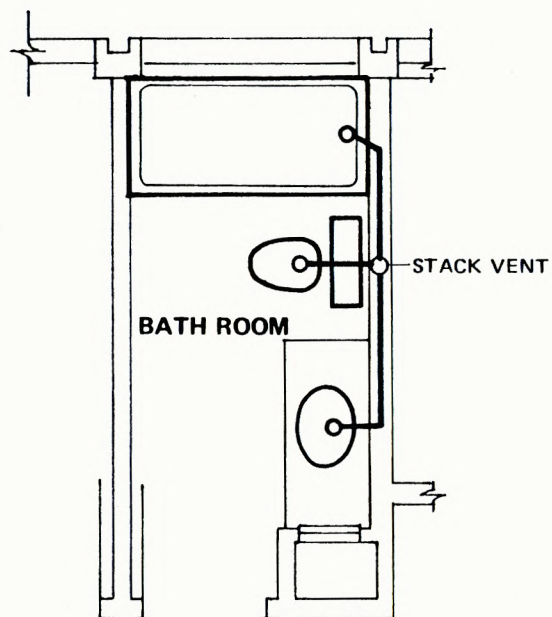
VENTING OF FLOOR DRAINS

FIGURE 30

EXAMPLES OF PLUMBING VENTING SYSTEMS IN DESIGNED OR
EXISTING DEPARTMENTAL BUILDINGS

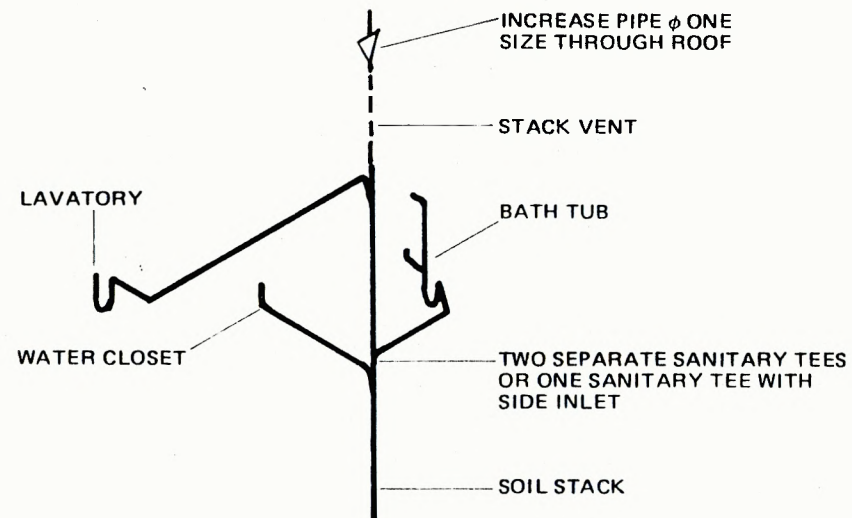


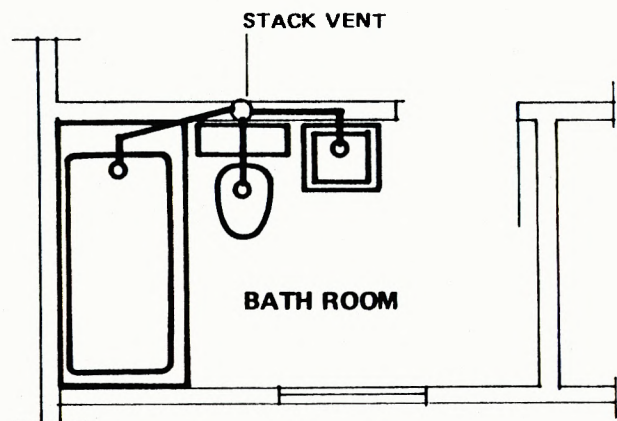
EXAMPLE NO 1

TYPICAL SINGLE BATHROOM STACK VENTING IN ONE STOREY BUILDING (STAFF RESIDENCE)

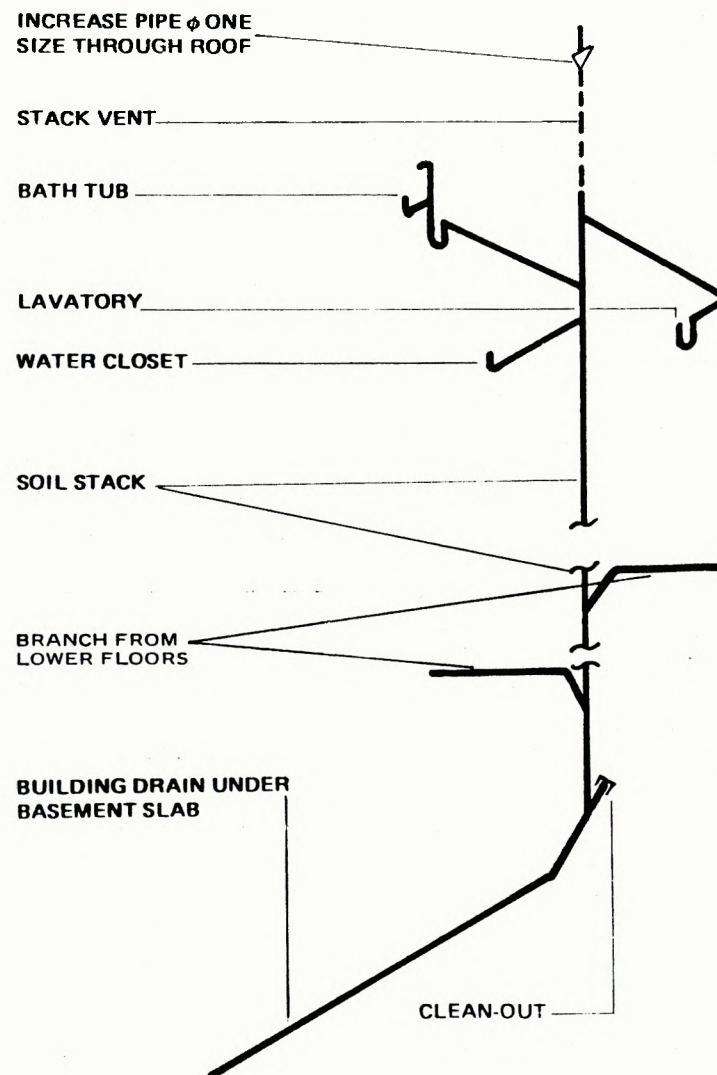
NOTE:

