How to Build a Yurt

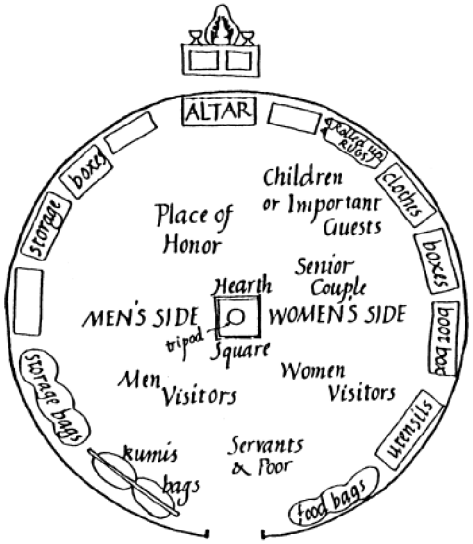
factsheet
Centre for Alternative Technology Publications

From the Steppes of Central Asia to Western Europe, the Yurt is an extremely comfortable tent like structure suitable for temporary or permanent living and recreation.

Yurt-dweller Steve Place offers instructions on how to build your own.

Above: A nomadic kazakh family on their journey back from Mongolia after the collapse of the Soviet Union Mongols fixing a felt covering to their family yurt.

"The houses of the Mongols are circular and made of wands covered with felt. These are carried along with them wheresoever they go, for the wands are so strongly bound together and likewise so well combined that the frame can be made light."
- Marco Polo



Right: The interior plan of an Altai Tartar's yurt, firmly established by rules of etiquette.

The Yurt (Turkic for 'dwelling') has been the traditional home of the nomads of Central Asia for almost two thousand years. It is a round domed tent with a sturdy wooden frame, able to withstand all extremes of weather. It is insulated from heat and cold alike with thick woollen felt and in modern times has acquired a covering of canvas.

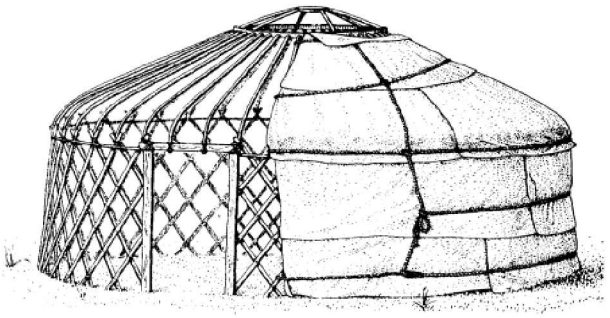
The whole structure can be quickly folded down to become a small pile of components, easy to transport and just as quick to reassemble.

There are two main types of yurt. These are the Mongolian Ger, with its straight roof poles and heavy wheel supported by uprights, and the Turkic style I shall concentrate on here. This has steam bent roof-poles and a lighter wheel, making a self supporting domed roof.

In Britain there is a strong case to make for using the yurt as a low impact home. Using yurts for sustainable rural development would help to fulfil the requirements of Local Agenda 21, which should by now be a priority in local planning departments

Where to Start

The first step is to choose your stock. Coppiced willow is the traditional wood. It is light, easy to work and readily available. Coppiced hazel is a good alternative and works well. Small dimension (up to 8" / 20.3cm) ash or sweet chestnut can be cleft down with a froe and cleaving break. This gives extremely tough poles. To keep time down I use straight green ash bandsawn to size and finished with drawknife and spokeshave. Try your local sawmills and estates and see what is available in your area.



"The yurt is unquestionably one of the greatest inventions Asia has brought forth. Its circular structure and dome-like roof combine the maximum structure with extraordinary stability. During my stay in the Parnirs the heaviest storms raged over the *aul* without a moment's cessation all through January, yet never once was one yurt blown down."

- Gustav Krist, *Alone Through the Forbidden Land*

Cutting list

16' Yurt

Roof ribs

40 green poles, 8'6" (2.6m) long, 1.5 - 2" (3.8-5.1cm) at the butt and 1" (2.5cm) minimum at the tip. Cleft or sawn to size 8'6" x 1.5" x 1" (2.6m x 3.8cm x 2.5cm).

