



4.1 Rainwater Gutters

A rain gutter is used for collecting rainwater from the roof. The collected rainwater flows through an outlet drain that is connected by a pipe to the rainwater container (jar/tank). The rain gutter can be made from various materials depending on local availability, such as:

- Galvanized iron sheet
- Bamboo
- Wood (join 2-3 pieces of wood together and fill the joints with tar or cover the joints with plastic sheet)

a. Galvanized iron gutter

Commercially available galvanized iron gutter is made in different shapes such as semi-circular, trapezoid, etc.

b. Bamboo gutter

Bamboo gutter is commonly used where bamboo is available. It is easy to make and install.

c. Wooden gutter

A wooden gutter is made by joining pieces of wood (2.5 centimetres thick by 6 centimetres wide, or 1.2 centimetres thick by 15 centimetres wide) into a "V" shape. Fill the joints with a mixture of tar and lime or with resin. Sometimes, plastic sheet is used to cover the joints. There is no need to fill them.

4.2 The Gutter Holder

The function of a gutter holder is to secure the gutter to the roof structure at certain intervals. A gutter holder can be made using iron sheet, wood and tree twigs.

4.3 Sizes of Rain Gutter and Outlet Drain

The roof area and slope determine the size of rain gutter. The diameter of the outlet drain is proportional to the roof area and the width of the gutter. An appropriate gutter width and outlet drain diameter corresponding to the roof areas are shown in [Table 4-1](#).

Table 4-1: Appropriate Width of Gutter and Diameter of Outlet Drain and Various Roof Areas

ROOF AREA, sq. m	GUTTER WIDTH, cm	OUTLET DRAIN dia., cm
50	12	6.5
60	13	6.5
70	14	6.5
80	15	7.5
90	16	7.5
100	17	7.5

a. *Depth of gutter*

The depth of the gutter is one-half of the gutter width. For example, if the gutter is 14 centimetres wide, then the depth is 7 centimetres.

b. *Diameter of outlet drain*

The diameter of the outlet drain is proportional to the volume of rainwater collected in the gutter. The rainwater would overflow if the outlet drain were too small. Recommended diameter of the outlet drain is shown in **Table 4-1**.

4.4 Fixing the Rain Gutter to the Roof Structure

Different ways of fixing various types of rain gutter to the roof structure are illustrated in the following figures.

a. *Fixing the galvanized iron gutter*

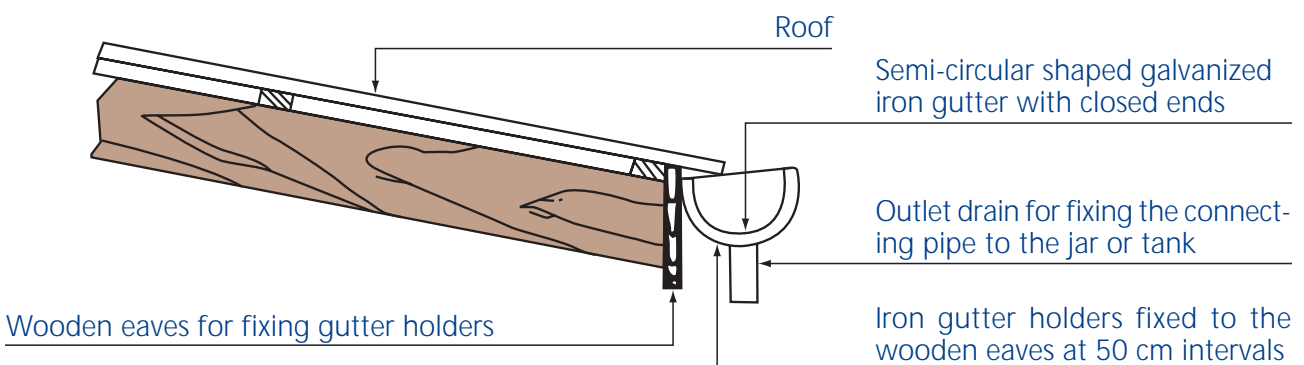


Figure 4.1: Fix the semi-circular shape galvanized iron gutter to wooden roof structure using iron gutter holders.