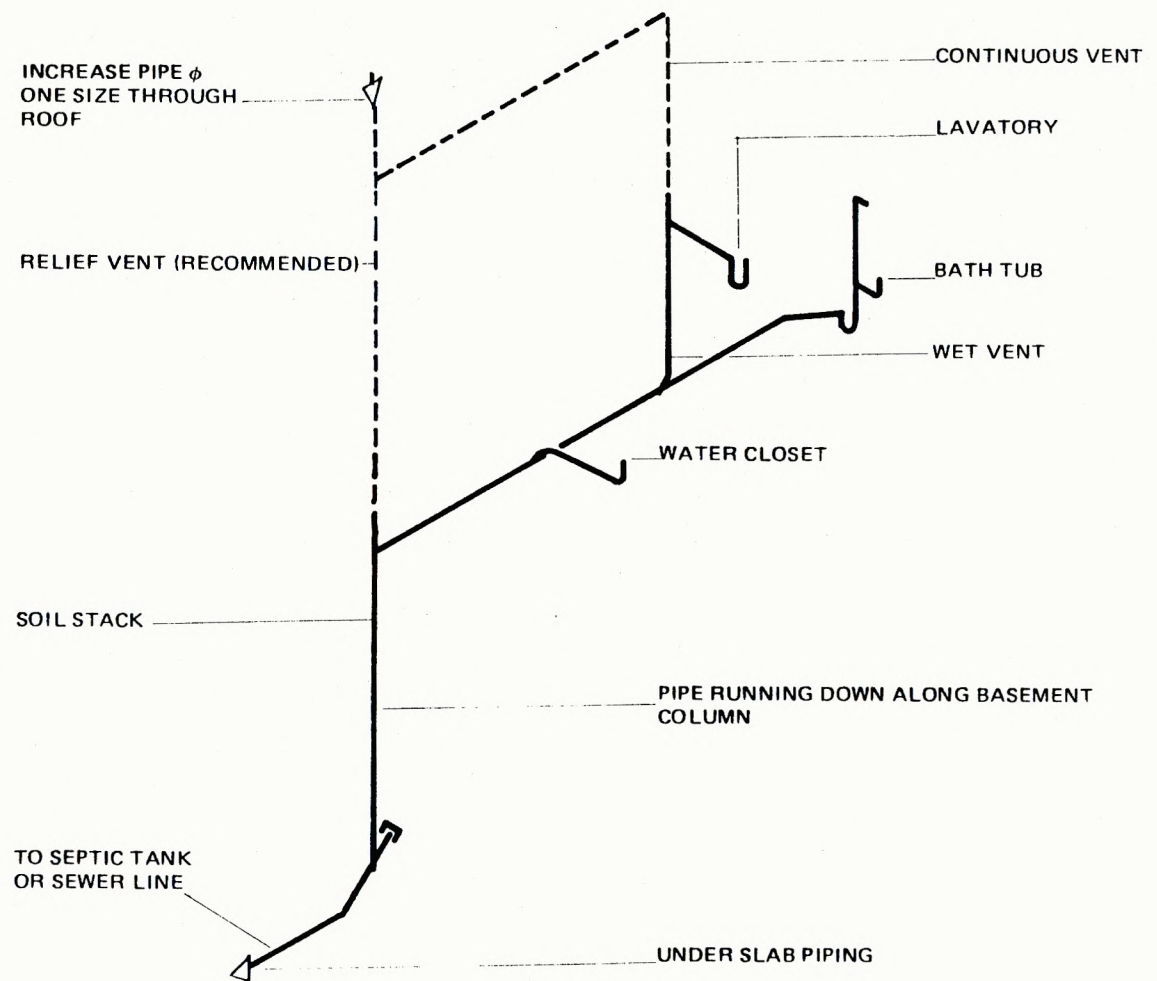
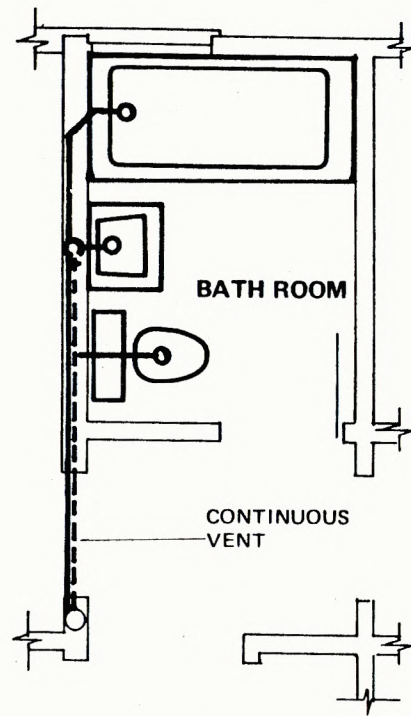
SAME DISPOSITION MAY BE USED ON TOP FLOOR OF A MULTISTOREY BUILDING