Trellis

80 green poles, 6'6" (2m) long and 3/ 4" (1.9cm) at tip. Cleft or sawn to size 6'6" x 1'1/ 8" x 7/ 8" (2m x 30.8cm x 2.2cm).

40" Roof wheel

To cleave - a knot free straight ash log 4 to 8" (10.2 to 20.3cm) diameter and 6'6" to 7' (2 to 2.13m) long for a 40" (1.02m) wheel. Sawn 3 to 4" (7.6 to 10.2cm) wide, 6'6" - 7' (2 to 2.13m) long and 3/ 4 to 7/ 8" (1.9 to 2.2cm) thick. This must be as knot free as possible and straight grained from end to end.

Door frame

If you have cleft your wheel you should have enough ash left for the top and bottom of the door frame. Otherwise you will need two ash planks 36" x 4" x 1" (91.4 x 10.2 x 2.5cm). The uprights are two straight poles, 5'6" (1.68m) long and 1.5" (3.8cm) thick.

Cord

60m (197') of 4mm polyester, pre-stretch, three-strand. *It is important to buy quality cord.* Try ships chandlers.

The yurt band

50' (15.24m) of 12oz canvas 1' (30.5cm) wide.

100' (30.48m) of 10mm rope or upholstery webbing.

Canvas

Approximately 70 - 80 m^2. I suggest Government surplus tarps or second hand marquee canvas.

Rope

50m (164') of 10mm rope for lashing on the cover .

14 ' YURT

Roof Ribs

32 roof ribs 7' 6"(2.29m) long.

Trellis

70 poles each 6'6"(as for 16' yurt). Assemble to make three sections of trellis each having 11 points, including the single 'horns' on each side.

Roof Wheel

As for 16' yurt but with 32 holes.

Door Frame

As for 16' yurt.

Yurt Band

Will be 41' 4"(12.6m).

12 ' Yurt

Roof Ribs

28 roof ribs 6' 5"(1.96m) long.

Trellis

60 poles each 6' 6"(2m) long. Assemble to make two sections of trellis each having 14 points including the single 'horns'.

Roof Wheel

As for 16' yurt with 28 holes.

Door Frame

As for 16' yurt.

Yurt Band

Band is 35' 9"(10.9m).

10" Yurt

Roof Ribs

24 roof ribs 5'5"(1.65m).

Trellis

50 poles each 6'6"(2m) long. Assemble to make two sections of trellis each having 12 points including the single 'horns'.

Roof Wheel

As for the 16' yurt but with 24 holes.

Door Frame

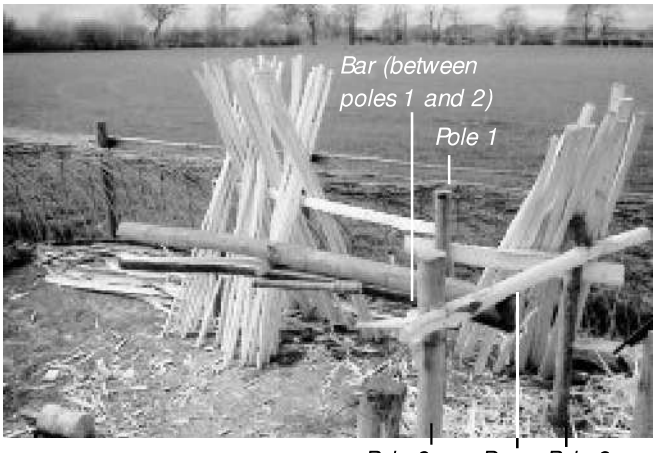
As for the 16' yurt.

Yurt Band

Band will be 30'3"(9.22m).

Metric conversion: 1 inch to 2.54 cm.

Tools and Devices



A froe (splitting axe), in a branch, held in a cleaving break.

Above: A steam box covered with old carpet for insulation. The can is on the right.

The cleaving break

The best all-purpose work station is a cleaving break with shaving post. This consists of three posts joined by two bars, one horizontal, and the other sloping. Wood to be cleft is placed in the frame resting on the front (sloping) bar. A splitting axe (Froe) is beaten into the end grain with a heavy mallet and used to lever open the split. By pushing down on one side or other of the cleft the split can be guided through the wood.

A roof rib (bent on the extreme right) on a shaving post.

