MSF-OCA Inflatable Operation Theatre manual

December 2010







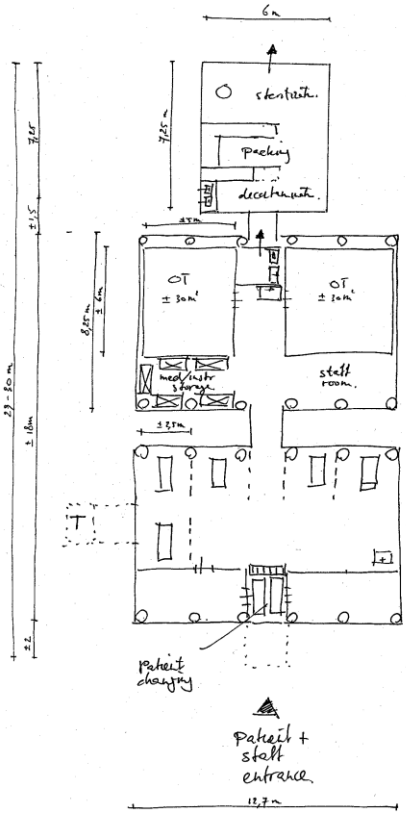
Content:

1. Concept and floor plans

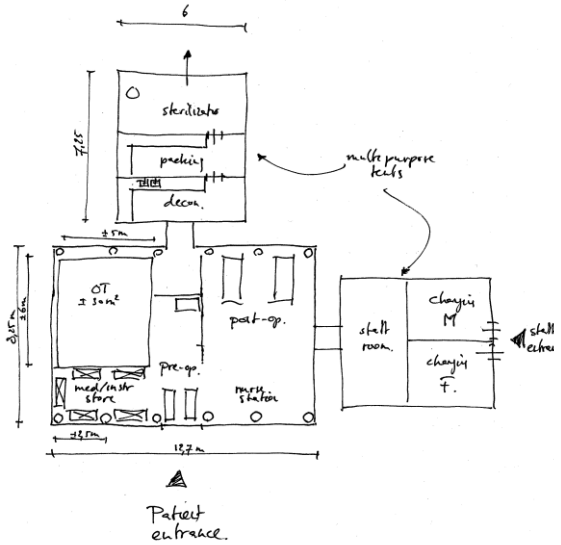
1.1 Concept

In some scenarios of a disaster response, MSF will decide to do a surgical intervention. In the initial phase directly after a disaster, the focus will mainly be on life-saving surgery in any condition available at that time, which could be under a tree when nothing else is available. As these are definitely not the ideal conditions, MSF should try to move as soon as possible into a facility that provides a good working environment and guarantees the quality level of our services.
This inflatable tent solution intends to provide good surgical conditions for nearly all the most common operations. Besides this it also provides all related facilities and organizes the routing and patient flow in order to keep a good overview and reduce infection risk as much as possible.

1.2 Floor plans



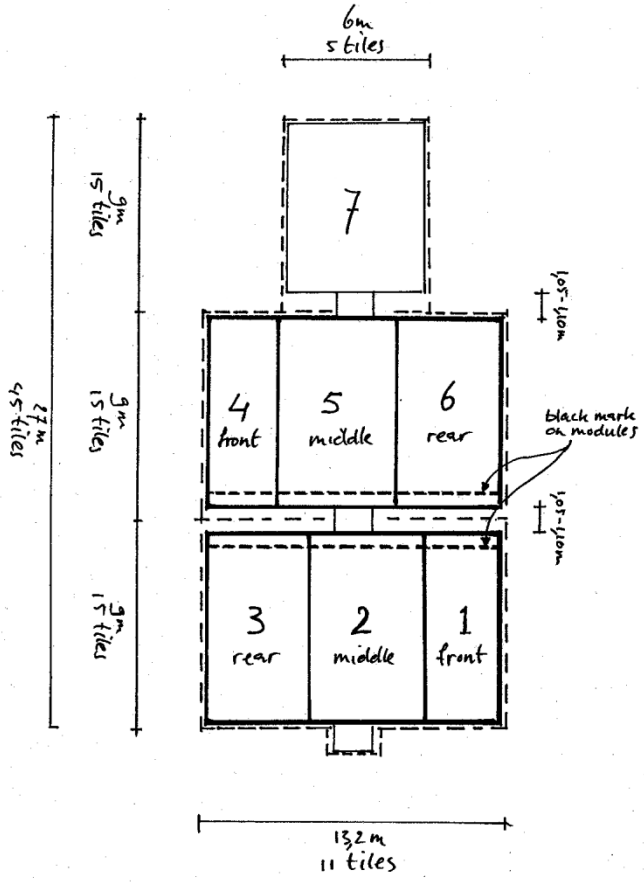
Double OT set-up



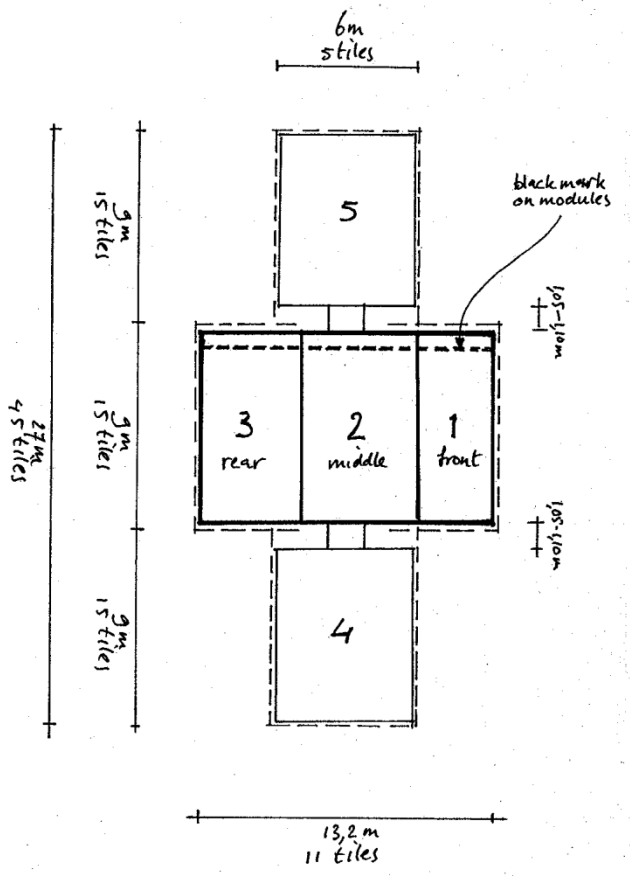
Single OT set-up

Depending on the available space on location, two or only one inflatable tent can be set-up. Sterilization is here in both options connected directly to the operation theatre, but could also be organized away from the operating facility. This would mean that the medical waste and instruments need to be collected from the waste and cleaning area.
Patient and staff entrance could also be organized with an additional multifunctional tent.
(For more detailed floor plans see attachments 1 and 2)