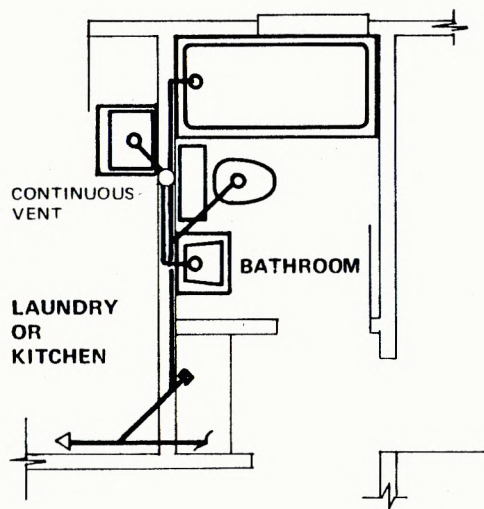




EXAMPLE Nº 2
TYPICAL STACK VENTING OF UPPER FLOOR
BATHROOMS IN ROW HOUSING UNITS

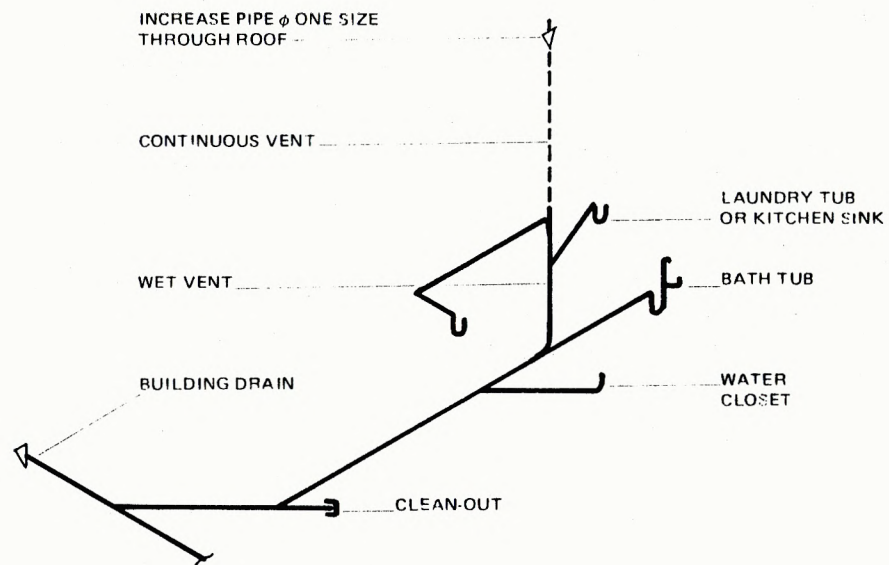


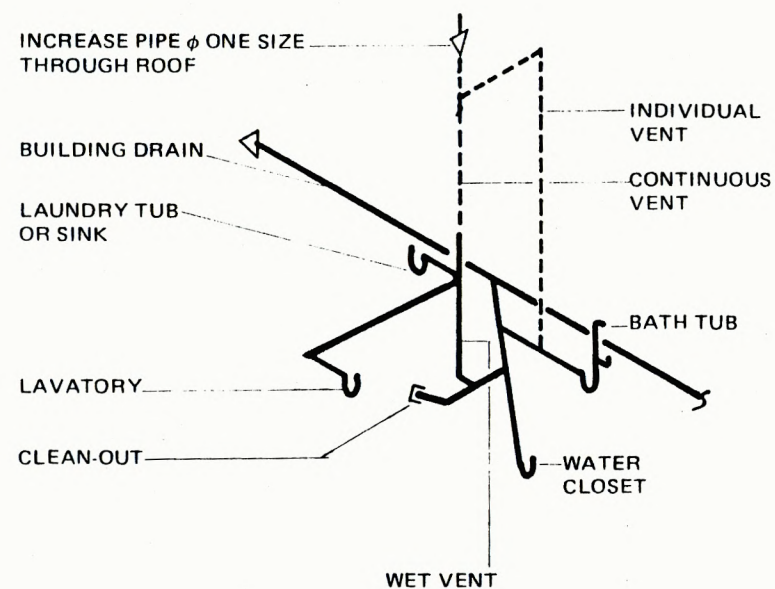
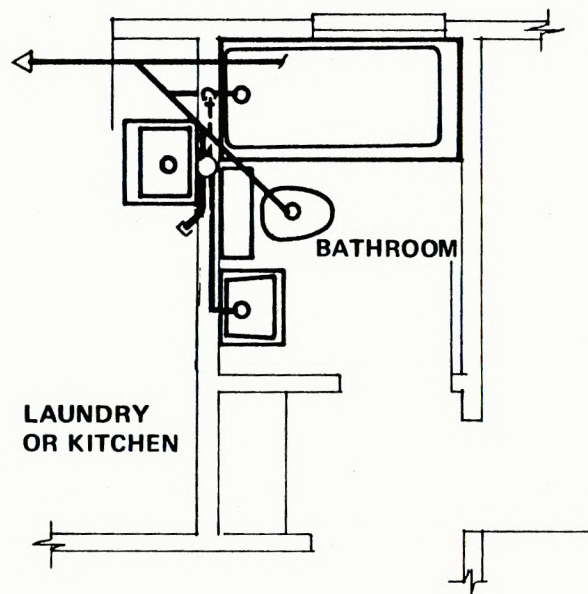
**EXAMPLE No 3****TYPICAL WET VENTING OF A BATHROOM IN STAFF RESIDENCE WITH BASEMENT**



EXAMPLE Nº 4

TYPICAL WET VENTING OF BATHROOM & EXTRA FIXTURE (LAUNDRY TUB OR SINK)
IN ONE STOREY HOUSE.