The shaving post

The shaving post is a fourth post three feet behind the frame. Its top level with the horizontal bar. Wood to be gripped is passed under this bar, and over the sloping bar until its end can just be lifted onto the shaving post. It will than be held firm while you work de-barking or shaving with the drawknife. For more information than we have space for on this factsheet see *Traditional Woodland Crafts* by Raymond Tabor. Alternatively if you have little cleaving to do then a shaving horse can be used to grip poles. If neither of these are available then an ordinary vice can be used.

The steam box

A simple steamer consists of a metal can of boiling water on a hot wood fire, attached with 3/4" (1.9cm) copper pipe to a wooden box. I used a cheap sheet of 8' x 4' (2.44 x 1.22m) shuttering ply 3/4" (1.9cm) thick. When cut into four strips 8' x 1' (2.44 x 0.3m) and joined, this makes a 1' (0.3m) square box 8' (2.44m) long. This was four inches (10.2cm) too short for roof ribs so I extended it to 8'6" (2.6m) with scrap plywood. As I assembled the box I nailed in a row of rough wood laths 12" (30.5cm) wide to make a rack 4" (10.2cm) from the top. This is where the hottest steam will be. To finish off, board up one end and fit a hinged door at the other. Fill any gaps with bathroom sealant and it's ready to use. The old metal can I use holds 3 - 4 gallons (14 - 18 litres) of water, enough for about three hours of steam. On windy days I throw old carpets or underlay over the box as insulation.

Never boil water in a sealed can - it will explode! Fit your pipe into a wooden bung carved to fit the opening on the top of the can. Drill a hole in the box two feet from the back (sealed) end, close to the bottom, and push your pipe in.

Always keep plenty of wood on your fire for hot steam!

Tools you will need

- Crosscut saw
- Drawknife
- Bowsaw
- Spokeshave
- Surform tool
- Drill / 4.5mm bit
- Heavy mallet or Beetle
- Froe (splitting axe)
- At least six G clamps
- Tape measure
- Carpenters brace - 1/4" 1/2" 3/4" 1" (6 13 19 25mm) auger bits
- 1/2" chisel and 1" chisel
- Sharp scissors
- Sewing machine

Construction Details

Please note; figures in text refer to 16ft yurt

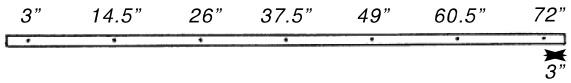
Shaving the wall laths on the shaving post.

The Trellis

Peel all the bark off green poles and smooth off knot marks. Shave smooth all sawn or cleft laths rounding off sharp edges. Cut to 6'3" (1.91m) and measure 3" (7.6cm) in from one end. Drill every 11.5" (29.2cm) ending up with 7 holes at 4.5mm diameter.

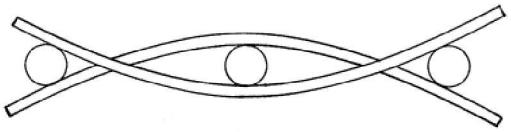
Smooth off sawn ends with a surform tool. The trellis is now ready to bend.

Fig. 1



Make your bending jig from three 3" (7.6cm) or 4" (10.2cm) posts (Fig.2) set in a line 27" (68.6cm) apart. Make sure your steamer is hot and put in 20 to 30 laths. Steam them for 40 minutes then take them out two at a time and force them to the bottom of the former. Place alternate pairs on opposite sides of the centre post (see Fig. 2) until the former is full. They should be left on for a week or more and kept dry, by which time they should have set.

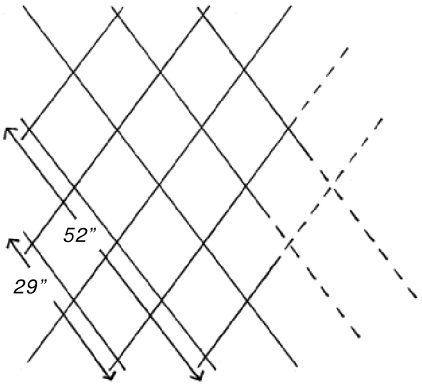
Fig. 2



Assembling the trellis

You will need to make up three sections of trellis each having 11 crosses at the top and a single at each end (Fig.3). These ends are called the "horns" or "ears" and make thirteen points in all per section.

