Repair of Lock Gates at Cullen Bay Marine, Australia

**AN OPEN & SHUT ~~CASE~~ GATE**

Cullen Bay Marina project proves an open and shut case for underwater wet welding.

After suffering a number of constructional and operational mishaps, the lock gates at Cullen Bay Marina in Darwin, Northern Territories, in Australia finally gave up the ghost. Local diving specialists Tim Proctor of Territory Diving was asked to evaluate their repair. “We had a stroke of luck here,” said Tim. “I knew David Keats, the underwater wet welding expert was in the country, opening a new training center in Perth, Western Australia. I was very much aware of David’s reputation in the field. As the author of the UK’s National Qualification and The Professional Divers Manual on Wet Welding, I knew he was the man for the job and asked him to advise us on the suitability of wet welding”.

“One of the most difficult aspects of tackling any underwater welding job is to convince the client” said David. Underwater wet welding generally has a very poor reputation and the first thing I usually need to do is dispel the myths that surround this much maligned process”. After a number of meetings with the client, where I provided evidence of the typical quality they could expect from wet welding, they agreed I should take a closer look at the gates. Armed with all the details I conducted an inspection dive. After which, I detailed a welding procedure using my own ‘Barracuda’ underwater electrodes and a method statement for the repair.

Figure 1 shows one of the gates. Each gate weighs over 12 tones and stands some 15 metres high.
The gates consisted of a total of five hinge brackets, secured to the door via a hinge pin and then welded to a steel channel in the side of the concrete lock wall. The first task was to remove the pins from each gate, to allow the door to be removed out of the lock altogether. This involved the use of a number of heavy cranes.

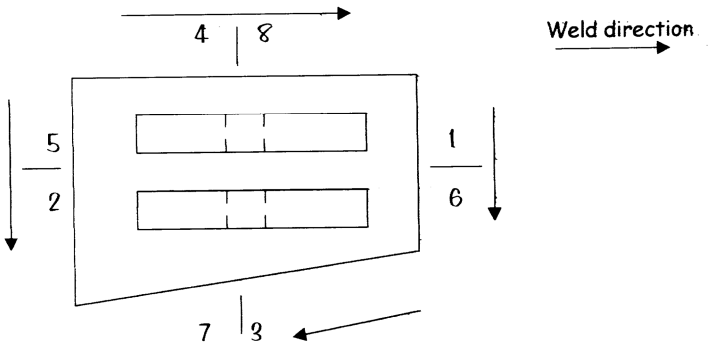
Then the task of removing the damaged hinges from the wall began. This involved divers cutting away the damaged weld using hydraulic grinders and air tools. Once all the hinges were removed these were machined up and the hinges were re-used. While this process was taking place, Tim's divers were busy grinding up the old welds on the channel faces, ready for fitting the new hinges.

Figure 2 shows one of the failed hinge brackets in situ.

Once all the hinges had been machined as required, and the grinding was complete, the hinges were secured onto the door and the door was lowered into the water. I, or my able colleague, local diver 'Noel Palmer' guided each door so that all the hinges could be located in position, then tack welded into place. A somewhat delicate operation as each door weighed over 12 tonnes and each hinge weighed over 70 kilos. Any small movement on the top of the door, even of a few millimeters, would amount to a movement of many centimeters on the bottom and even holding the door vertical had its problems. However, through the excellent team work of local contractor, 'EC & E' controlling crane operations and Territory Diving's surface support personnel, the task was accomplished in good time and without any serious hitches.

Getting back to the welding operations, one of the biggest problems we faced was the very poor visibility and for me CROCODILES! Being just a simple pohm the most dangerous thing I've ever faced was an old shopping trolley. But seriously, the water conditions in Darwin meant that visibility was usually very poor indeed. In fact, fresh water was often pumped down to us in an attempt to improve conditions.

Figure 3 shows yours truly being dressed in ready to weld.




The actual preparation of the hinge bracket and the welding sequence was as shown above.

The bracket was cut back in this way, to aid overhead welding. In this way, the bubbles generated from the burning electrode could escape without interfering with the welding arc. The root and hot pass welding sequence, was conducted in a series of 8 blocks so as to minimise stresses and distortion. Once these two passes had been completed the welding followed a similar pattern, but attempts were made to ensure as few stop/starts as possible. The total number of passes was 9 for each bracket. This allowed for a 12-mm leg length to be produced as shown below.

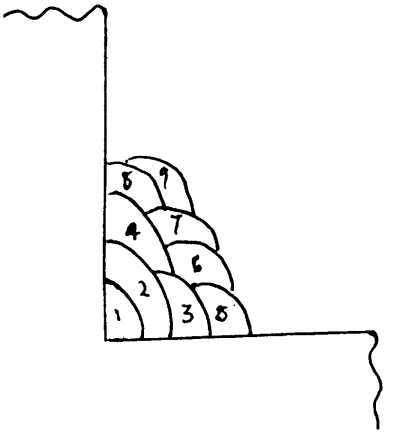



Figure 4 shows a sketch of the number and location of weld passes.

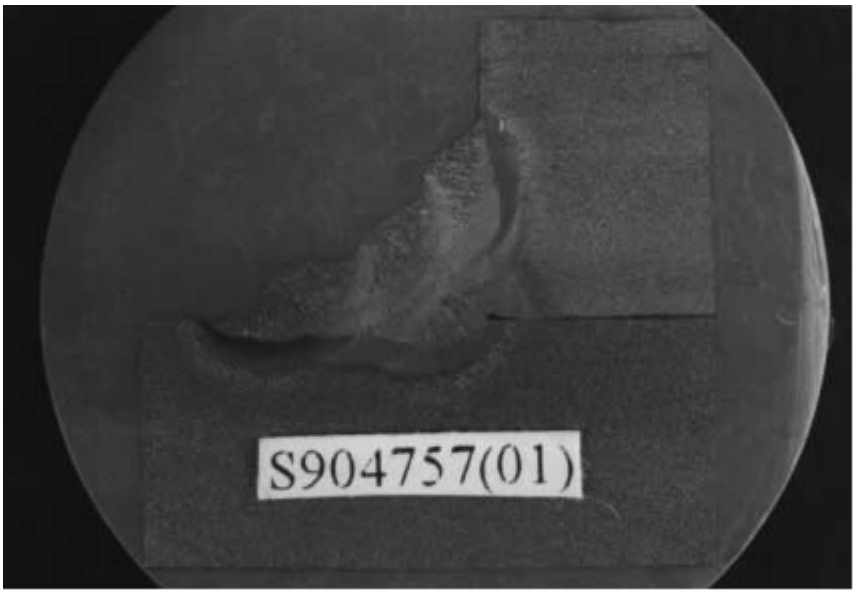



Figure 5. Shows a macro photo of the weld at (x3.4) magnification.

Each hinge could take up to 4 hours to complete and involved many hours welding in total. With Noel and me the only two qualified welders, spending up to 5-6 hours in the water, at any one time, wasn't unusual.

Figure 6 shows one of the hinge brackets fully welded. This photo was taken after pumping fresh water down to the hinge, to improve visibility.

I would like to take the opportunity of thanking Tim's crew, EC & E and of course the management of Cullen Bay for all putting up with me, a blooming winging 'pohm'. They all did a splendid job, it was a pleasure to be in Darwin and I am pleased to learn after many months of operation the gates have performed without hitch. A testament to the fact that with proper procedures and control wet welding can perform to realistic standards of quality and at an attractive price.

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