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## TRADITIONAL CARPENTER'S ROOFS

### Introduction

The primary task of the roof is to protect the building from the atmospheric influences. The roof to a large extent is determined by the appearance of the building. Making the roof's structure of wooden material belongs to the Polish tradition. Carpenter's constructions were made for centuries without any calculations. Wood used for roof construction is usually pine, spruce or fir. Generally, we distinguish the following rafter framings constructions: single roof; collar-beam roof; purlin-tie roof; truss roof; mansard roof.

### 1. The types of rafter framings constructions

Depending on the manner in which the rafters are supported on external walls we distinguish three solutions of the single roof (Figs. 1-3):

- **rafter-beam roof** in which the spacing of rafters is the same as the spacing of joists (beams in a wooden beam-framed floor), and rafters are supported on joists.

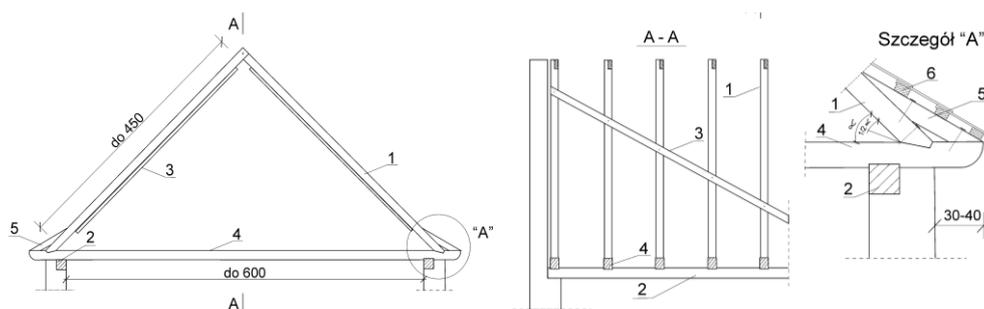


Fig. 1. Rafter-beam roof: 1 - rafter, 2 - plate (torsel), 3 - wind brace (wind beam), 4 - joist (beams in wooden beam-framed floor), 5 - false rafter (sprocked piece), 6 - lath (batten)

- **rafter-“foot” purlin roof with main joist**, where the main couples (full) are with joists, and the others without (empty). Main rafters are placed on main beams at distances of 3 to 4 m, other rafters are placed on purlins.

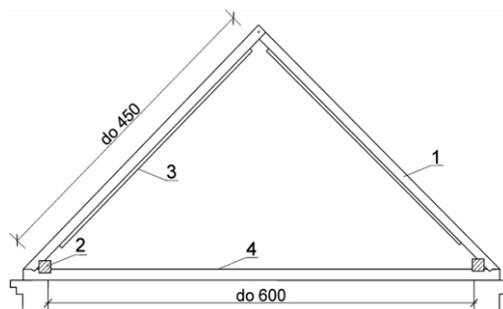


Fig. 2. Rafter-“foot” purlin roof with main joist:  
1 - rafter, 2 - “foot” purlin, 3 - wind brace, 4 - main joist

- **rafter roof with plates** (torsels) in which rafters are placed on plates, arranged on external walls. This manner of supporting rafters is used in buildings with reinforced concrete ceilings.

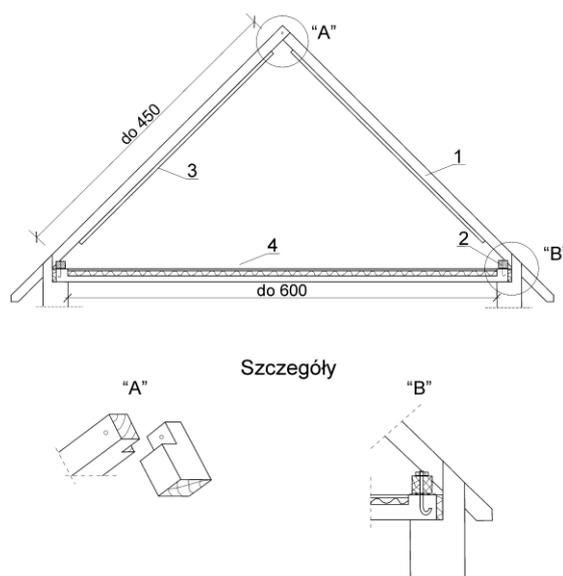


Fig. 3. Rafter roof with plates: 1 - rafter, 2 - plate, 3 - wind brace, 4 - concrete ceiling

We distinguish three solutions of the collar-beam roof (Figs. 4-6):

- with **not supported** collar rafters;
- with **supported at one point** collar rafters;
- with **supported at two points** collar rafters.