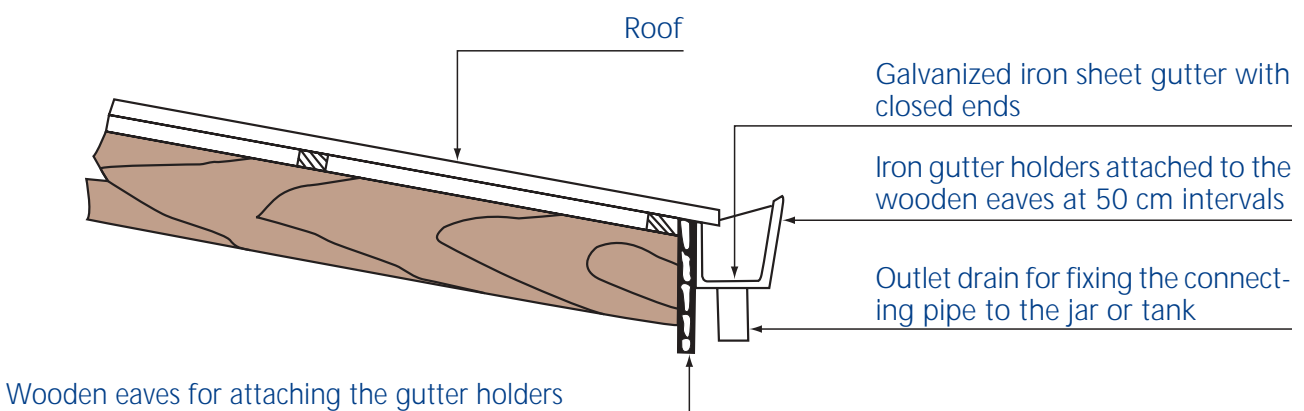


Figure 4-2: Fix the "U" shape galvanized iron sheet gutter to wooden roof structure using the iron gutter holders.

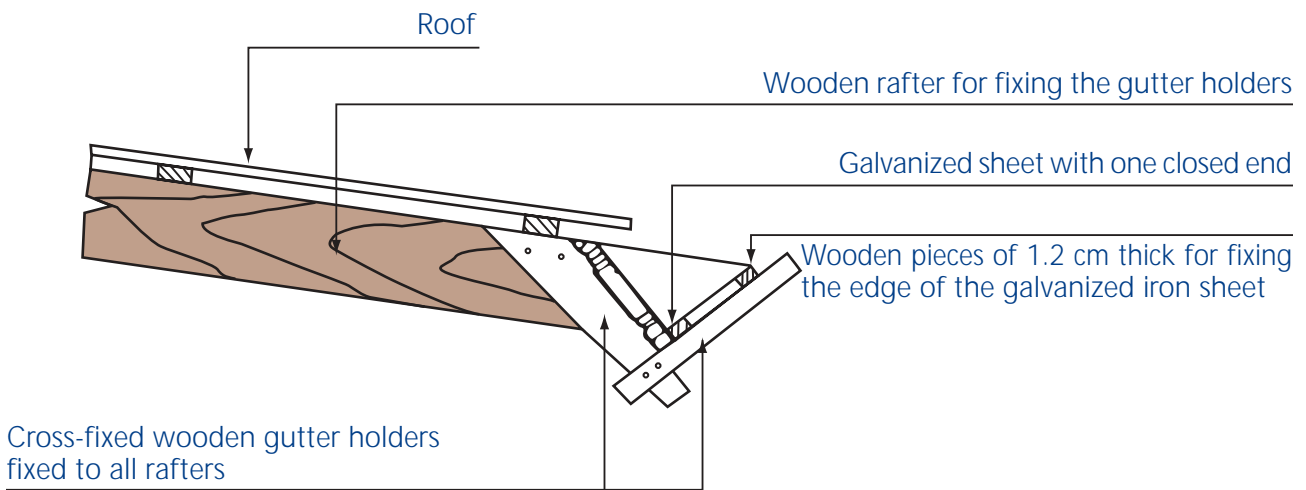


Figure 4-3: Fix the "V" shape galvanized iron sheet gutter to wooden structure using the wooden gutter holders.