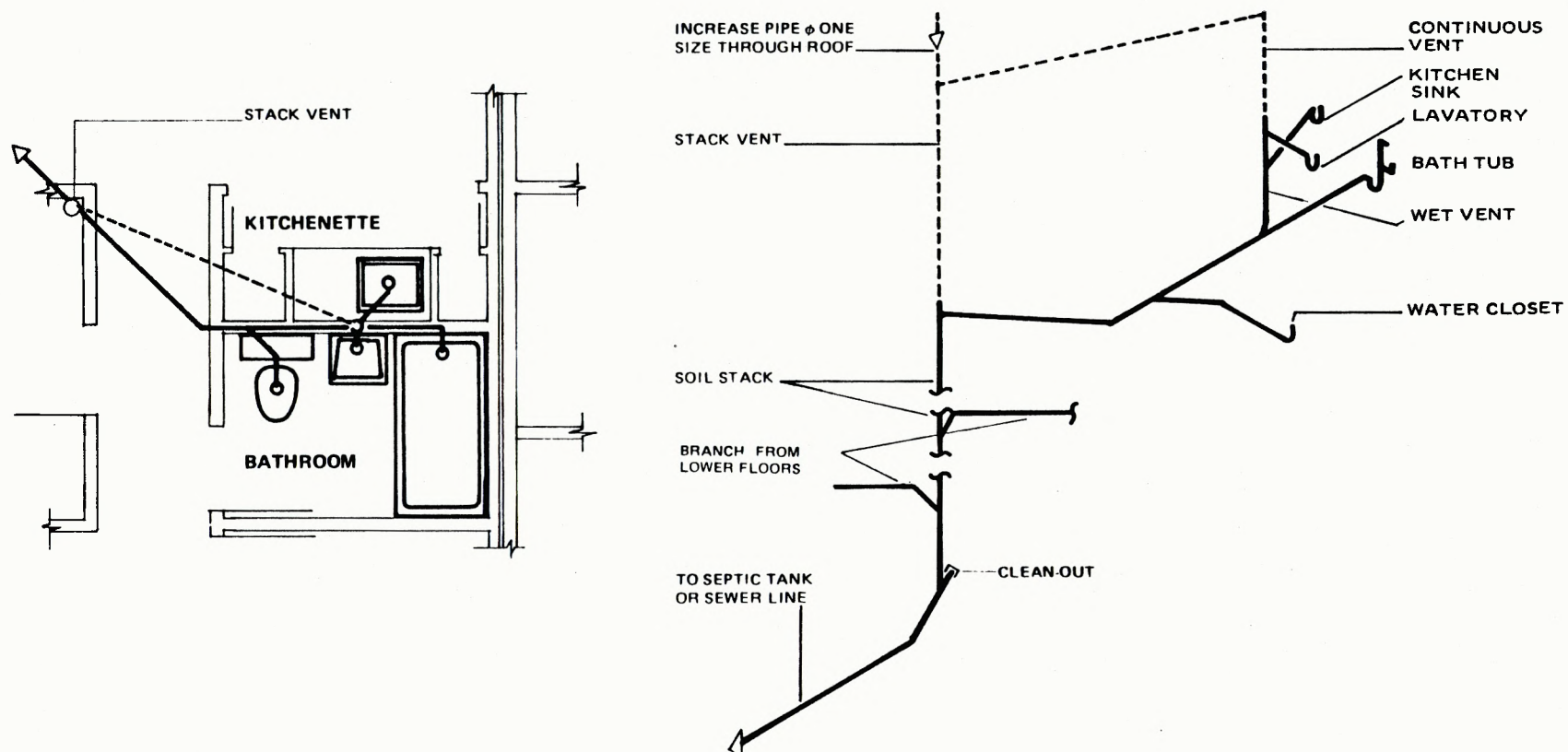


**EXAMPLE Nº 4A**

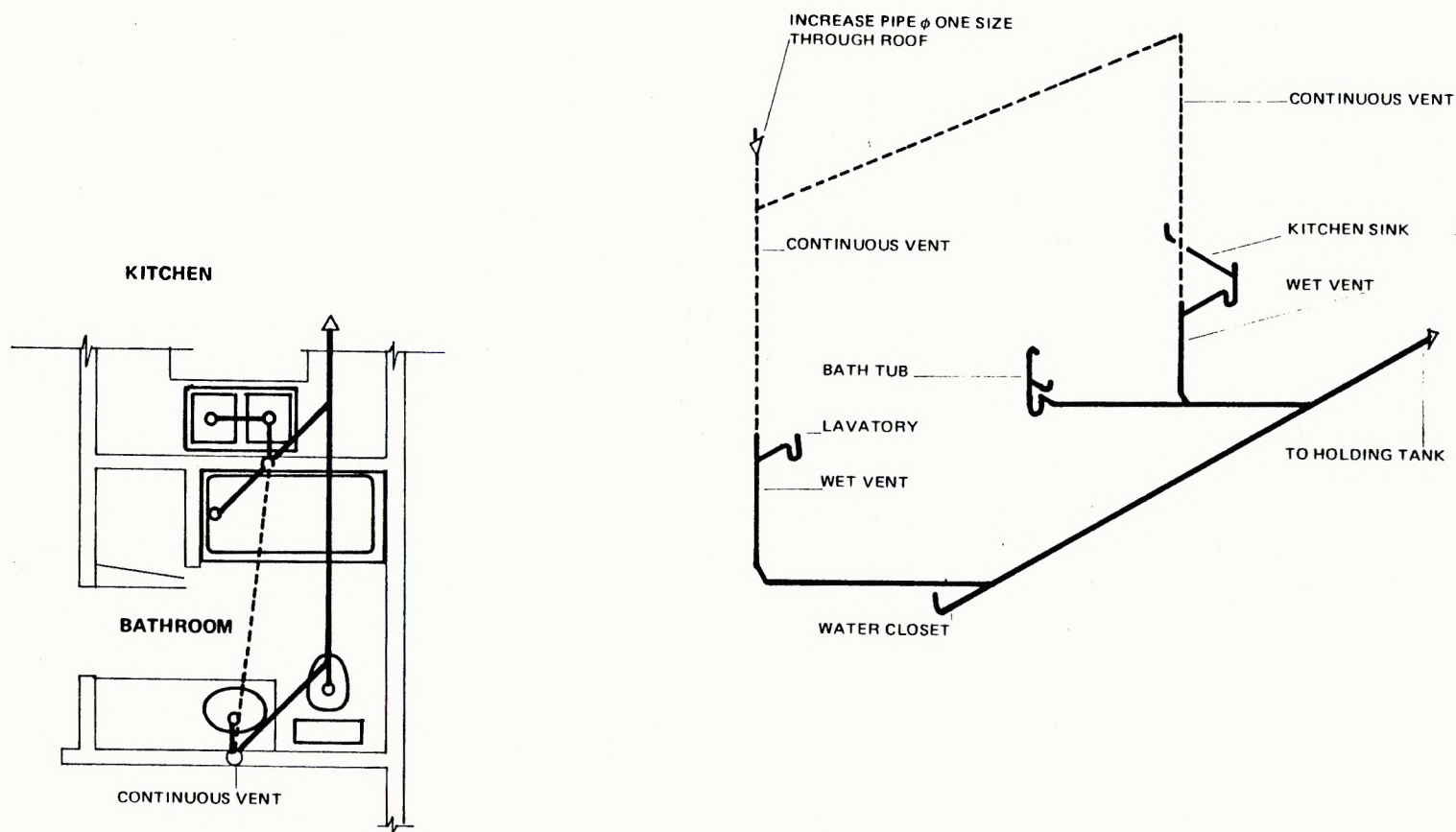
**TYPICAL COMBINED WET & INDIVIDUAL VENTING OF BATHROOM & EXTRA FIXTURE (LAUNDRY TUB OR SINK)
SAME AS EXAMPLE Nº 4 WITH BUILDING DRAIN LAYOUT ALTERNATIVE**

NOTE:

IN THIS CASE THE BATH TUB REQUIRES AN INDIVIDUAL VENT BECAUSE IT IS CONNECTED DOWN STREAM OF A WATER CLOSET.