2. Preparation ground floor



2 inflatable tent set-up



1 inflatable tent set-up

Ground space needed

	L x W (m)	L x W with tiles (m)	# of tiles (0,6 x 1,2 m)	Total tiles
1 inflatable tent	8,25 x 12,70	9,0 x 13,2	11 (length) x 15 (width)	165
2 inflatable tent	17,60 x 12,70	18,0 x 13,2	11 (length) x 30 (width)	330
2 infl. + multi-functional	24,70 x 12,70	27,0 x 13,2	11 (length) x 45 (width)	405 – 495 (full)
multi-functional	6,0 x 7,25	6,0 x 9,0	5 (length) x 15 (width)	75
One OT set-up + multi func				250

- Ground space cleared from stones and leveled with rough sand at 5-10 cm higher (should be higher than the surroundings so rain doesn't enter)
- Start laying the tiles of the platform from the corner right to the other side left (because of the connections of the tiles)
- Check again that the tiles are flat and that there are no stones under them

3. Connection of the modules

3.1 Connecting the ground floor

Organize bags with front, middle and rear modules and roof sheet.



- Roll the front out with the black stripe to the other side (**stripe indicates where the inflation valves are**)
- Unfold front module and position it on the right corner with a distance of around 25 cm from the edges of the platform
- Roll out the middle module with the black stripe to the other side (same as front section)
- Position the front and middle module in a way that the sides are nicely lined up. Check that the V-indications are in the middle



- Tighten the floors of the two modules with the Velcro band. Take care that the Velcro band is closed well, so that no water can enter from underneath.
- Fasten the hooks on both ends. They prevent that the floors separate
- Roll out the rear module with the black stripe to the other side (same as front and middle section)
- Position the rear module and tighten the Velcro band and hooks

3.2 Connecting the roof

- The purloins (inflated connections between arches) are connected on one side with a tube so air can go from the tube to the purloin.
- Look for the purloins and bring them to the other side
- Lock the purloins with the pins through all the holes and turn (and straighten) them so that they can properly inflate

- Look for the V-indication in the middle, align both sides of the roof and untie the rope
- Put the hole over the black rubber on one side and put the hole from the other side over it as well
- Put now the rope through the black rubber hole and continue with the next part
- When arriving at the end of the rope, leave some space and make a knot (**rope should not be tight**)
- Pull the PVC roof to the middle before continuing with the next rope, as this makes it easier.

- Tighten also the last rope and start with closing the roof sheets
- To get it really waterproof, the outer flap needs to go over the inner flap. Look for the Velcro on the inner flap.
- Tighten the inner and outer flap together with the Velcro on the outer flap.
- Connect the last Velcro strip along the whole length of the roof. Make sure that it closes well to prevent water coming in.

4. Inflating the tent

- Check again if all hooks are tightened underneath the floor
- Pull on all corners to stretch the ground floor, but not too strong, because then the floor can come loose
- Hammer the anchor stakes and tighten the corners (precaution for wind)
- Put the ventilation L-bars in



- Get the inflators, the hoses and put them beside the tent (every inflator can do max. 3 valves, but it is also possible to connect one valve at the time)
- Check if all valves of the tubes and hoses are closed (otherwise air will escape when disconnecting)
- Connect inflators to the electricity and hoses to the upper valve



- Initiate the inflators and stop the again when tent comes up a bit, after around 5 min.
- Stop for around 7-10 min. to allow air to go in the purloins.
- Start inflators again and help the tubes to erect themselves by pushing from inside and/or pulling on the ropes outside
- Inflate all tubes until the air comes out of the pressure valves and close the valves of the hoses.
- When all tubes are inflated, then stop the inflators and disconnect them from the tubes.
- Connect the ropes for the stakes and put the steel bars inside the tent between the arches (on the black rubber knots at eye level)



5. Attaching the sun roof (should be done before the tent is inflated)



- Lay the roof purloins out on the top of the tent with all valves on one side.
- Connect them to the black rubbers with the pins.
- Inflate the purloins until the air comes out.
- Spread the roof sheet over the tent until the connection ropes are above the rubber hole on the middle purloin
- Flap over the roof sheet on one side and connect the sheet all along the purloin
- Flap the roof sheet back and take all the black ropes out to the sides.
- Start inflating the tent

6. Interior and linings

6.1 Floor sheet and inner linings



- Attach the linings Velcro bottom strip between the Velcro strips of the floor
- Use the cords to attach the inner linings to the black rubbers on the tubes
- Close the inner linings around the tubes with the Velcro strips

(Be careful when attaching the linings as they can easily tear/rip when they are at some points already attached to the outer walls)

6.2 Operation Theatre linings - Block 1 and Block 2

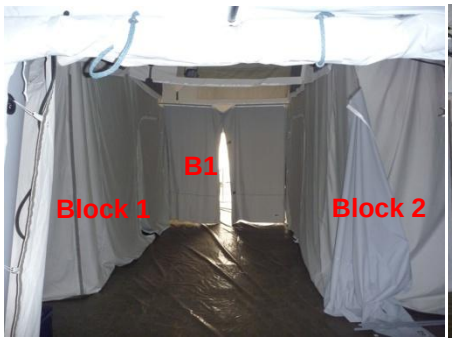


- Lay the OT lining out on the floor and start with the middle
- Lift the lining with some persons to reduce the weight on the connections
- Use the cords to attach the OT linings to the white loops sewed in the inner linings.
- When all the cords are connected, then stretch the ground floor and place the lead in the corners of the ground sheet inside the OT lining

6.3 Divisions - Linings B1, B2, C3 and C4



- Take the grey strips and push them on the inner linings where the divisions need to be made
- Take the correct lining and push them in the grey strip
- Attach the linings with the Velcro to the sides



7. Attaching the entrance and middle section



- Place the floor tiles for the module (min 4 tiles) and attach the ground sheet of the module between the Velcro strips of the ground sheet of the main tent
- Attach the cover with the ropes to the tent (in the same way as the main modules)
- Make sure that PVC roof is connected in such a way that water cannot enter
- Place the steel structure and adjust the horizontal bars to the distance needed



8. Deflating the tent



- Open de valves of the main tubes, connect de hoses and turn the inflator to deflation (aspirazione). Make sure that the valves of the hoses are opened.
- Let only a bit air out and remove the steel bars.
- When the tubes are empty then disconnect the modules at the roof
- The purloins needs to be deflated separately, so look at the valve of the purloins
- Connect the inflator hoses to the purloins and deflate them

9. Packing the modules

- Wrap the modules according to the folding plans step 1 in the Annex
- When folded, walk over the modules to press all the remaining air out (take shoes off)
- Fold the module according to the folding plans step 2 in the Annex (sometimes a measuring tape is necessary to get a good result)
- Step onto the folded module to compress it as much as possible
- Roll the module into the white sheet and wrap it up.
- Put all the attributes in the small bag as indicated on the bag

10. Installing the pressure maintenance control

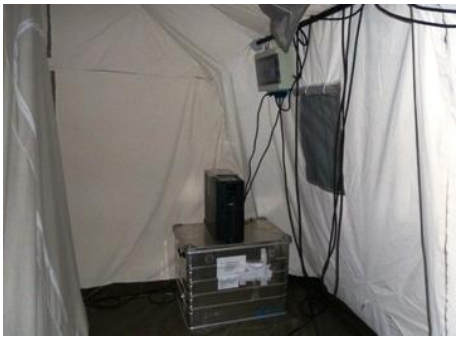


- Install the pressure monitoring device to the steel bar in the tent.
- Connect the electricity cable to the distribution box
- Connect the inflator to the pressure monitoring device with the blue plug
- Connect one transparent hose to the tube from the inside
- Connect the 3-way transparent hose to the tubes on the outside.