Fig. 3



Each section will need -

20 poles at 6'3" - 1.91m (7 holes)

4 poles at 52" - 1.32m (5 holes)

4 poles at 29" - 73.7cm (3 holes)

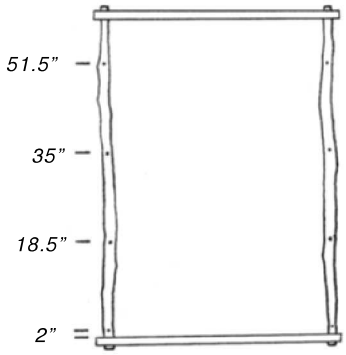
Start by tying two full length poles together at the centre. You can now lean these up against the wall and work along.

It will help if you cut your cord to 8' (2.44m) lengths, with one end heated and rolled to form a "needle". Tie a knot on the other end and thread through the drill holes. Tie off as tight as you can on the other side then cut your excess free. Tie another knot on the end and carry on until you need a new length.

Assemble the sixty 6'3" (1.91m) poles of all three sections first. You can then cut your shorter pieces from the 20 remaining poles. Make sure you have assembled them all the same way i.e. right leaning poles over left leaning poles. It is a common and frustrating mistake to assemble one section back to front!

You now need to tie four 20" (50.8cm) laces through the two trellis ends that are to meet left and right of the door frame. They will lash into holes drilled in the uprights to set the height of the trellis.

Fig. 4



Door frame

Prepare two ash planks each 36" x 4" x 1" (91.4 x 10.2 x 2.5cm). Measure 1.5" (3.8cm) in from each end along the centre lines and drill through at 1" (2.5cm). Now select two straight poles 1.5" (3.8cm) thick and 5'6" (1.68m) long. Trim each end with a sharp knife into a 1" (2.5cm) round tenon. Now fit the frame together and starting 2" (5.1cm) from the base on each side drill the 4mm holes to lash on the trellis ends. These must be every 16.5" (41.9cm) up the posts (Fig.4). Take the frame apart and smooth off all corners, sharp edges and knots. I like to leave the bark on the uprights for appearance's sake.

Roof ribs

As you did with the trellis, peel all the bark off green poles and smooth off all knot marks. With the sawn or cleft ribs, shave the underside flat and round off the top side. This gives a slightly stronger 'D' shaped profile. Now shave down the bottom 22" (55.9cm) of each roof rib to 3/ 4" (1.9cm) thick. This is the section which will take the steepest bend. You should now have 40 roof ribs ready for bending. Cut to the final length of 8'4" (2.54m).

Steaming the roof ribs

Set up your bending jig for the roof jibs, again this is very simple, see Fig.5. Too tight a curve will result in the wood splitting. Half of a 45 gallon (200litre) drum is just right, with a 4" (10.2cm) high plank pegged down just 1" (2.5cm) in front of the drum. Now steam your roof ribs for one hour. Do not let the steam subside or they may not get hot enough.

If you do not have a steam box it is possible to boil the ends in a barrel or milk churn.

Boiling the ends of roof ribs.

Fig. 5. Bending a roof rib over a former to set it.

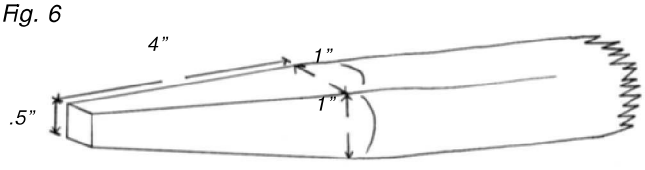
Make sure you have a hot fire and boil the butts for 15 - 20 minutes. Now take the ribs one at a time from the steamer (or boiler). Push the butt into the front of the former and slowly bend over the drum.

It is handy to have a helper to weigh the ends down as you go. If the wood splits badly the grain may not be straight enough or may be too knotty. Alternatively it may not be hot enough. On the first yurt I built, half of the roof ribs split on bending. Don't worry too much as all but the worst splits can be glued and clamped. Once dry you can spokeshave off any rough or excess glue and hardly see the repair. Leave the ribs to set for at least a week on the former. You will need one straight pole to fit over the door, which can be made from a badly split rib.