b. Fixing the bamboo gutter

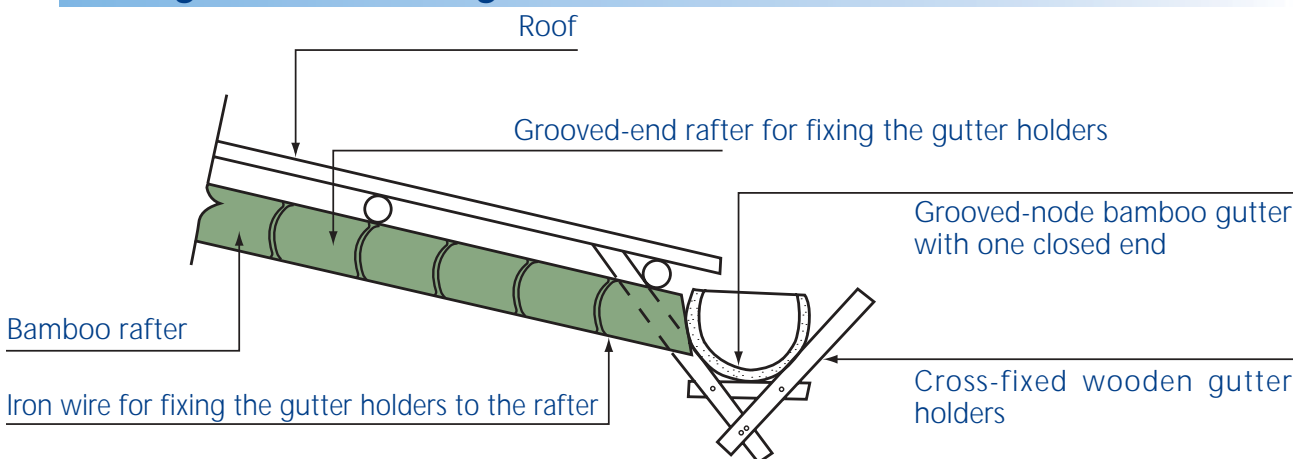


Figure 4-4: Fix the bamboo gutter to the bamboo roof structure using cross-fixed wooden gutter holders.

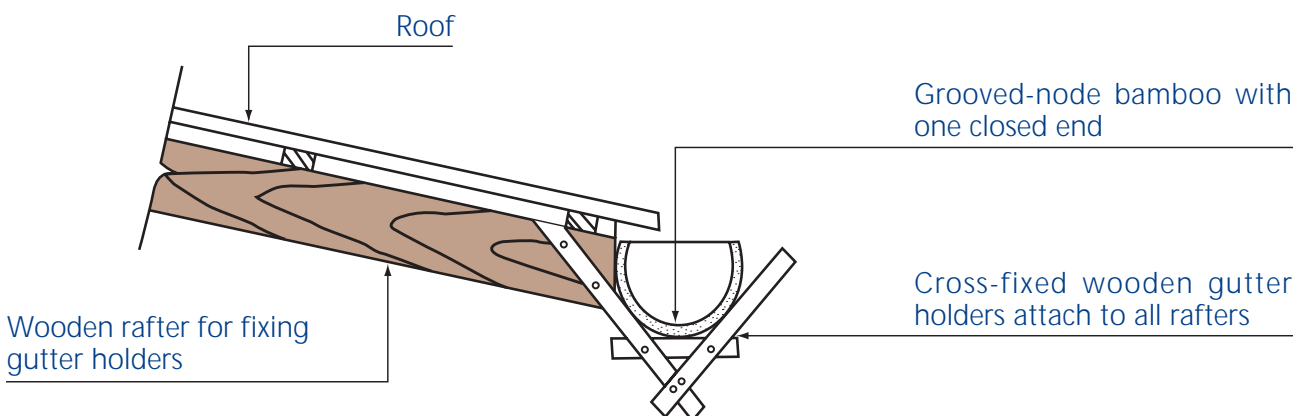


Figure 4-5: Fix the bamboo gutter to wooden roof structure using cross-fixed wooden gutter holders.