The pressure monitoring device will assure that the pressure in the tube will be between 0,19 and 0,22 bar. In case there is not enough pressure, it will initiate the inflator until pressure is sufficient.

12. Electricity plan





- Place the generator max 40 m away (to void the noise)
- Install the earth pin sufficient deep into the ground (preferably hitting ground water)
- Connect the switch/fuse box with the big electricity cable to the generator (when needed another generator or other power supply source could be connected through this distribution box)
- Install the distribution box to the steel bars in the tent and plug it into the switch/fuse box
- Plug the UPS into the distribution box



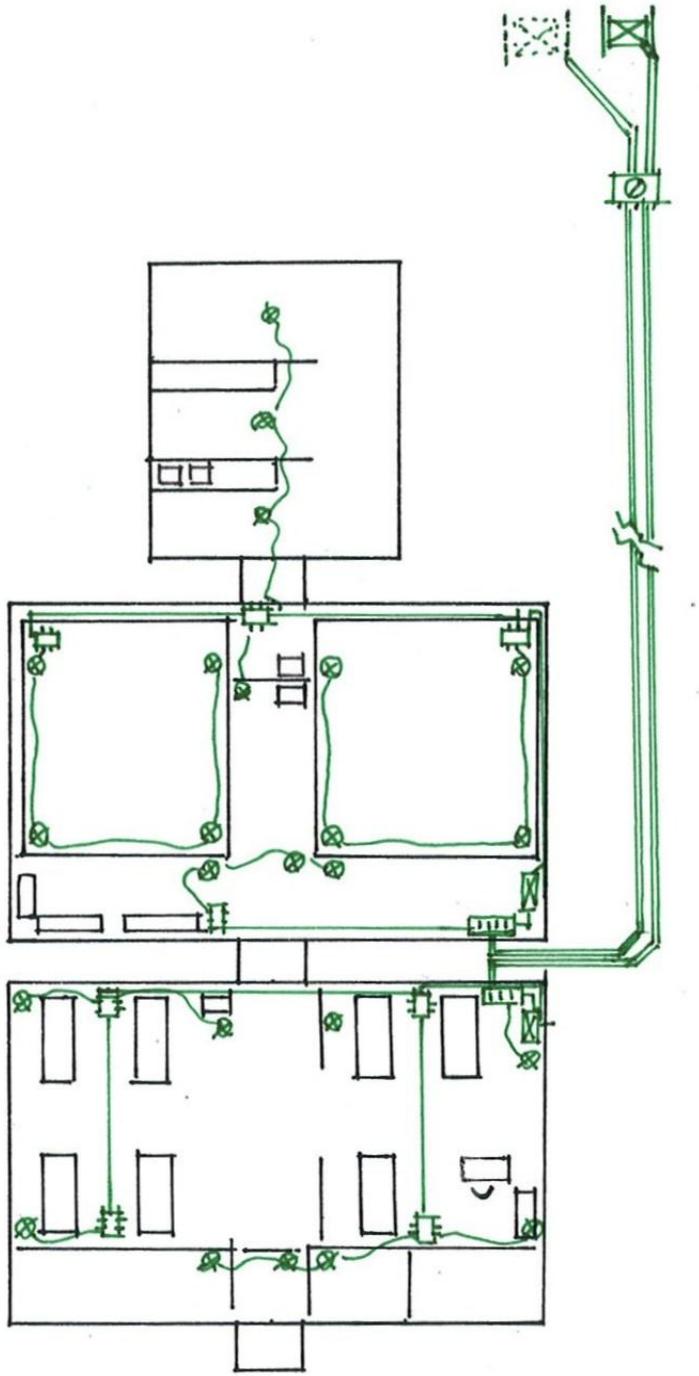
- Plug an extension cable specifically for the OT into the UPS and lead it through the hole made for this purpose. **Keep all electricity from the floor!**
- Attach the lamps to loops in the lining and plug them into the socket. Reserve enough sockets for the medical equipment in the OT
- Connect all other devices into separate extension cables, so that they are not running from the UPS.
- Tie the extension cables to the steel bars in a way that there are sockets available on strategic locations (i.e. every bed in post-op needs a socket)



- Connect the inside air-condition unit to the compression unit outside the tent and use the extension cable to connect it to the distribution box (**no UPS!**)
- Make sure that all cables are tied to the loops on the inner linings so that they are above the floor

Principle electrical system

- generator
- gen. switch board
- distribution box
- UPS
- Extension cord 4 sockets
- Lamp (2 sockets)



12. Water and sanitation plan

12.1 Water supply system



- Water source is depending on the local situation, but equipment is available for all situations: surface water (river, pond), borehole, water trucking and grid.
- Water treatment will be done by online chlorination or batch chlorination depending on the quality of the water and the supply. A online dosage pump is available.
- A 2” hose connects the water storage with a pressure pump (1000 Watt)
- HDPE 1” pipes will be used for the distribution
- All side connections will be installed with a valve
- HDPE pipes can directly be connected to a tap stand outside
- Connection to the scrub basins inside the OT will be done with a flexible hose