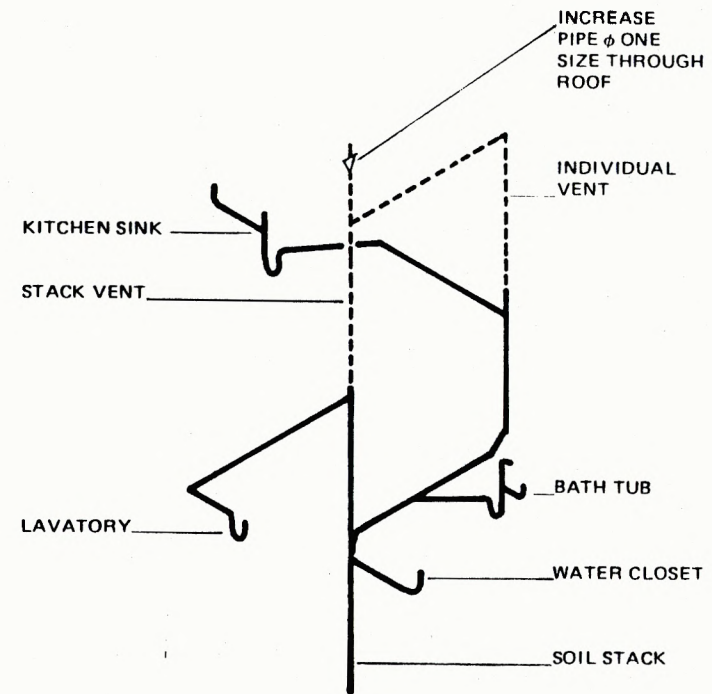
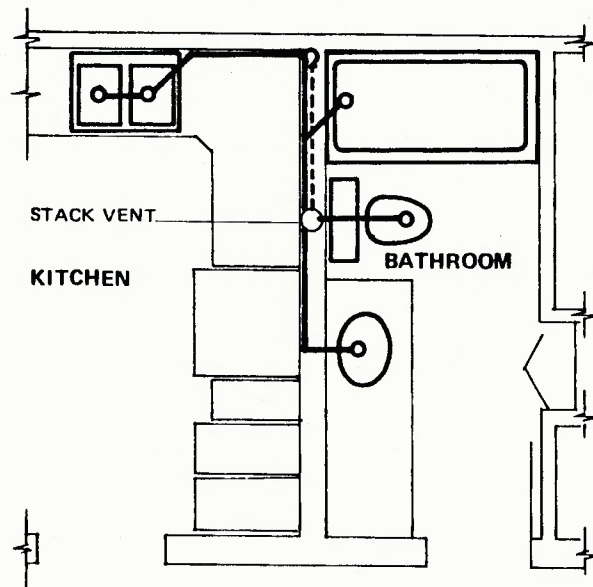


EXAMPLE N° 5
TYPICAL WET VENTING OF BATHROOM AND KITCHEN SINK IN THE UPPER FLOOR OF ROW HOUSING



EXAMPLE N° 6

TYPICAL WET VENTING OF KITCHEN & BATHROOM IN A STAFF HOUSE WITH HOLDING TANK

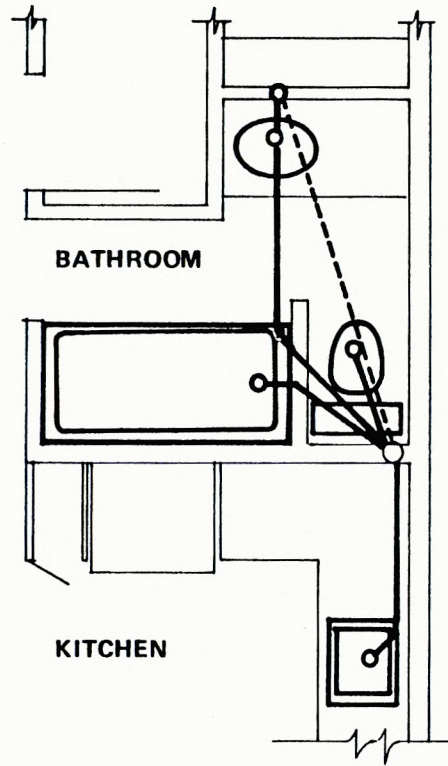


EXAMPLE Nº 7

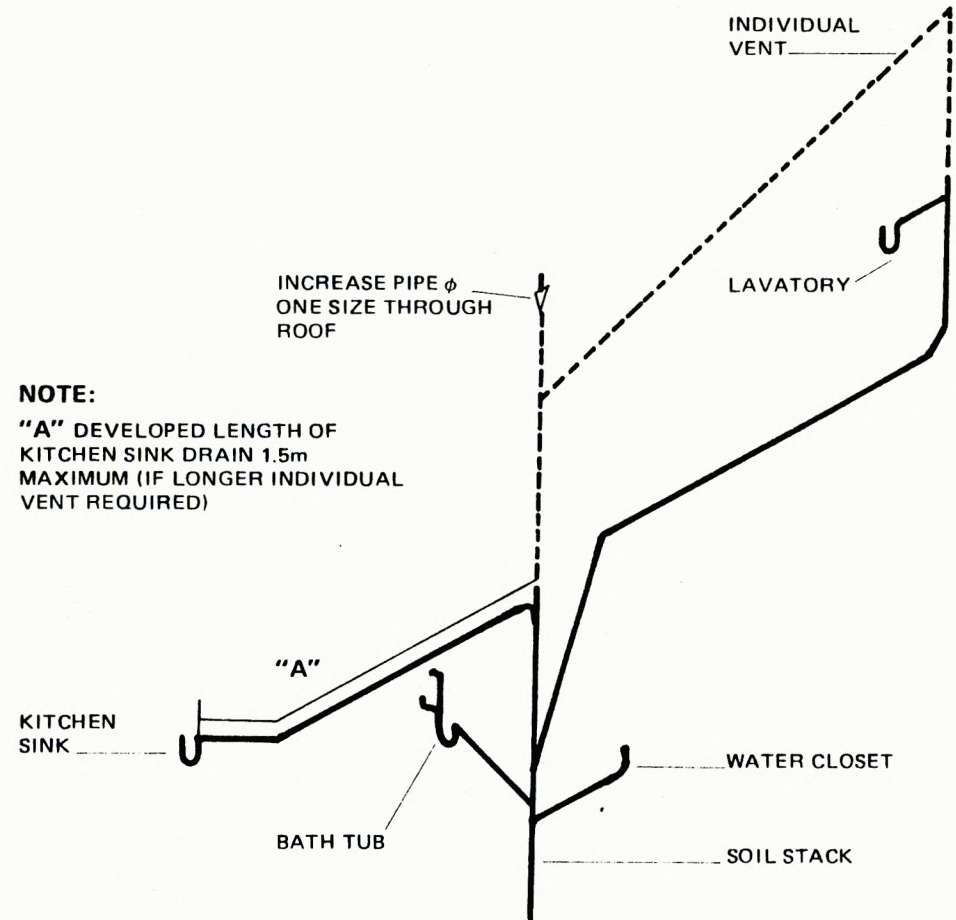
TYPICAL COMBINED STACK & INDIVIDUAL VENTING OF BATHROOM & KITCHEN FIXTURES IN A ONE STOREY RESIDENCE