Finishing the roof ribs

When you are ready take them off and smooth the butt ends with a surform tool. Drill a 4.5mm hole 1.75" (4.4m) from the butt ready for the lace. The laces must be 28" (71.1cm) long

Fig. 6



and heated and sealed at one end to stop them unravelling. Tie a knot at the other end and thread them through to the inside of the roof rib. Fix them in place with a second knot. You must now cut a tapered square tenon on the end of each roof rib. (Fig.6) This can be done quickly and easily with a drawknife. The taper should be 4" (10.2cm) long and run from 1/2" (13mm) square on the tip to just over 1" (2.5cm) square at its start. Make sure it is square on to the curve of the butt.

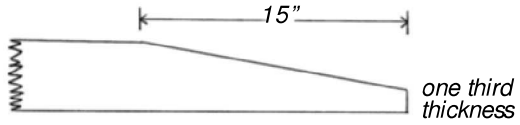
The roof wheel

This is perhaps the most complex part of the job and can only be done with a steam box. I suggest a 40" (102cm) diameter wheel, but this will depend to some extent on what you find for your former. I use a 38" (96.5cm) iron cartwheel. Try local scrapyards, but remember the smaller the wheel, the less light you get, and the longer your roof ribs will have to be.

If you can use a cleaving break, choose a knot-free and straight ash log 4 - 8" (10.2 - 20.3cm) in diameter. Cleave it down the centre and then split each half into two planks.

Choose the best pair of clefts and shave them down to produce two ash blanks 7/8"(2.2cm) to 1 1/8"(2.9cm) thick. It is important to keep the thickness even or it will bulge when bending. The length will be half the diameter of your former, plus 15" (38.1cm) to allow for the scarf joints. If you cannot cleave the wood then buy two ash planks from a sawmill, knot free with straight grain from end to end.

Fig. 7



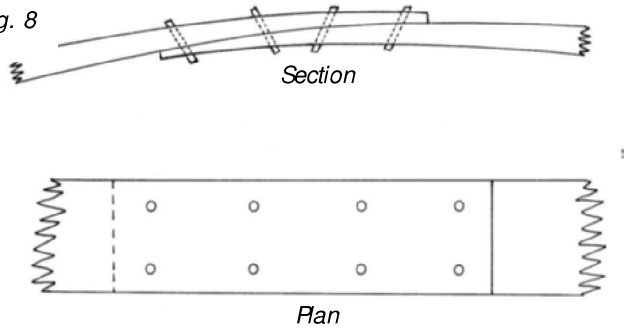
Bending the wheel on the former.

You must now cut the scarfs. Measure in 15" (38.1cm) from each end of your blank and starting with your drawknife taper the thickness down to one third (Fig. 7). Try to get the sloping face flat as it will take the glue later on. Cut the second scarfe on the opposite side to the first. When you have done both blanks you will be ready to steam.

Make sure that your former is secured so it will not move and have at least six G clamps ready to use. Steam each half of the wheel for 50 minutes to an hour, starting the second half 20 minutes after the first half. Do not allow the steam to subside and if you need to, top up the boiler with boiling water. Take the first half out when ready and have a helper clamp one end to the former. As soon as it is tight bend the wheel straight round as quickly as you can. Have your helper follow with G clamps concentrating on any bulges or splits. It will bend easily at first but you will lose leverage as you go. The last 12" (30.5cm) is always the hardest and can be closed up with a pair of G clamps.

When the next half is ready have your helper loosen off the first G clamp by about 2" (5.1cm). Slide the scarf of the second half 15" (38.1cm) under the first half and as soon as the clamp is tight again bend quickly right round. You will have to juggle the clamps around as you finish the bend ending up with the second half clamped over the first. The most important thing is speed, so as to bend the wood while it is still hot. Leave the wheel on the former a week if you can, and keep it dry.

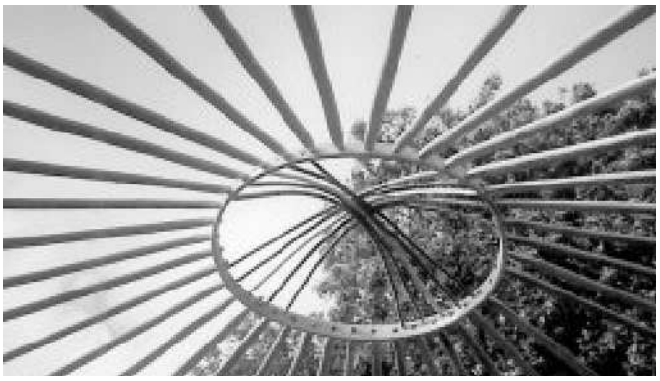
Fig. 8



Joining and morticing

Take the two halves off the former and clean up the scarfs. Glue one joint and clamp tightly. You will have to force the other joint together and may need a helper to close it up. PVA wood glue or Cascamite are both suitable. When set, remove the clamps and glue two sets of four dowels at an angle through each joint (Fig.8). I use a 1/4" (6mm) auger bit for this job.