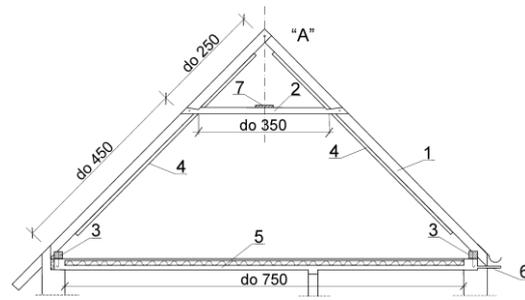


Fig. 4. Collar-beam roof with not supported collar rafters: 1 - rafter, 2 - collar rafter, 3 - plate, 4 - wind brace, 5 - reinforced concrete floor, 6 - cornice, 7 - board brace

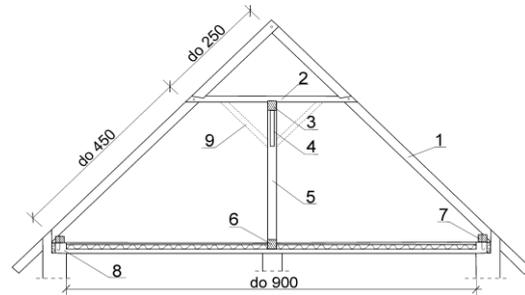


Fig. 5. Collar-beam roof with supported in one point collar rafters: 1 - rafter, 2 - collar rafter, 3 - purlin, 4 - angle brace (angle tie), 5 - post, 6 - ground sill (sleeper, sole-plate), 7 - plate, 8 - reinforced concrete curb-plate, 9 - extra angle brace

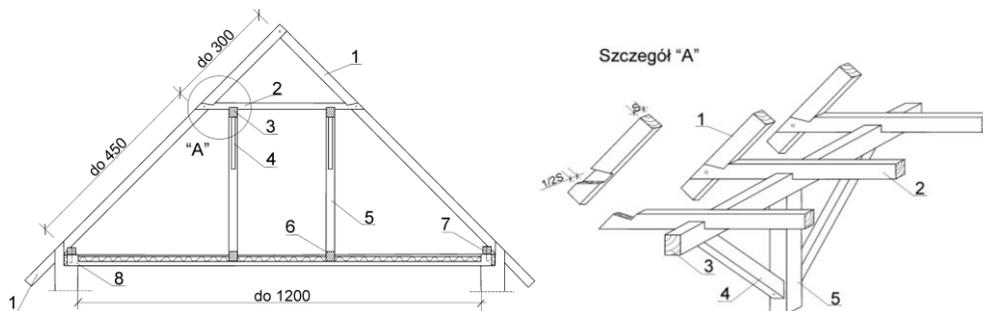


Fig. 6. Collar-beam roof with **supported in two points** collar rafters: 1 - rafter, 2 - collar rafter, 3 - purlin, 4 - angle brace (angle tie), 5 - post, 6 - ground sill (sleeper, sole-plate), 7 - plate, 8 - reinforced concrete curb-plate

The **purlin-tie roof** is more modern and economical than a collar-beam roof. We distinguish four solutions of the purlin-tie roof (Figs. 7-9):

- the purlin-tie roof **with comb board**;
- the purlin-tie roof **with inclined post frames**;
- the purlin-tie roof **with two intermediate purlins**;
- **collar and tie roof**.

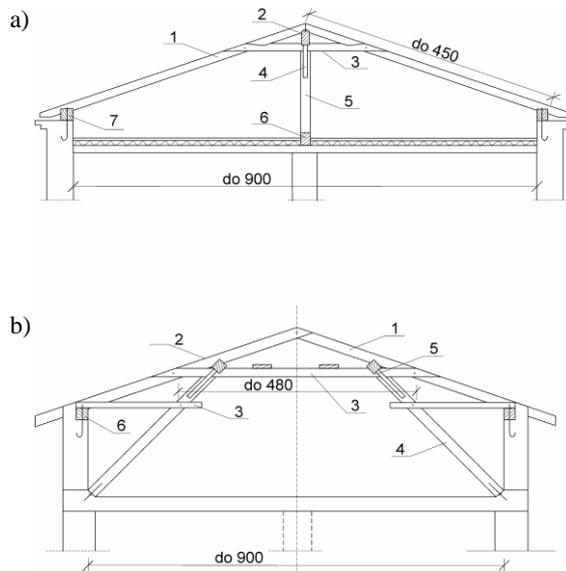


Fig. 7. a) Purlin-tie roof with comb board: 1 - rafter, 2 - comb board, 3 - collar tie (roof tie), 4 - angle brace, 5 - post, 6 - ground sill, 7 - plate  
 b) Purlin-tie roof with inclined post's frames: 1 - rafter, 2 - plate, 3 - collar tie, 4 - diagonal post, 5 - angle brace, 6 - plate

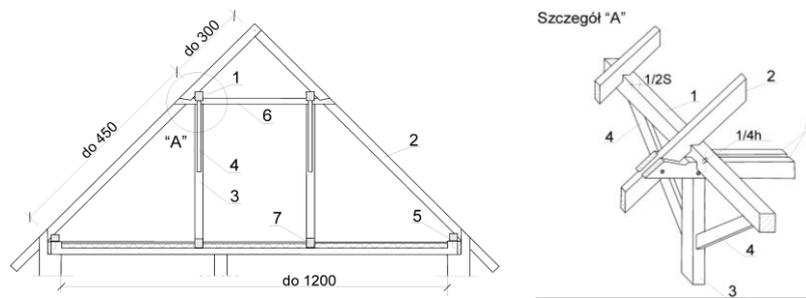


Fig. 8. Purlin-tie roof with two intermediate purlins: 1 - purlin, 2 - rafter, 3 - post, 4 - angle brace, 5 - plate, 6 - collar tie, 7 - ground sill