NOTE:

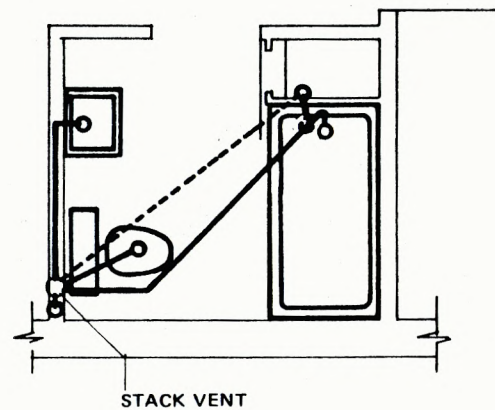
SAME DISPOSITION MAY BE USED ON TOP FLOOR OF A MULTISTOREY BUILDING

**NOTE:**

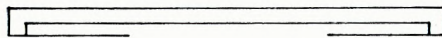
"A" DEVELOPED LENGTH OF
KITCHEN SINK DRAIN 1.5m
MAXIMUM (IF LONGER INDIVIDUAL
VENT REQUIRED)

**EXAMPLE Nº 8**

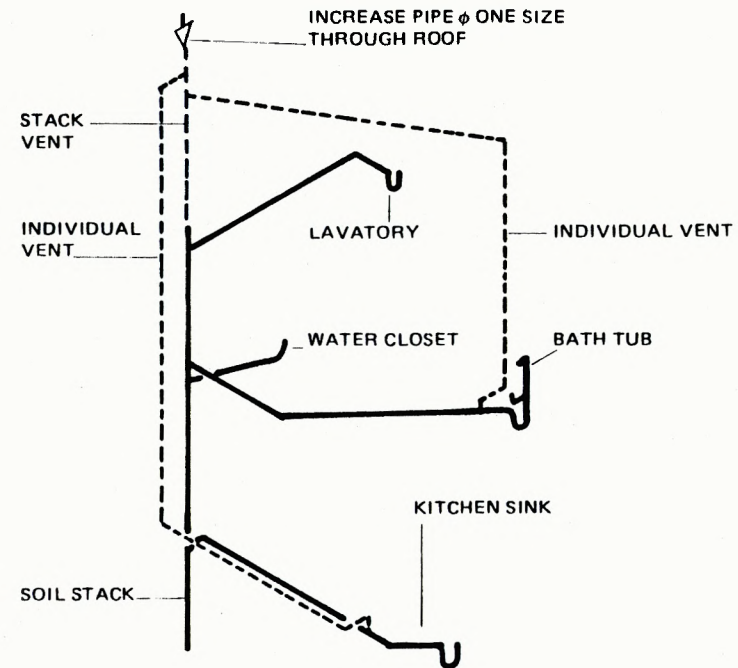
TYPICAL COMBINED STACK & INDIVIDUAL VENTING OF BATHROOM & KITCHEN FIXTURES IN A RESIDENCE



BATHROOM (UPPER FLOOR)



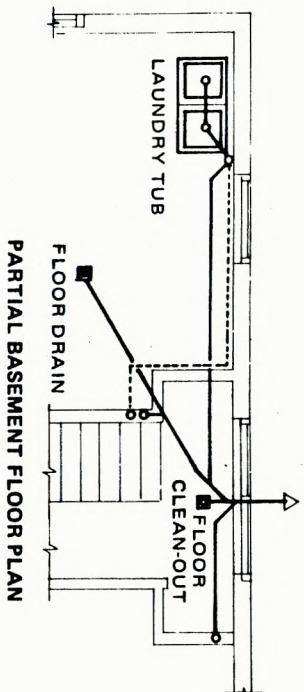
KITCHEN (LOWER FLOOR)

**NOTES:**

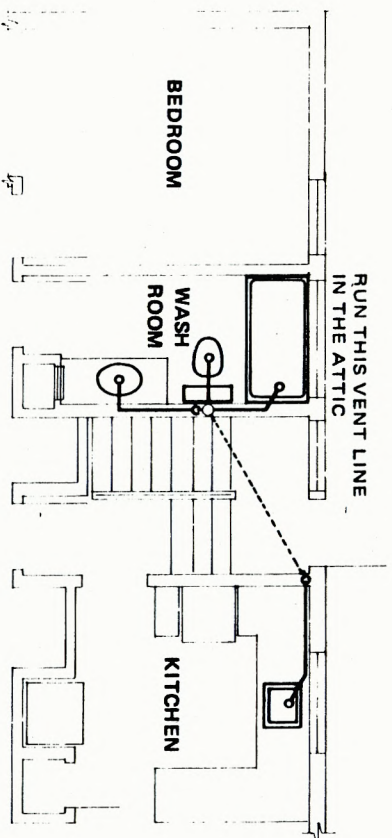
- WATER CLOSET & LAVATORY ARE STACK VENTED
- IF DEVELOPPED LENGTH OF BATH TUB FIXTURE DRAIN IS SHORTER THAN 1.5m, THE INDIVIDUAL VENT IS NOT NECESSARY

EXAMPLE Nº 9

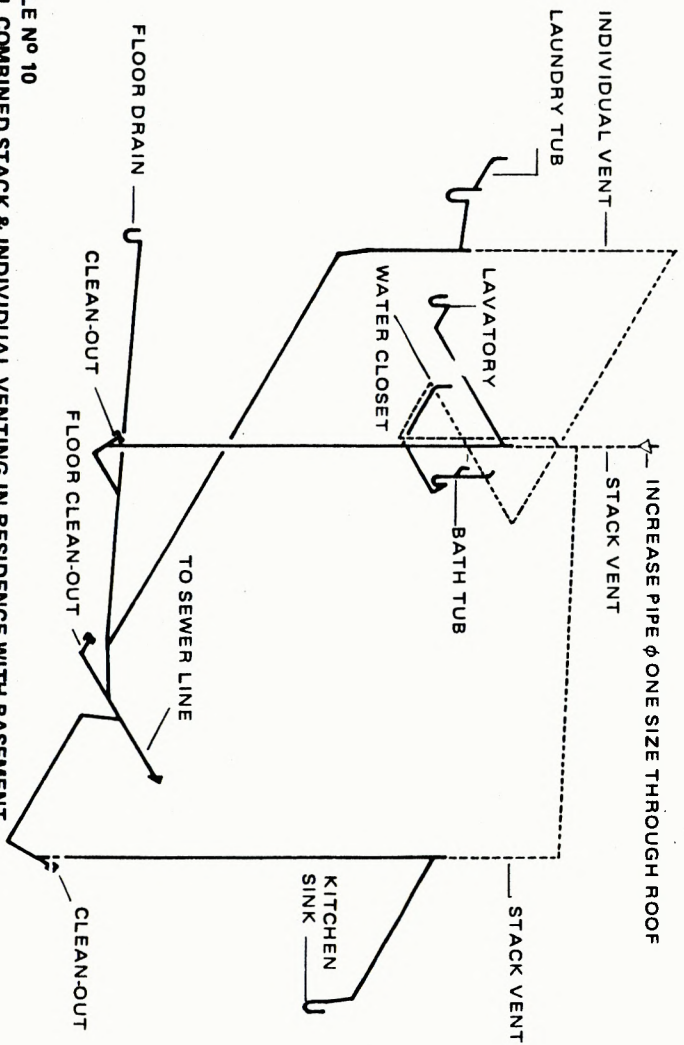
TYPICAL COMBINED STACK & INDIVIDUAL VENTING OF BATHROOM & KITCHEN FIXTURES IN A ROW HOUSING UNIT