12.2 Waste water system

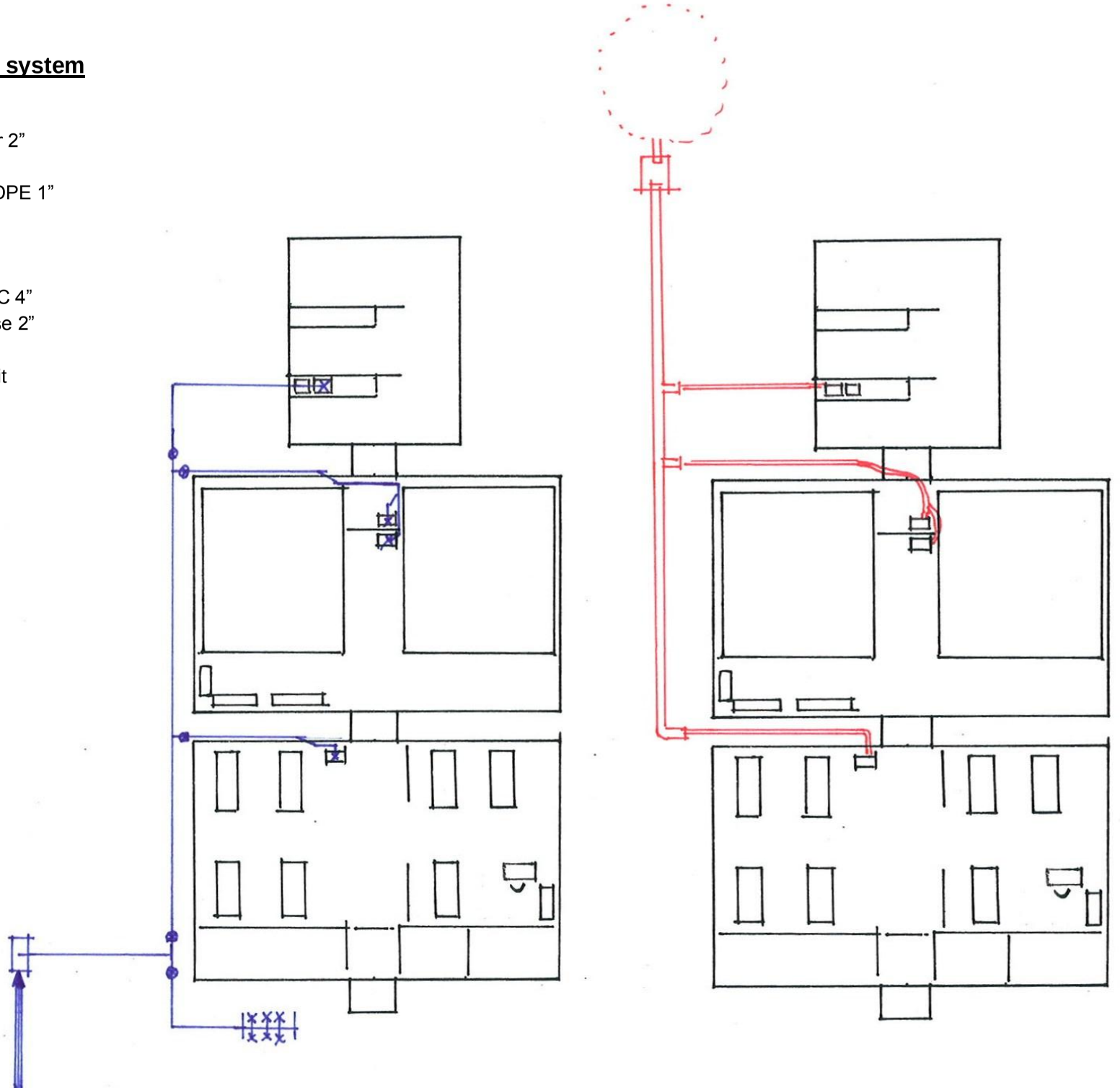


- Waste water from the scrub basins in the OT will be done with a 2” flexible hose that leads to 4” PVC drainage pipes.
- As we don’t expect have many solids, only a slight slope is necessary (1%-2%), however digging a trench will be necessary to reach the needed slope.
- 4” PVC drainage will be connected to a grease trap and further into a soak away pit