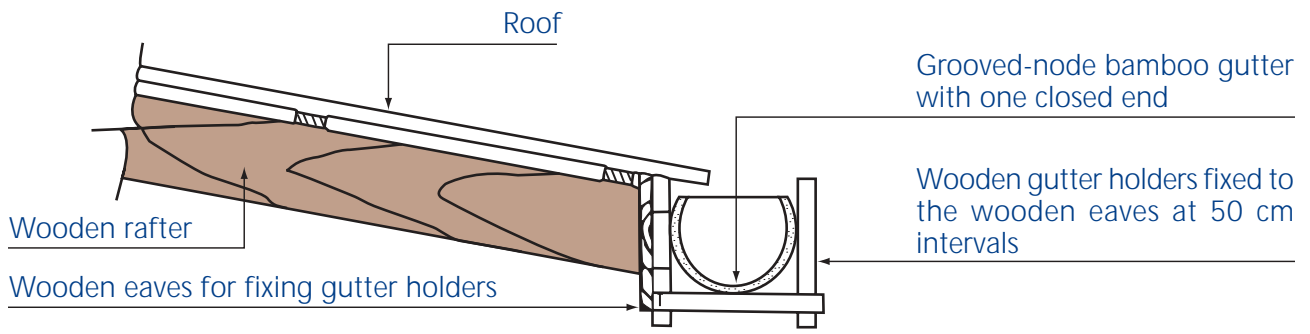


Figure 4-6: Fix the bamboo gutter to wooden roof structure using wooden eaves.

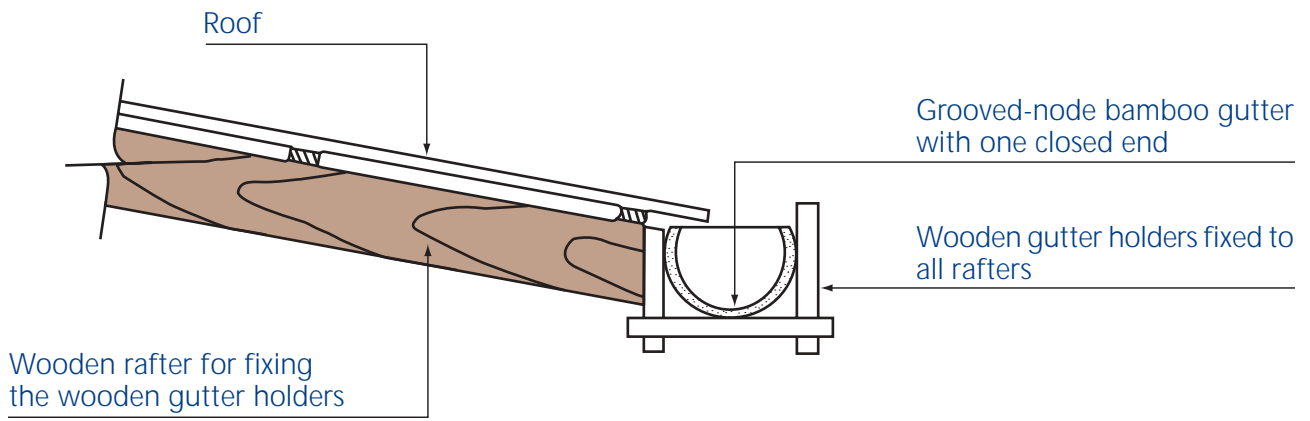


Figure 4-7: Fix the bamboo gutter with wooden gutter holders to wooden roof structure without eaves.

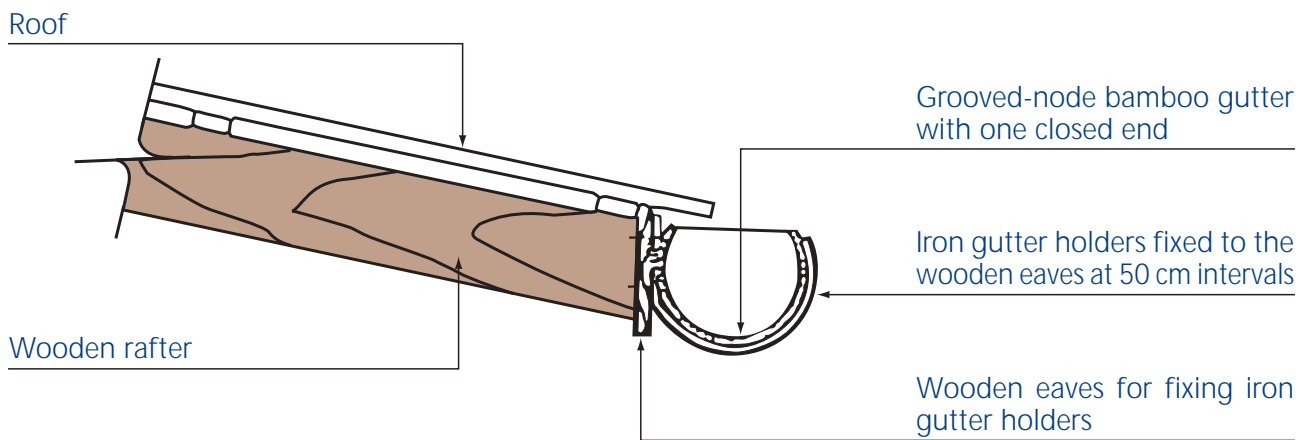


Figure 4-8: Fix the bamboo gutter with iron gutter holders to wooden roof structure using wooden eaves.