PARTIAL BASEMENT FLOOR PLAN



PARTIAL FIRST FLOOR PLAN

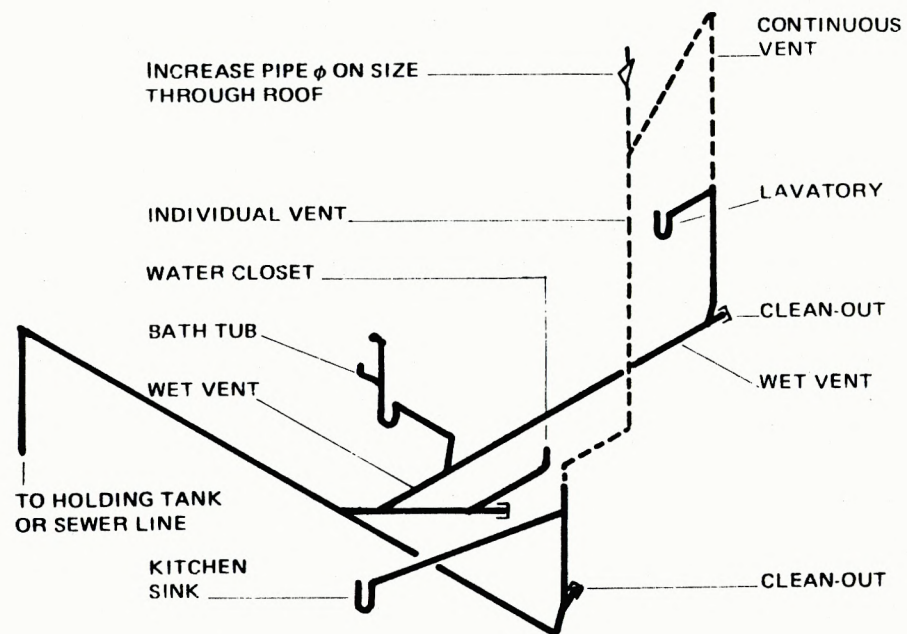
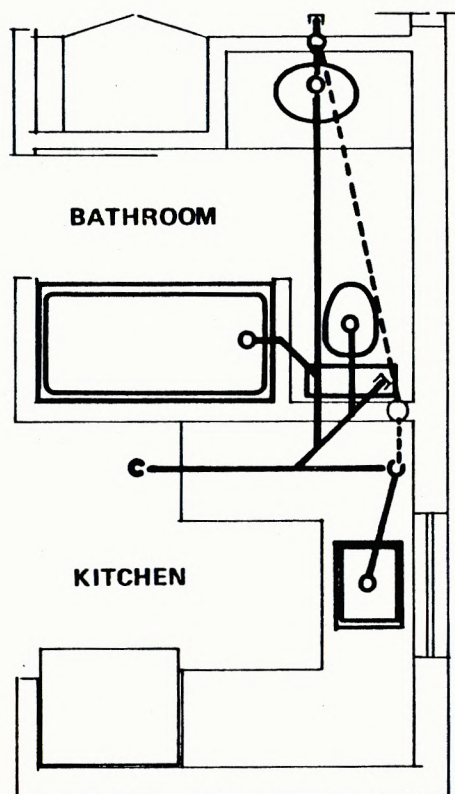


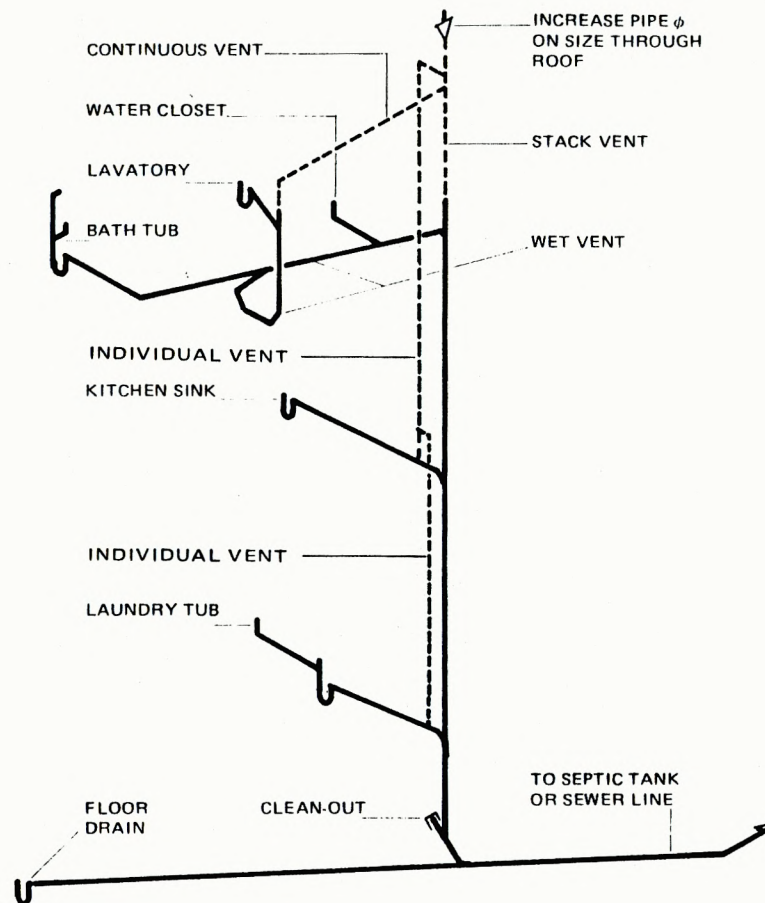
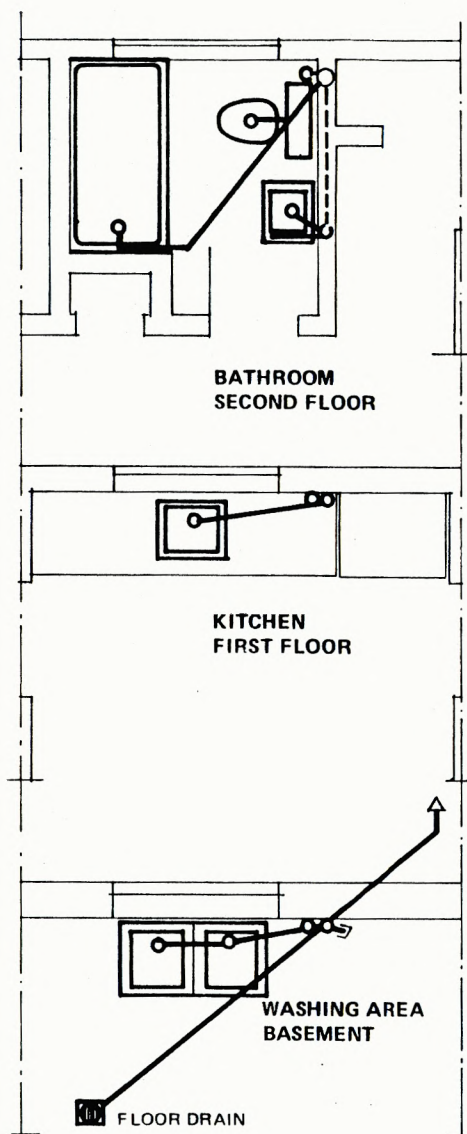
EXAMPLE No 10

