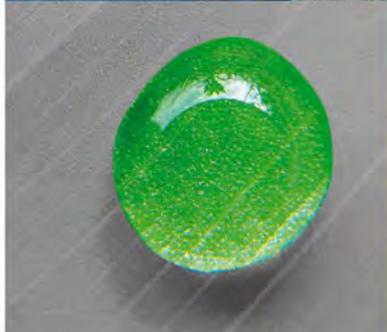


COLETANCHE®



INSTALLATION SHEET

Sheet 1 : Installing the hydraulic beam

1 Installing the hydraulic beam on the excavator.

- Use the right couplings for the hydraulic hoses.
- The hydraulic hoses used to operate the hydraulic beam must be the same as those used to operate the bucket of the excavator.
- When the beam is installed, lift it (without a roll) and test the various functions.
- If, when unrolling the membrane, the motor controlling the beam runs rough, the hydraulic hoses should be purged or damage will ensue.



Hydraulic beam installed on excavator

Sheet 2 : Delivery of rolls and distribution on worksite

2 Determine the storage area where the containers are to be stored and record their ID numbers.

2.1 Determine what type of machinery should be used to distribute the rolls

For this project, I wondered whether the containers could be placed where the rolls could be moved one by one to the project site so that they could be off-loaded directly where they would be laid. It seemed to me that this would require less handling of the rolls.

2.2 Distribute the rolls on the worksite based on the initial layout drawing

They can thus be deposited along the rear side of the dam using an unloading pin.



Unloading pin



Distribution of rolls near where they will be installed so that the excavator can pick them up





2.3 Put together the team in charge of distributing the rolls.

2.4 Reception of the rolls

The content of each container is checked and approved by the COLLETANCHE® technician. **See Appendix 1** for the form to be completed.



Sheet 3 : Preparing the base on worksite

3 Preparing the base

The base must be well and uniformly compacted :

- Careful manual compacting is required around intrusions.

The base must be :

- Free of organic material since rotting vegetation produces gas and modifies the compressibility of the base.
- Free of sharp or angular materials that could damage the geomembrane (protruding aggregates and chert).
- Rut-free to avoid subjecting the geomembrane to excessive pressure from the weight of the protective layer and the structural load.
- If the excavator transporting the rolls must manoeuvre on the base, it must do so parallel to the membrane panel being unrolled so that workers can manually rake out any imperfections prior to laying the membrane on the base.
- The COLETANCHE® technician will approve the quality of the base.
- See **Appendix 2** for the form to be completed.



Cleaning the base using rakes



Excavator with the hydraulic beam offset so the base can be rectified manually just before laying the geomembrane



Loader grading the base



Sheet 4 : Worksite organization

4. Standard team and installation equipment

A typical installation team is made up of :

- A foreman,
- Three workers to handle the membrane panels and temporary anchors,
- An excavator operator,
- A crawler excavator equipped with an unloading pin instead of a bucket.

Each worker should have the following equipment (see **Appendix 5**)

- Work gloves,
- Knife,
- Vice-grip pliers,
- Markers,
- Tape measure.

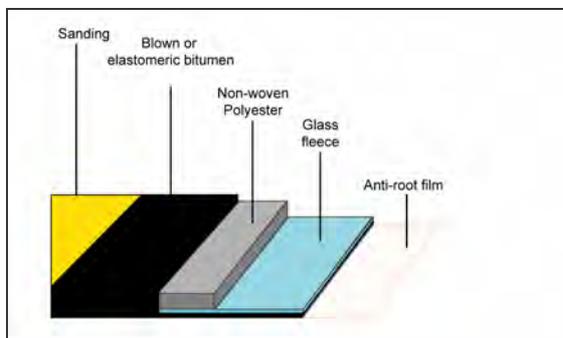
4.1 Membrane installation

Using the initial layout drawing, determine the start point of the first panel (west and east phases).

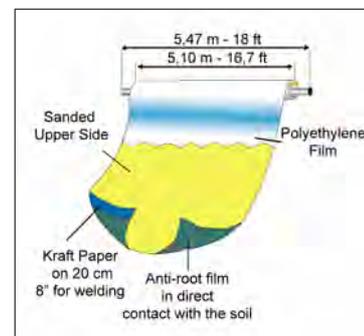
The layout drawing will serve as the reference for the panels that follow.