c. **Fixing the wooden gutter with plastic sheet to cover joints**

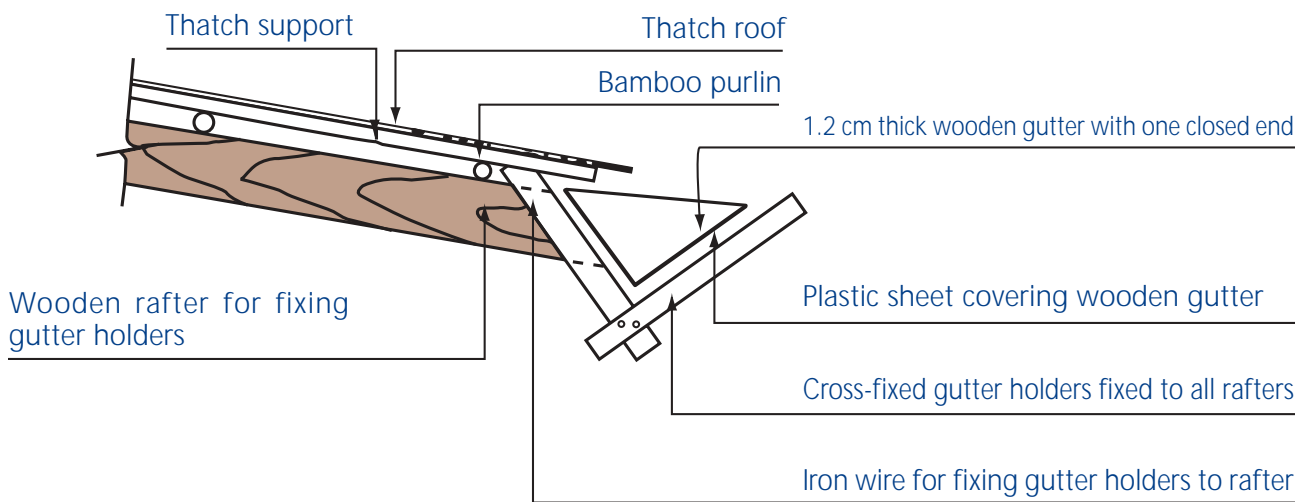


Figure 4-9: Fix the "V" shape wooden gutter to bamboo roof structure.

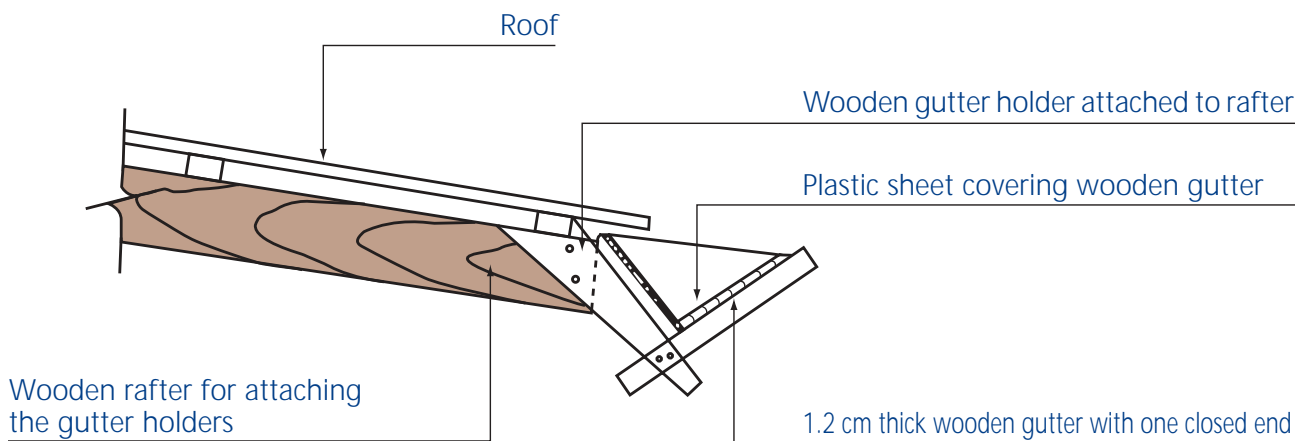


Figure 4-10: Fix the "V" shape wooden gutter to wooden roof structure.