TYPICAL COMBINED STACK & INDIVIDUAL VENTING IN RESIDENCE WITH BASEMENT

NOTES:

- 1) WASHROOM FIXTURES ARE STACK VENTED
- 2) IF DEVELOPED LENGTH OF KITCHEN SINK FIXTURE DRAIN LONGER THAN 1.5m AN INDIVIDUAL VENT BETWEEN THE STACK VENT & THE SINK TRAP IS REQUIRED
- 3) INSTALL A 75mm ϕ FLOOR DRAIN TO AVOID VENTING (SEE PAR. 2.4)

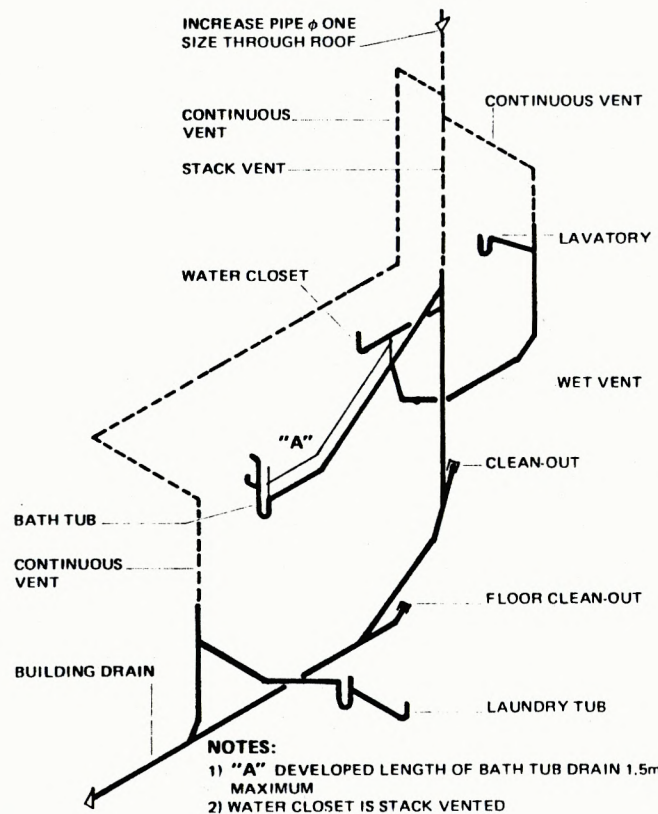
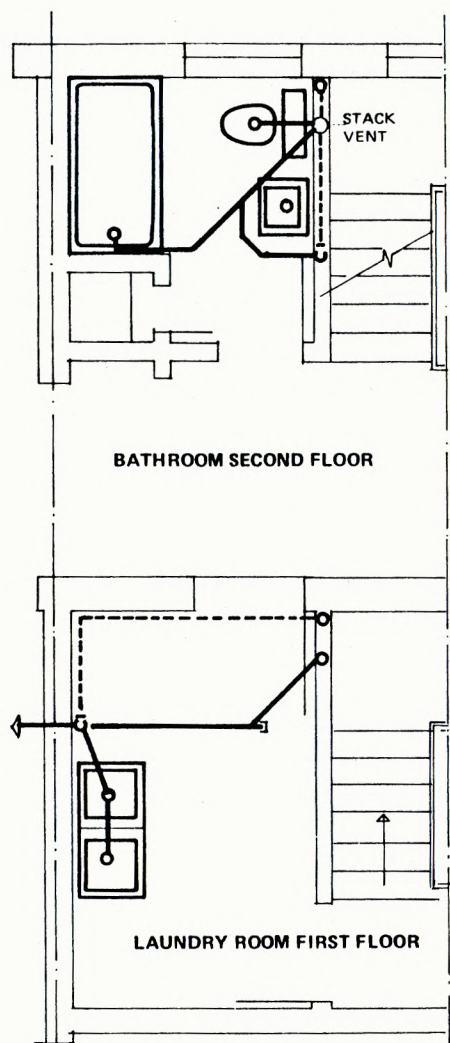
**EXAMPLE Nº 11****TYPICAL COMBINED WET & INDIVIDUAL VENTING OF BATHROOM & KITCHEN FIXTURES IN A PREFABRICATED HOUSE**



NOTE:
INSTALL A 75mm ϕ FLOOR DRAIN TO AVOID VENTING
(SEE PARAGRAPH 2.4)

EXAMPLE NO 12

TYPICAL COMBINED WET & INDIVIDUAL VENTING IN TWO STOREY RESIDENCE



EXAMPLE Nº 13
PARTIAL COMBINED STACK & WET VENTING IN A RESIDENCE