The next step is to measure the circumference of your wheel and divide by 36. This will give the spacing for marking out and drilling. Try to avoid the dowels when marking out. When you have marked 36 even spaces clamp the wheel to a



The finished braced wheel with ten ribs.

bench. Using a 1" (2.5cm) auger bit and brace, work round the wheel drilling each hole at a slight angle upwards (this allows for the angle of the roof ribs). Stop drilling when the centre screw breaks through and finish the holes drilling from the other side. This will give a clean finish. Now, working with a sharp 1" (2.5cm) chisel and mallet, chop each mortice out to 1" (2.5cm) square. Support the inside on a post as you go to prevent splitting out. Tidy up the finish with a spokeshave before you start the bracing.

The bracing

The wheel must now be braced with pliable green rods - hazel, willow and holly are all suitable. I leave the bark on to give an attractive finish when oiled. Starting from the centre of one of the scarfe joints, mark out the four quarters of the wheel with pencil. Use these marks to plan where you will drill the holes for the bracing rods. Allow about 3" between them, drilling at an angle to match those of the roof ribs. As you fit the rods angle them in towards the centre. I also try to dome them up about 4" from the rim of the wheel to help rain run off.

Roof ribs, trellis and band.

The tent band

This is a structural part of the frame and serves to stop the trellis expanding under the weight of the roof. It consists of a band of canvas 8" (20.3cm) wide and 46'9" (14.25m) long when finished. Reinforce it by sewing in upholstery webbing or 1/2" (13mm) rope, and finish it by sewing a 4" (10.2cm) loop on each end. You can make do with a 50' (15.24) length of strong rope at first.

Oiling the frame

Now give your whole yurt a thorough coat of boiled linseed oil mixed with 40% turpentine (not substitute). Leave for a day then repeat with an 80% linseed to 20% turpentine mix. Wipe off excess after a few hours and allow to set (1 to 2 days).

The completed yurt frame erected.

Putting up the frame

Take the three sections of trellis and arrange them in a 16' (4.88m) circle. Overlap the ends by one full diamond 16.5"(41.9cm) and lash together with soft rope or webbing. Assemble the door frame and tie the four laces on each end of the trellis through the holes drilled in the uprights. This will set the trellis at the correct height with all the laths at 45°. Now take the top off the door frame and slide one of the loops on the tent band onto one side of the frame. Walk around the yurt paying out the band and slide the other loop onto the other side. Now put the top back on the door frame and adjust the trellis to take up any slack. You should now have 35 points on the trellis (including the two lashed to the door frame), and space for one more over the door.

Now tie a roof rib onto the first cross to the left of the door. Use a clove hitch if possible. Count around one third of the yurt (i.e. leave 11 spaces) and tie on a second roof rib. Count out the two corresponding holes in the yurt wheel and mark them with pencil. Now hold up the wheel and slot the tips of these two ribs into the marked holes on the wheel. Count around the last third on the wheel and slot in the top of a loose rib. By pushing up on this rib the wheel will rise into place. Count another third around the trellis and tie in the butt. It is possible to do this on your own with practice but for now you will need a helper. Tie in all the remaining roof ribs leaving three spaces between them at first to keep the weight even, then walk round and fill in the gaps. The last rib over the door is shorter with a straight butt end and ties to the top of the door frame.