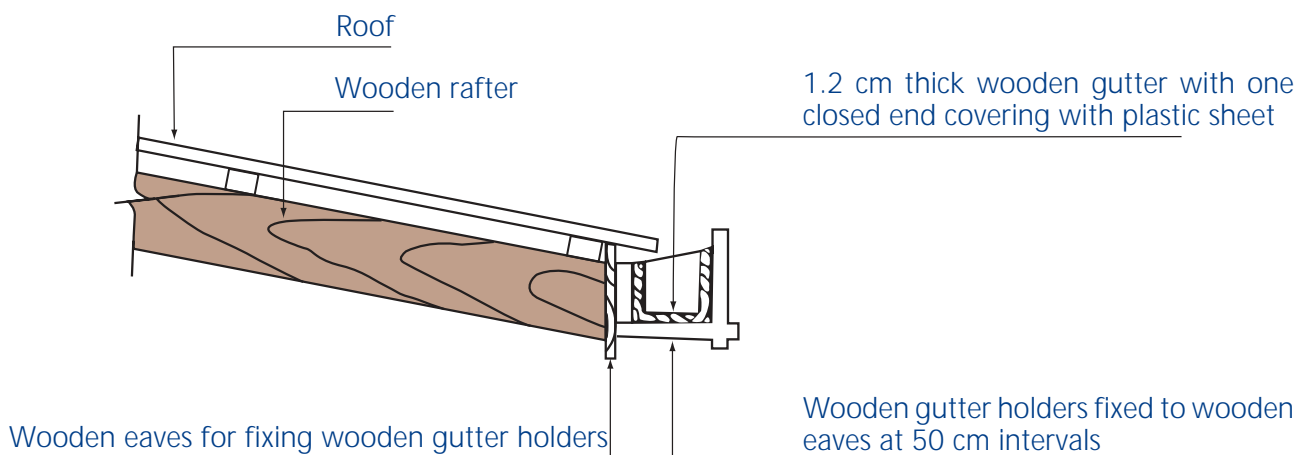


Figure 4-11: Fix the "U" shape wooden gutter to wooden roof structure.

4.5 Making Tree Twig Gutter Holder

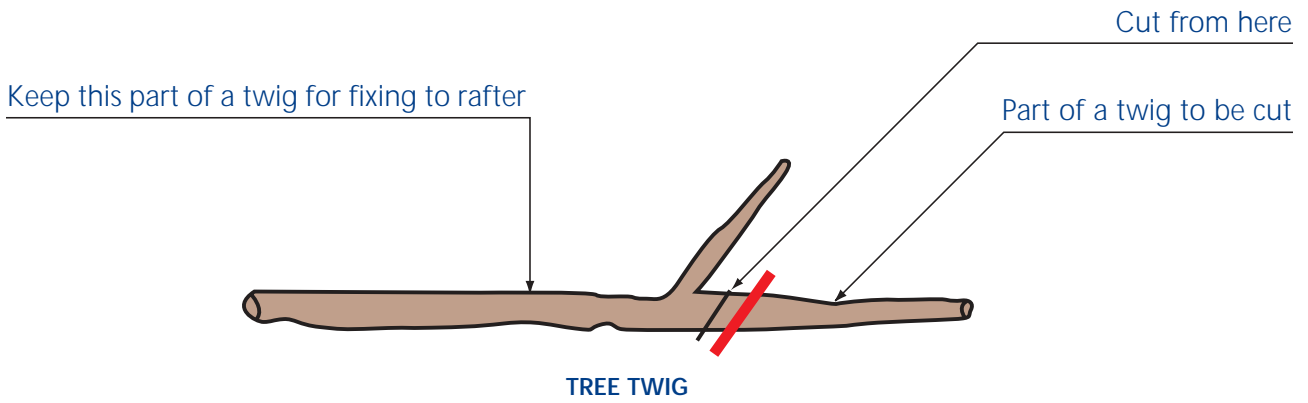


Figure 4-12: Details of making tree twig gutter holder.