The 20 cm (8") overlap must be chalk marked to ensure proper alignment of the panels.

The COLETANCHE® geomembrane, in most cases, is laid with the terphane layer (shiny plastic film) face down.



Coletanche geomembrane



The ID number of each roll should be indicated on a hand drawing as the roll is deployed.

This drawing will be used later to draft the final report.

- See **Appendix 3** for the form to be completed.



Laying

- A waste container is required.
- The polyethylene film separating the rolls as well as the wrapping must be disposed of in the waste container.
- The protective edge tape must be disposed of in the waste container.





Waste management (polyethylene film, protective tape, etc.)

4.2 Cleaning overlaps

Make sure the overlaps to be welded are clean. If not, clean them carefully in the following way :

- Lift the edge of the upper panel slightly and remove the protective tape from the lower panel.
- Use a broom to carefully remove all debris (sand, soil, grit, etc.) from the edge of the lower panel.



Cleaning overlaps

Sheet 5 : Assembling

5. Welding

COLETANCHE® technicians on site will train the welding team.

- Training is given two days before actual installation begins.
- Poor welders are not selected.

A welding team is typically made up of :

- One welder
- One roller handler

The welder directs the welding operation. He determines the pace of welding and positions the worker handling the roller based on the bitumen melt conditions.



Welding



Rolling: Bitumen bead

5.1 Assembling

The team should have the following tools and equipment :

- Mobile welding device with 30 m hose and a regulator
- Propane cylinder mounted on a dolly
- Seam roller
- Cleaning implements such as brooms and a mop with a wringer
- Hook blade knife
- Flint lighter
- Gloves



Sheet 6 : Inspections

6. Weld inspections

6.1 Non-destructive inspections

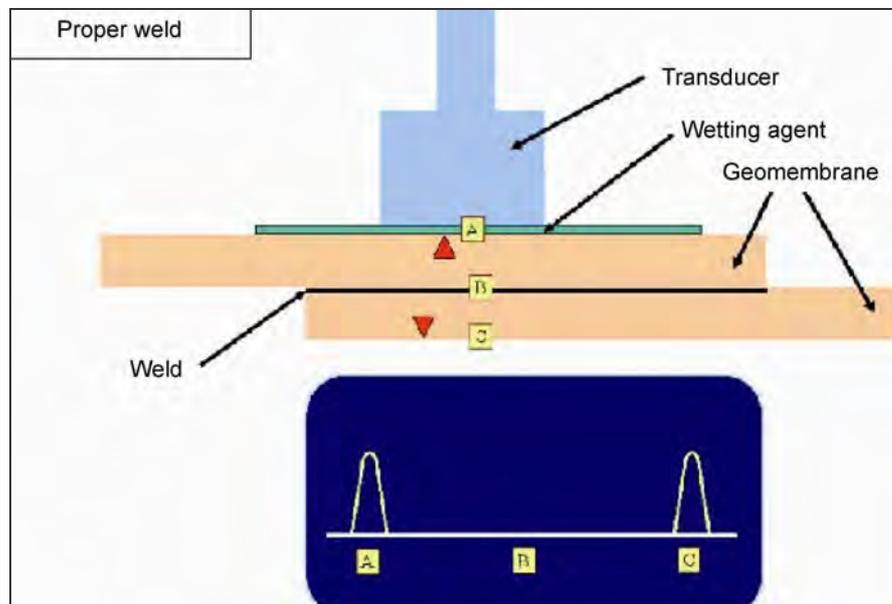
6.1.1 Visual inspection

A technician

- Visually inspects the weld,
- Marks locations requiring remedial action,
- Makes sure that defective welds have been repaired correctly.