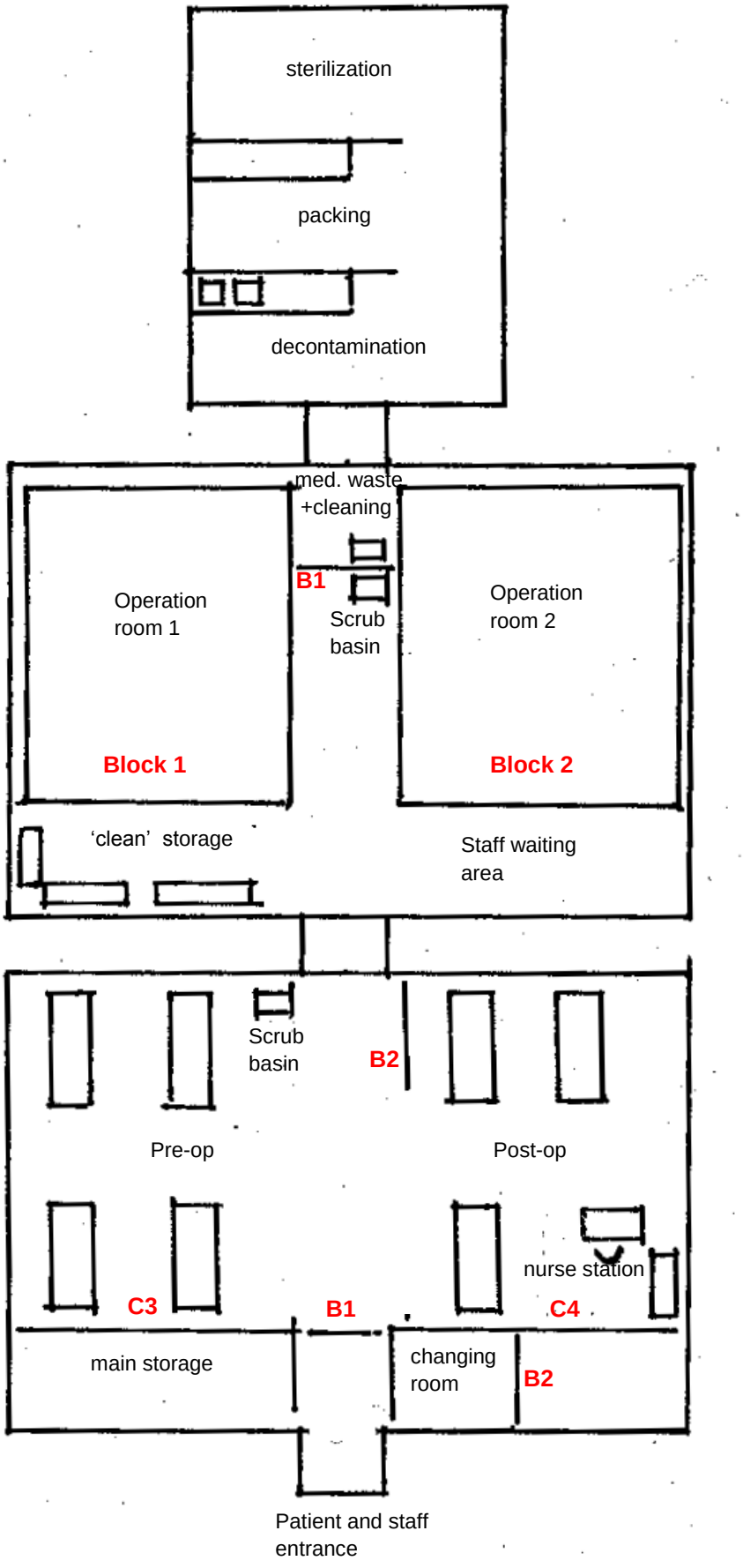
Principle water system

- treated water 2”
- tap and sink
- valve and HDPE 1”
- water pump
- tap stand

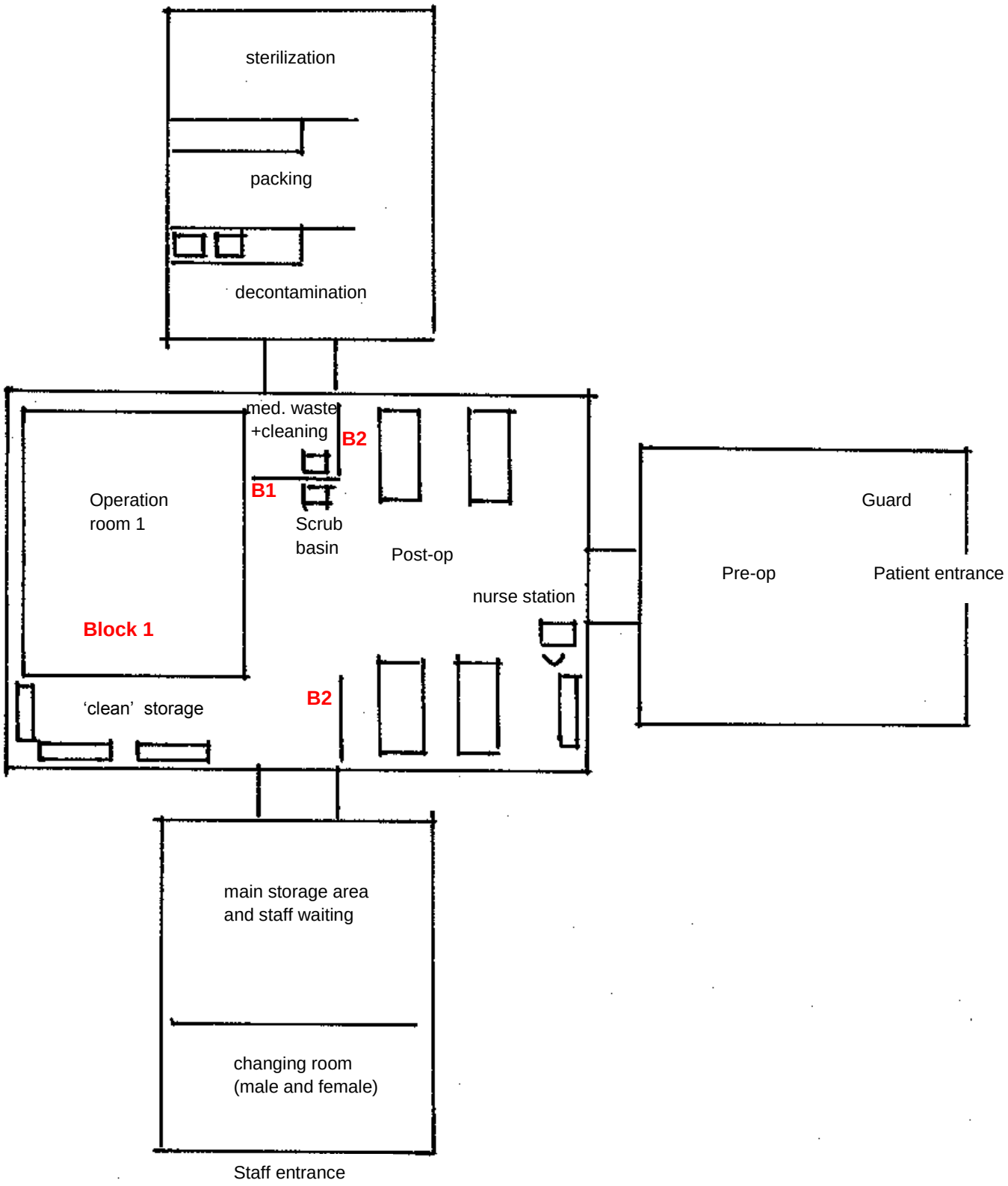
- drainage PVC 4”
- drainage hose 2”
- grease trap
- soak away pit