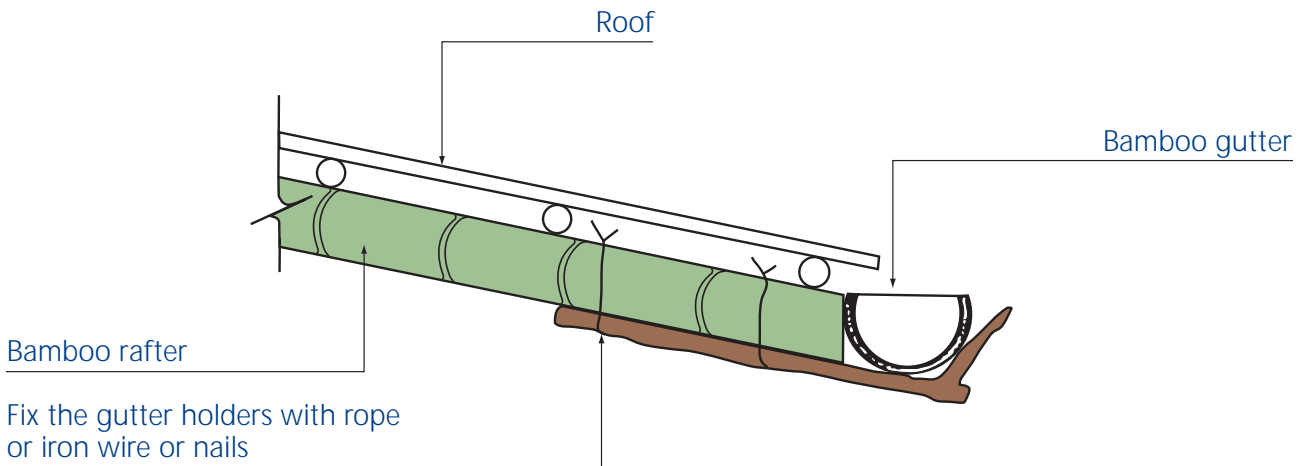


Figure 4-13: Fix the tree twig gutter holders to the roof structure.

5. RAINWATER JARS AND TANKS IN USE IN THAILAND



Millions of households in rural Thailand have been collecting rainwater for drinking and domestic purposes. The rainwater jars and tanks are produced by the private sector and are readily available in the local market. Many families buy the rain jar and tank as and when needed over a period of time until they have got adequate storage capacity to collect the rainwater for household use. A rain jar of 2000 litres and a tank of 3200 litres currently cost about Thai Bahts 900-1000 (US\$ 20-25) and Thai Bahts 1100-1200 (US\$ 25-30) respectively, including the delivery charge through waterways in many rural areas.

To collect rainwater for domestic use, families are advised to strictly follow the code of practices mentioned below so as to ensure that the rainwater collected is safe for human consumption and no mosquitoes breed in the tanks and jars.

- Drain away the first and the second rain falling on the rooftop collected in the gutter at the beginning of the rainy season each year, as the first and the second rain in the gutter invariably contain the dirt and the bird droppings deposited on the rooftop during the dry season.
- Keep the connecting pipe between the gutter outlet and the tank inlet, or the jar mouth, movable for easy draining away the first and the second rain when the rainy season starts.
- Clean the tank and jar annually, prior to the start of the rainy season, for ready storage of the fresh rain.
- Cover the tank inlet with a piece of nylon net to prevent mosquitoes from entering into the tank.
- Keep the mouth of tank and jar covered to avoid mosquitoes and dirt from getting into the rain tank and jar.
- DO NOT empty the tank and jar completely at any time. Maintain a level of water inside the tank and jar at the bottom up to the tap level during dry season to prevent cracking of the tank and jar.

This Section illustrates rainwater collection in rural Thailand, in particular, the various indigenous ways of fixing the connecting pipe between the gutter outlet and the tank or jar using local materials.



Figure 5-1: Production of rainwater tanks and jars in the yard of a local private entrepreneur in a village.



Figure 5-2: Household collects rainwater in a series of four tanks.