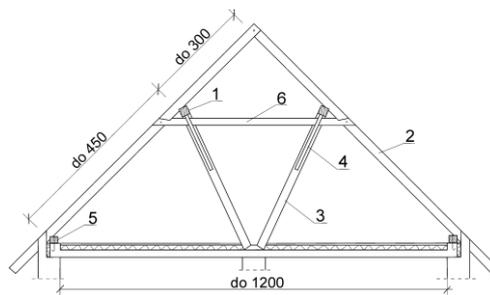


Fig. 9. Collar and tie roof: 1 - purlin, 2 - rafter, 3 - diagonal post, 4 - angle brace, 5 - plate, 6 - collar tie

The **truss roof** is an old construction, generally used in the past when it was not possible to use the floor to support the roof construction. We can distinguish two solutions of the truss roof (Fig. 10):

- **king-rod** roof (joggle-truss roof) - with one king rod;
- **queen truss** roof - with two queen rods.

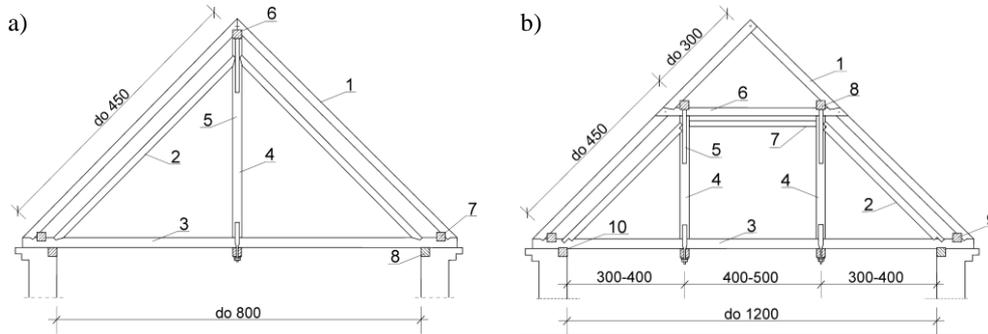


Fig. 10. a) King-rod roof (joggle-truss roof) - with one king rod: 1 - rafter, 2 - angle brace, 3 - wooden bowstring (knee-brace), 4 - king rod, 5 - angle brace, 6 - comb board, 7 - "foot" purlin, 8 - plate  
 b) Queen truss roof - with two queen rods: 1 - rafter, 2 - angle brace, 3 - wooden bowstring (knee-brace), 4 - queen rod, 5 - angle brace, 6 - extra collar tie, 7 - straining beam (strut), 8 - purlin, 9 - "foot" purlin, 10 - plate

The **mansard** roof is a mixed roof truss. We can speak about upper and bottom roof trusses or about the two-floor roof truss. The upper roof trusses can have different construction, most often a purlin-tie roof or collar beam (Fig. 11).

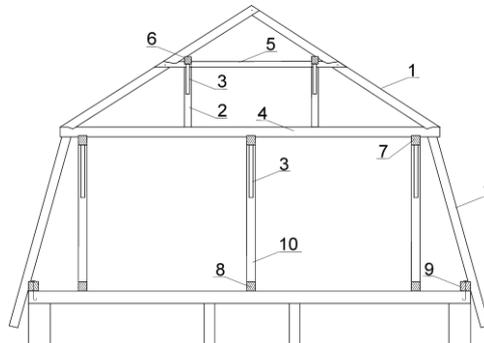


Fig. 11. Mansard roof: 1 - rafter, 2 - upper post, 3 - angle brace, 4 - collar rafter, 5 - collar tie, 6, 7 - purlins, 8 - ground sill, 9 - plate, 10 - lower post

## 2. Construction of multi-surface roofs

In the paper the most commonly met rafter framings are presented on examples of gable roofs. Multi-surface roofs are made based on the method of constructing

manner shown in these examples. The method of constructing rafter framings is a little more complicated in such roofs. Hip rafters and valley rafters appear in them. Such rafters are more burdened than usual, because shorter rafters, called jack-rafters, lean on them. Hip rafters and valley rafters have to have suitable supports in the neighbourhood of chimneys, because of the disturbance in spacing the rafters, ends of rafters, which could go by the chimney are supported on trimmers.

### References

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### Tradycyjne drewniane więźby dachowe

#### Streszczenie

Drewno jest najstarszym materiałem wykorzystywanym do konstruowania dachów. W artykule zaprezentowano najczęściej używane w Polsce drewniane więźby dachowe. Na rysunkach przedstawiono szczegółowe rozwiązania konstrukcyjne tego typu przekryć dachowych.

### Traditional carpenter's roofs

#### Abstract

Wood is the oldest material used for the construction of roofs. Types of the most commonly used Polish carpenter's roof trusses are presented in the paper. Figures show solutions of such roof constructions.