Annex 1: Floor plan double OT set-up



Annex 2: Floor plan single OT set-up



Annex 3: Folding the front module, step 1

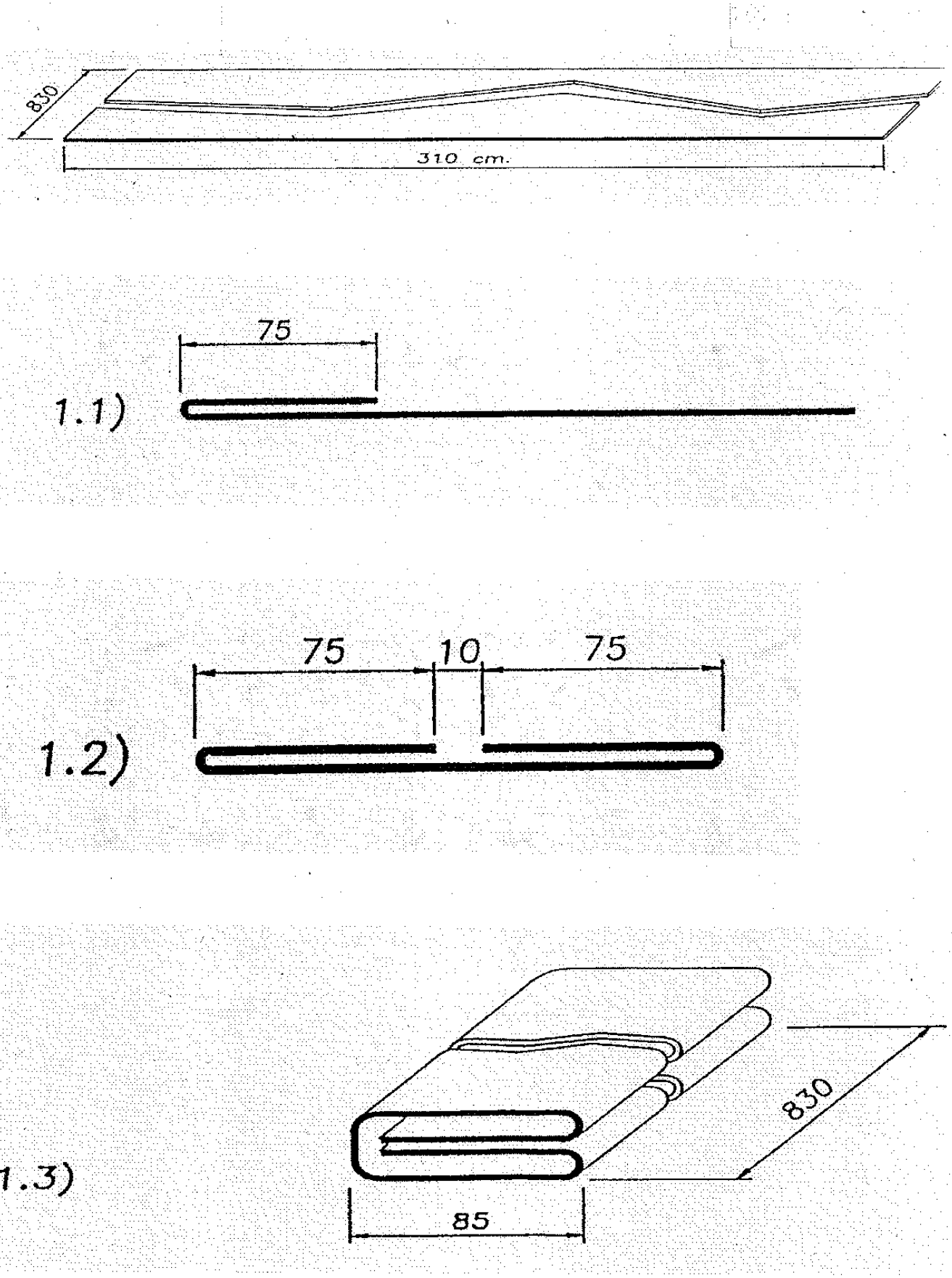


Figure 1-22 Folding the Front Module. Phase 1

Annex 4: Folding the front module, step 2

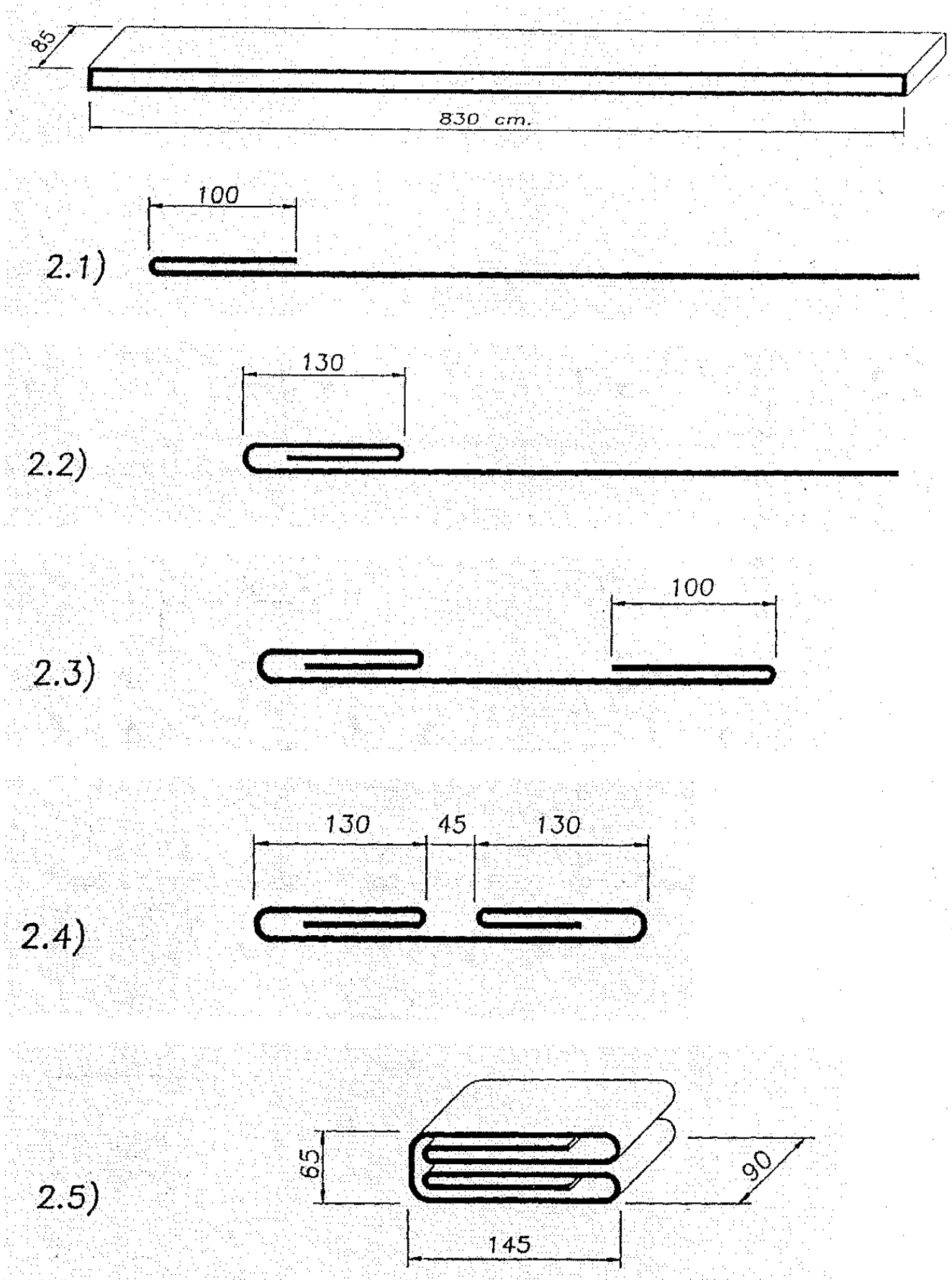