Figure 5-3: Bamboo is used as connecting pipe between the gutter outlet and the inlet of the tank.



Figure 5-4: A piece of galvanized sheet bent into a "U" shape is used as connecting pipe for rainwater to flow from gutter outlet to the tank.



Figure 5-5: A piece of galvanized sheet bent into a "U" shape is used as connecting pipe for rainwater to flow from gutter outlet to the jar.



Figure 5-6: A piece of plastic tube attached to a funnel hanging under the gutter outlet is used as a connecting pipe. The plastic tube can be moved away from the mouth of the jar or the tank inlet to drain away the first and the second rain of the season.



Figure 5-7: A plastic bottle is used instead of a funnel and fixed onto the connecting pipe inserted into the inlet of the tank.



Figure 5-8: A plastic bottle is used in replace of the funnel and fixed onto the connecting pipe inserted into the mouth of the jar.



Figure 5-9: Even a thatch roof can be used as the catchment for rainwater collection. A half-cut PVC pipe or bamboo is fixed on the thatch roof as a gutter to collect rainwater into a tank.



Figure 5-10: Gravalised sheet bent into "U" shape and fixed under the roof serves dual functions as rain gutter and connecting pipe to the tank.



Figure 5-11: This household shows an innovative way of making three rainwater tanks with very large diameter cement rings to store rainwater collected from the rooftop.



Figure 5-12: A newly constructed modern rural household is also collecting rainwater for drinking and domestic purposes.



Figure 5-13: Household collects rainwater from rooftop, which is stored in a square tank built on the ground. The connecting pipe between the gutter outlet and the ground tank is a plastic tube.



Figure 5-14: Closed up view of a connecting pipe made of half-cut PVC pipe collecting water from the gutter outlet to the tank inlet. The tank inlet is covered with a piece of nylon net to keep away the mosquitoes.



Figure 5-15: A gravelled pipe is fixed as the connecting pipe between the gutter outlet and the tank inlet.



Figure 5-16: The rooftop of a village meeting place is an idea rain catchment. Series of tanks are installed on the ground to collect rainwater from the rooftop for community consumption.



1994, Jock Montgomery

Figure 5-17: Rain jars are delivered or put on sale in a barge cruising along a river or klong (canal in Thai) in many rural areas.



6. THAI RAINWATER JARS IN USE IN EAST TIMOR



UNICEF has been supporting the government of East Timor in providing safe water supply and improved sanitation at the household level in 66 villages of 33 sub-districts in all 13 districts in the country. The assistance began during the emergency period from 1999-2000 and continues now in the transition time when people are returning to rebuild their communities. The UNICEF assisted Water Supply and Sanitation programme adopts several appropriate methods, including hand-dug wells, the rehabilitation of hand pumps and building cement jars for collecting rainwater, to ensure household water security, particularly in the rainy season.

Harvesting the rain and storing it in cement jars of 1,300-litre capacity is becoming popular in East Timor. The rainwater jars, known as *kusi* in the local language, are especially useful for displaced people returning to their villages and to homes that need rebuilding. Some families are using the *kusi* for storing water taken from dug wells or handpumps. Since mid 2001, some 1,040 rain jars have been built by families in East Timor.

Rainwater jars are very practical in coastal areas where the salinity level in dug-wells is high. In the mountain areas, the jars hold a quantity of water that is sufficient to reduce or eliminate the constant need to travel long distances to collect water for a family's basic needs - a chore typically relegated to women and girls. The rainwater jars save people time and energy. And they can be used year-round by storing water taken from other sources.

This section provides examples of rainwater jars in use among families in East Timor. The rainwater jar being promoted in East Timor is made of cement and sand with iron wire for reinforcement. The technique comes from Thailand via Vietnam. It was taught to East Timorese Water Supply and Sanitation team members by a Vietnamese technical team that had been trained by Thai resource persons through the Technical Cooperation among Developing Countries (TCDC) scheme. This has demonstrated the wide spread of the Thai rain jar technology in Southeast Asia and beyond.



Figure 6-1: Having adequate safe water at home is a source of pride; this rainwater jar was built by the family in their yard.



Figure 6-2: Safe rainwater stored in a jar helps improve hygiene. This two-year-old girl washes her hands and face with soap and water from the rain jar.



Figure 6-3: A placard, which describes the operation and maintenance procedure for a family to follow, is attached to each rainwater jar.