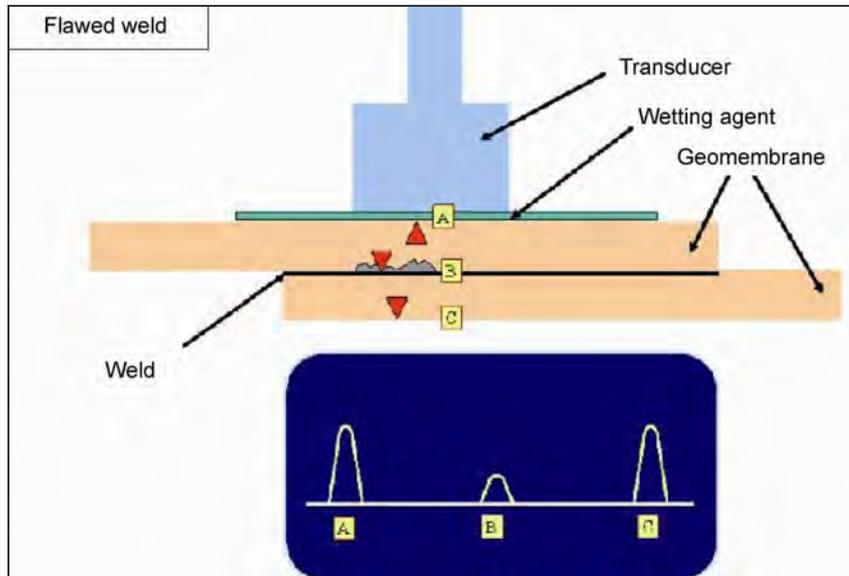
6.1.2 Ultrasound inspections

An ultrasonic pulse is emitted at the surface of the upper geomembrane. Echoes are generated at the point of entry (A) and the exit (C). If the weld is done properly, the acoustic impedance is constant and no secondary echo (B) is produced.



Ultrasound inspection showing a good weld

However, if the weld contains a flaw (air bubble, debris), a secondary echo (B) will be detected and displayed on the monitor of the flaw detector together with an audible signal to alert the operator.



Ultrasound inspection indicating a welding flaw

Portable ultrasonic flaw detectors are the most commonly used devices.

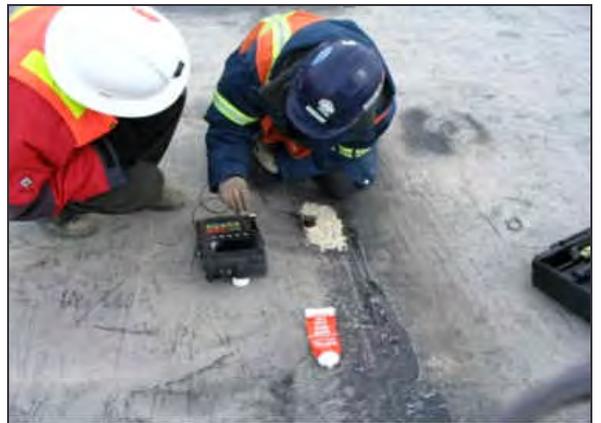
The operator scans the weld with a transducer and identifies flaws.

The surface of the weld is wetted using water on flat surfaces or upholstery adhesive on slopes.

Areas where welds are not wide enough to provide good mechanical resistance (minimum 13 cm, 15 cm in general) or where through-weld flaws are detected are marked by the operator for remedial action.



Epoch 4B ultrasonic flaw detector





6.2 Destructive inspections

Samples must be at least 200 mm wider than the width of the seam and the seam must be centred in the middle of the sample. Each sample must be identified.

See **Appendix 4** for the form to be completed.



Sheet 7 : Repairing and finishing seams

7 Repairing

7.1 Repairing flawed welds

An assistant welder will be trained to perform repairs (patches).

Remedial action must be taken to repair damage to the geomembrane and to flawed welds.

The remedial action consists of covering the damaged area with a geomembrane patch that exceeds the area to be repaired by 20 cm on all sides.

The assistant welder should have the following equipment:

- Propane torch for detail work with a 15 m (minimum) hose and a regulator,
- Propane cylinder mounted on a dolly,
- Cat's tongue trowel,
- Hook blade knife,
- Flint lighter.



7.2 Finishing

When the weld is completed, cooled and inspected, the welder finishes up by heating the lip between the two geomembranes to give the apron a bevel shape using a cat's tongue trowel.



Finishing the seam with a trowel



Sheet 8 : Closing the worksite for the day

8 Precautionary measures

8.1 At the end of each work day :

- Collect all small tools, propane hoses and propane torches,
- Close the valves on the propane cylinders,
- Place the membrane spools in an empty container,
- Identify the container(s) to ensure that the spools.

8.2 To make sure the geomembrane panels laid that day remain in place :

- Ballast the geomembrane panels