Figure 1-23 Folding the Front Module. Phase 2

Annex 5: Folding the middle module, step 1

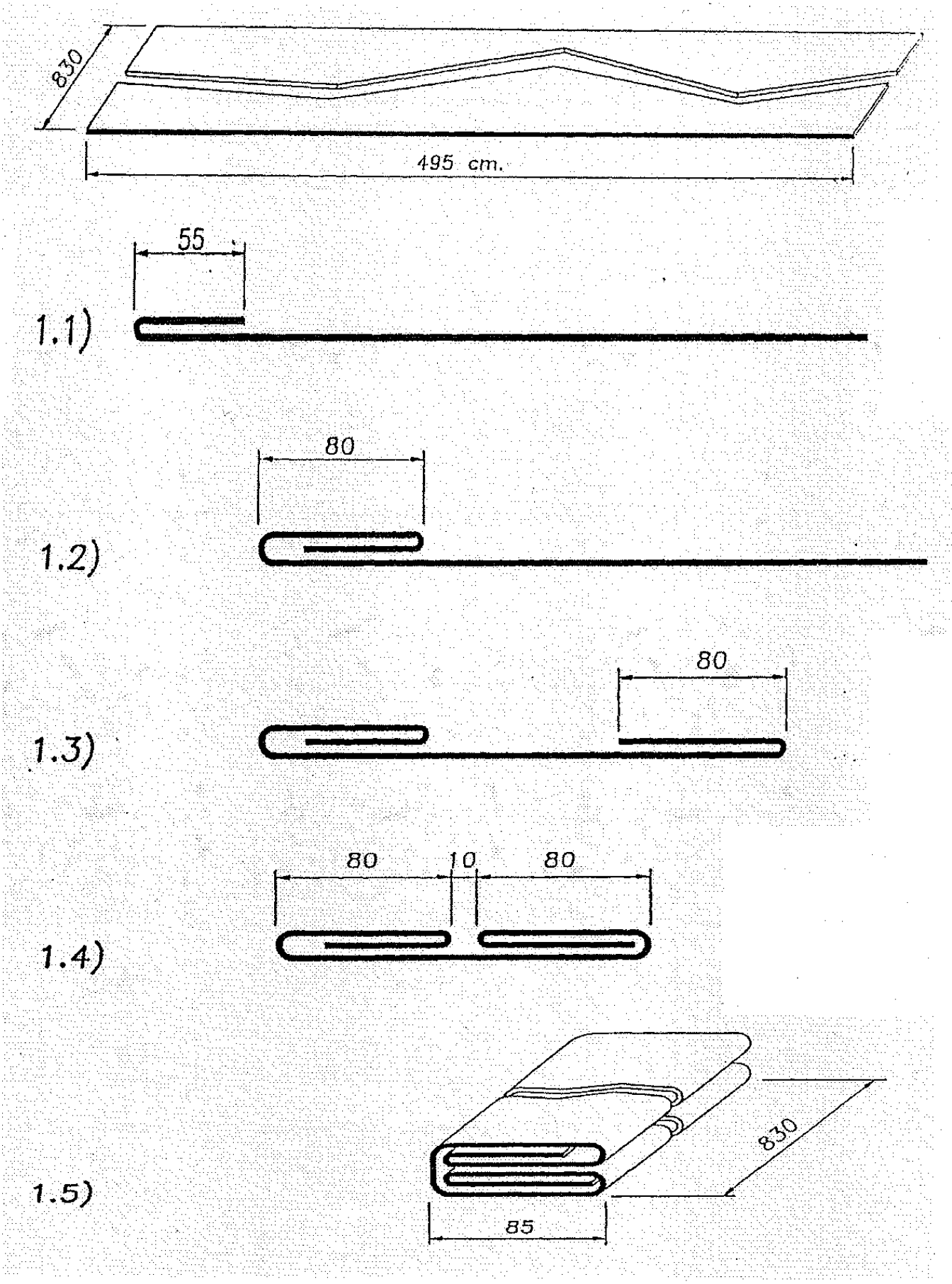


Figure 1-24 Folding the Central Module. Phase 1

Annex 6: Folding the middle module, step 2

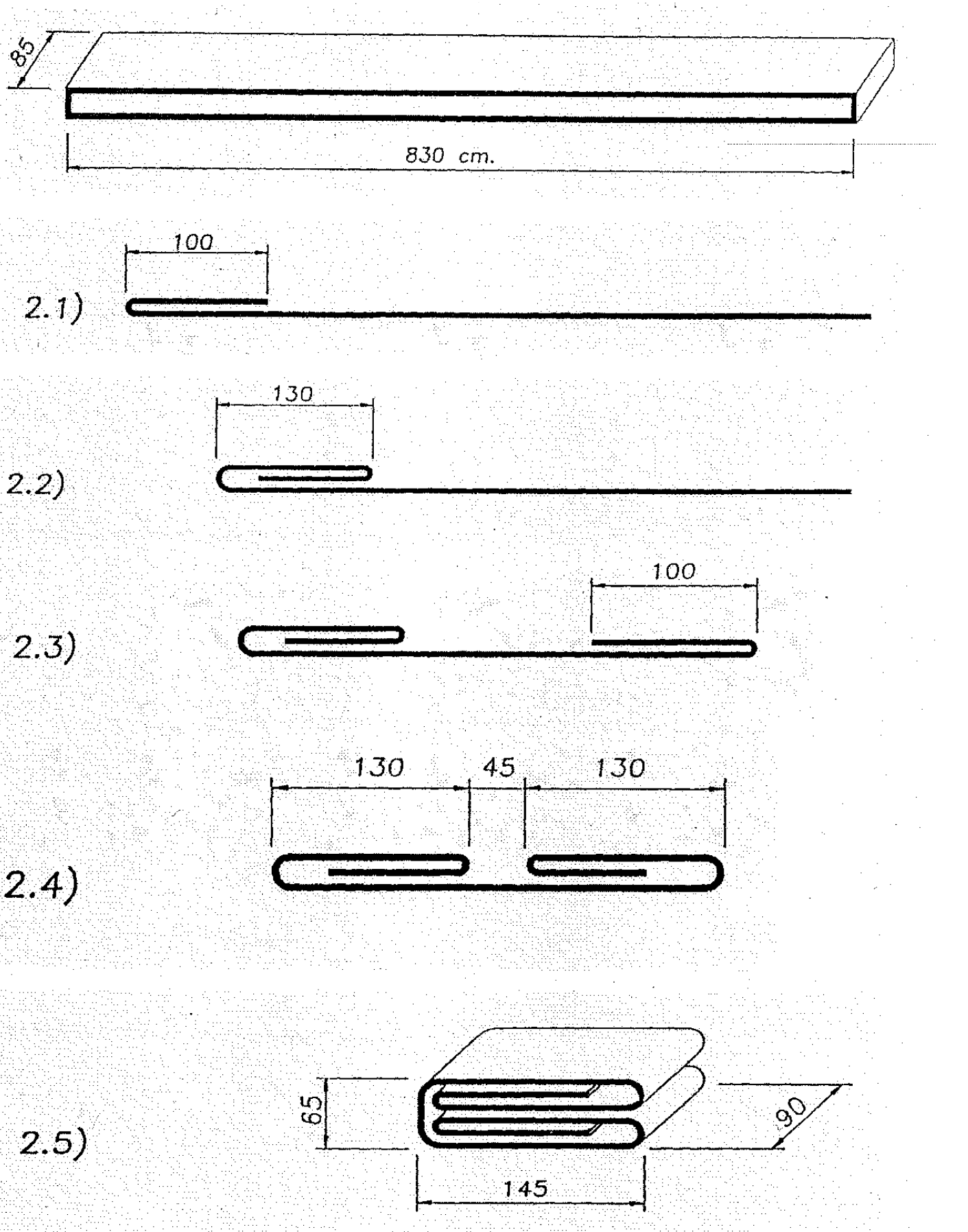