Covering your yurt

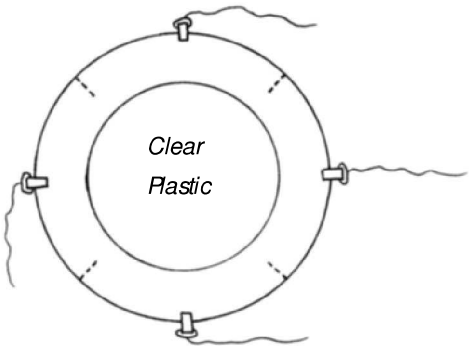
There are three parts to the cover of a yurt. The wall is the simplest part, consisting of a single panel 5'6" (1.68m) high and exactly the same length as the tent band (46'9" - 14.25m). It helps to sew in a loop every four rib spaces so it will tie on to the roof ribs. Lash it tight with two ropes passed round the yurt and tied inside the door frame.

The roof cover can also be made from a single panel. This must be roughly 20' x 20' (6.1 x 6.1m) for the 16' yurt. Pull it over your assembled frame and mark out the wheel. Take it off and cut out the wheel hole, leaving enough extra to hem the edge back. Now put it back on the yurt and take up all the excess around the roof in one fold. Mark the fold with tailor's chalk or safety pins. By sewing this one seam and cutting away the excess you will have a simple fitted cover.

Tie it on with a third rope tied inside the door frame passed around to cinch in the roof cover just under the roof ribs. You can cut away the four corners and hem right round the edge if you like, but I prefer to leave them on.

The roof wheel cover closes the roof wheel and lets the light in. Cut a circle of clear plastic to fit your wheel and sew this into a 1' wide collar of canvas. Now sew four strong loops of canvas around the collar (Fig.9). These serve to tie on the four cords that tie down the cover. If the collar does not fit tight sew four small tucks into its outer edge.

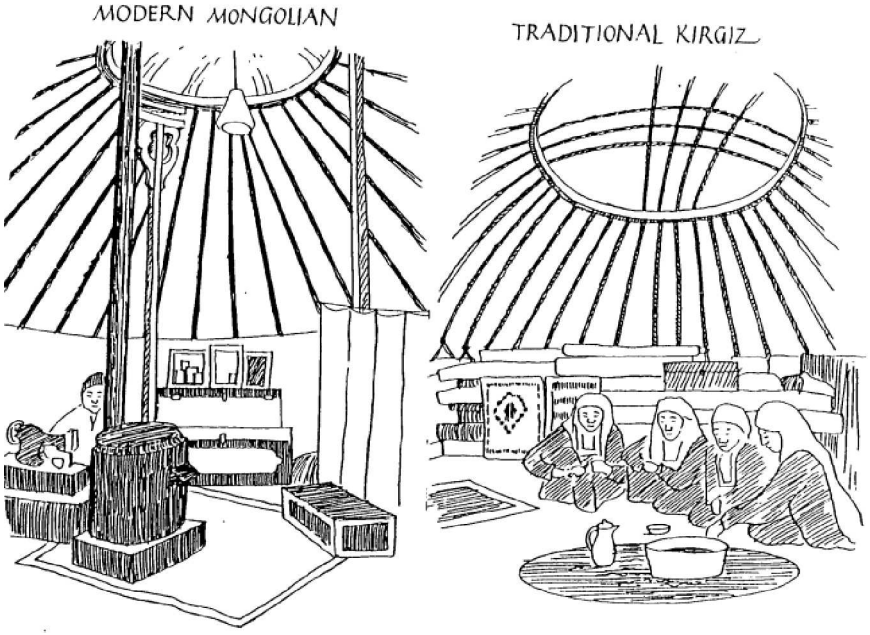
Fig. 9



The flue collar

Please note that lighting a fire in a tent is dangerous and is done at your own risk. If you need to fit a flue collar, then make it from aluminium which is nice and light. Rivet two 10" (25.4cm) collars onto each side of the plastic. Make sure the hole in the plastic is 1.5" (38mm) bigger than the hole in the collar. When in use always secure the chimney between bracing rods with wire to prevent it sitting against any woodwork.

The canvas will be fine throughout most of the year, but if you wish to use it in winter then insulation will become important. A layer of woollen felt is the best solution, but hard to come by. Alternatively you can use carpet, underfelt, even old blankets. Underfelt made from wool and recycled rags is a good alternative. The more layers you have the warmer you will be. *For details of Yurt building courses or further information contact the author - Steve Place, 'Handmade Hardwood Yurts', Llan Farmhouse, Hirnant, Penybontfawr, Nr. Oswestry, SY10 0HP. Tel. 01691 870331*



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