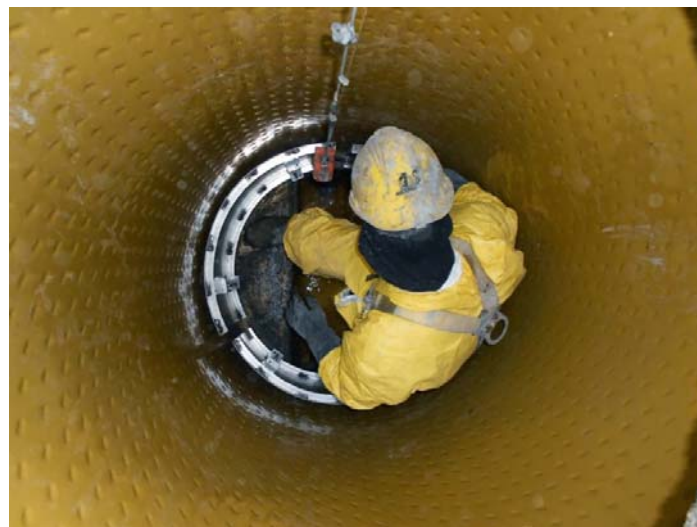


## Step by Step Guideline for Welding Predl Polypropylene & Polyethylene CPL Liners.

1. Traffic Measures provided by the contractor to make sure safe condition are met for Predl workers
2. Check for power requirements. Generator can be supplied by Predl if there is no power.
3. Set up confined space equipment [Lifting Harness, air exchanger, tripod crane]



4. PREDL employee enters the manhole for inspection. Inside surfaces of the newly lined manhole should be inspected to check for any leaks or defects. A spark tester may be used to ensure no gaps are left in the liners.



5. If there is an existing flow in the sewer line, the channel needs to be plugged or temporary work platform needs to be built, if required.

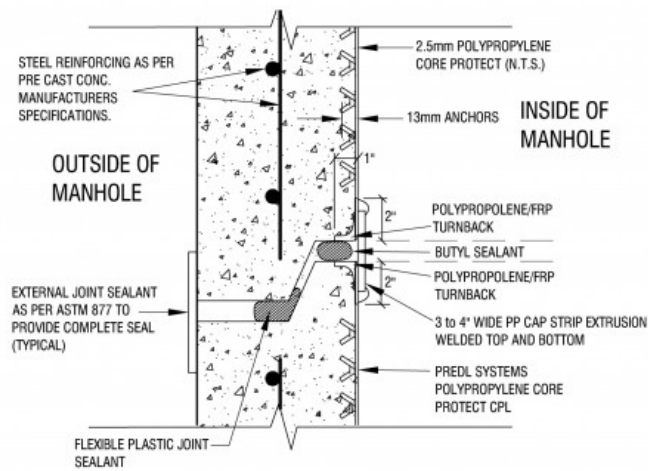


6. The welding area has to be protected from unfavourable weathering conditions as moisture, high humidity, wind, dust and temperatures below  $<5^{\circ}\text{C}$ . All joints are clearly marked and all welding parameter are recorded in conjunction with the joint number.
  - i. Assure that no remaining moisture (eg. groundwater ) is seeping through the joint section
  - ii. A climate control is given (eg. cover of the area by tent) temperature:  $+5^{\circ}\text{C}$   $-+40^{\circ}\text{C}$  moisture content: max 75%
  - iii. With environmental temperatures below  $+5^{\circ}\text{C}$ , moisture (relative air humidity  $>80\%$ ), strong wind and intensive sun radiation, welding can be done only under special precautions. The surface temperature of the semi-finished products must be minimum 3 K higher than the dew point.
  - iv. If appropriate measures (e. g. preheating, tent-covering heating) are taken that the required material temperature, ambient temperature and operating conditions will be maintained, welding operations may be performed at any outside temperatures
  - v. Clean and dry air must be available, and can be obtained with aid of fresh air exchanger (supply). Also in case that the environment conditions are not possible to weld appropriate measures shall be provided by the contractor (eg. Dust control/wind fence etc).
  - vi. The joining areas must be dry and clean (no pollution or oxidation film).

7. The following measures have to be done before the welding, as required:
  - i. Remove any oxidation material from the surface.
  - ii. Dry moist surfaces
  - iii. Clean the welding areas
  - iv. Machine/power wash the surfaces if required (supplied by the contractor).
  - v. The joining areas of the parts to be welded must not be damaged or contaminated.



8. Installing welding strips if required - When installing cap-strips, mark and measure where the cap strip will be applied. Install the cap-strip in place, such that each joining piece will have 2-3 inches of cap-strip overlay, and extrusion weld all around the perimeter (both sides) of the cap-strip.



**TURNBACK AND CAP STRIP JOINT DETAIL**

POLYPROPYLENE/FRP N.T.S.  
TURNBACK WITH BUTYL SEALANT DETAIL



9. Commence Extrusion welding



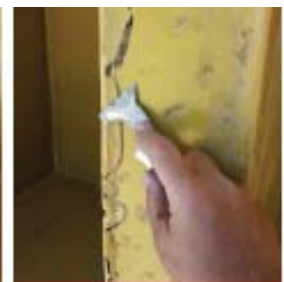
10. Grinding and post welding finishing



*Joint Cleaning*



*Grinding*



*Scraping*

11. After welding, perform spark tests to ensure complete seal in the liners.



12. If the weld sections do not pass the spark test, any areas that concerned need to be stripped back to parent materials and re-welded.
13. If vacuum test is required after the spark test, contractor is responsible with it unless otherwise noted.
14. Remove the Predl equipment and commence final inspection.
15. This concludes the work.

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