Figure 1-25 Folding the Central Module. Phase 2

Annex 7: Folding the rear module, step 1

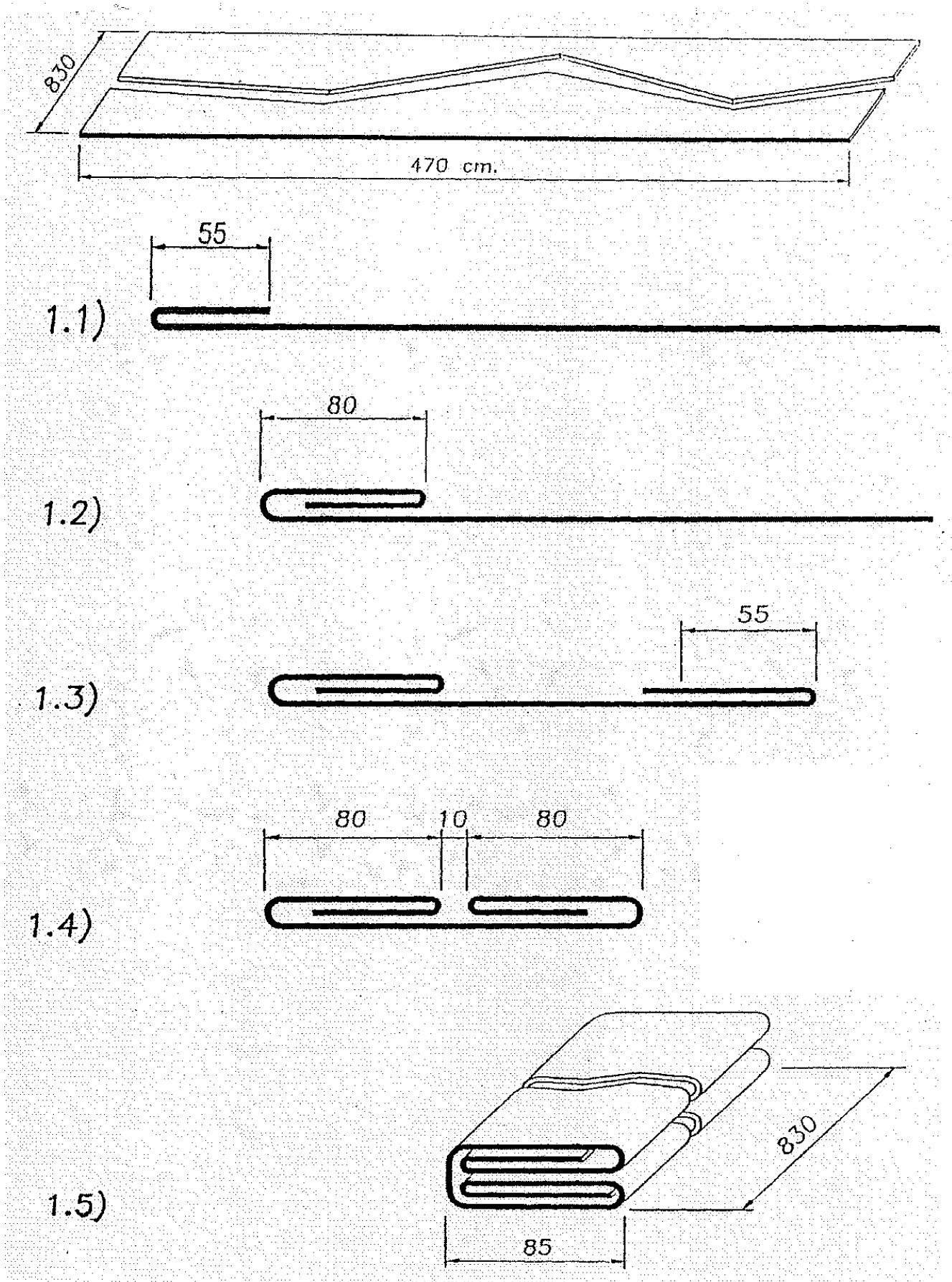


Figure 1-26 Folding the Rear Module. Phase 1

Annex 8: Folding the rear module, step 2

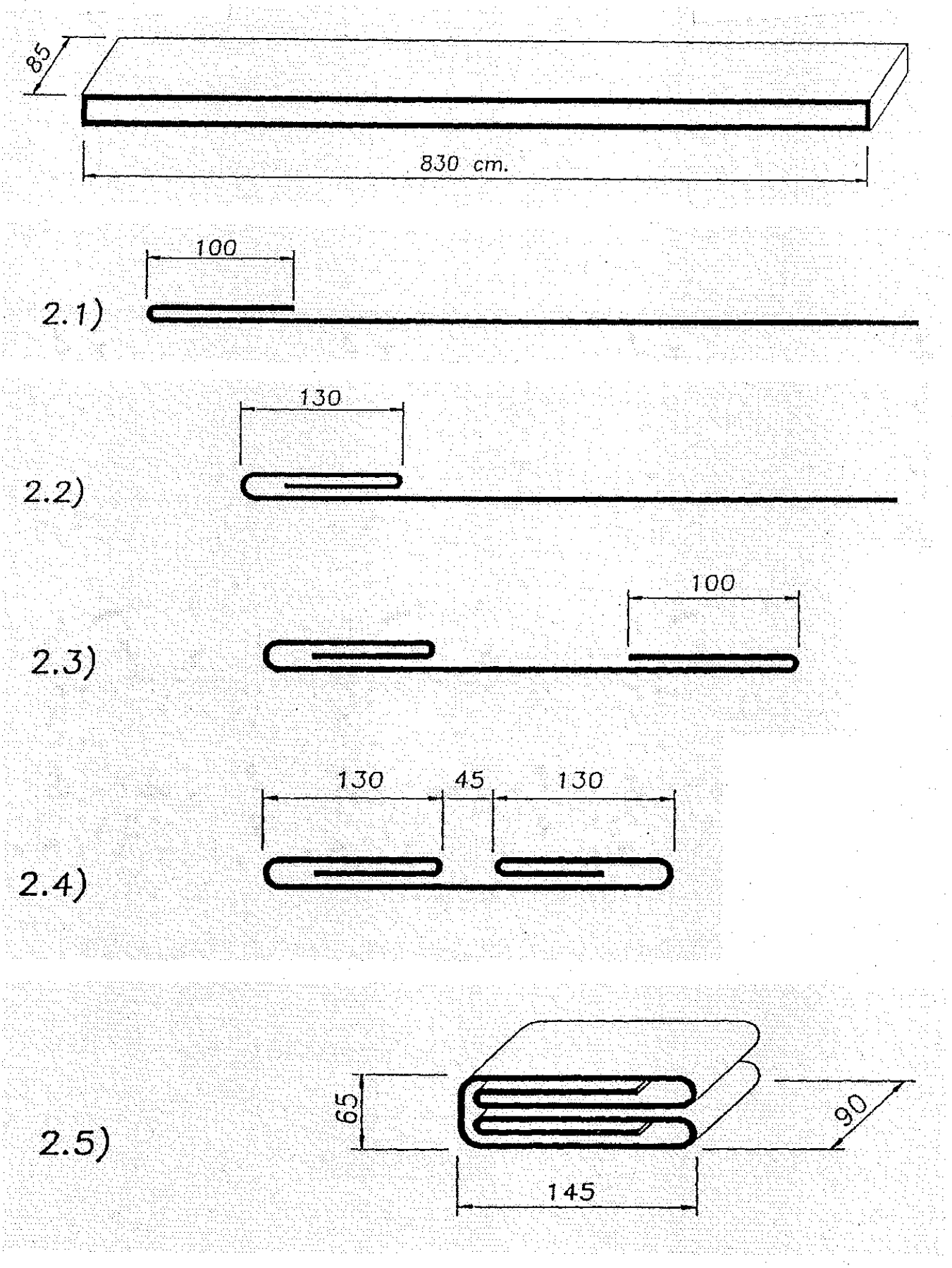


Figure 1-27 Folding the Rear Module. Phase 2