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## Treatment Systems for Process Water

**Engineered Systems:** Reverse Osmosis

**Case History:** Aluminium Bahrain

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### **Background**

As part of the Aluminium Bahrain (ALBA) line 5 expansion, Satec Ltd supplied a desalination plant through Bechtel International to provide ALBA with an extra flowrate of 110 m<sup>3</sup>/hr of treated potable quality water from a borehole source having a TDS level of 14,500 mg/l and hydrogen sulphide content of 6.5 mg/l.

Borehole water, dosed with sulphuric acid to a pH of 5.0, is pumped to a single stream, single pass reverse osmosis unit, operating under anaerobic conditions at a recovery rate of 75%. Hydrogen sulphide is removed from the system by passing the permeate through a degasser tower, followed by a 3 stage reaction tank, where the remaining traces of hydrogen sulphide are oxidised to sulphur and sulphates by contact with sodium hypochlorite and sodium bisulphite.

Any suspended solids are removed by passing the treated permeate through a bank of 5 micron cartridge filters followed by activated carbon filters for residual chlorine removal.

Re-hardening and pH adjustment of the treated water are achieved by the addition of carbon dioxide gas and hydrated lime, with final chlorination being carried out by sodium hypochlorite dosing.

### **Equipment Installed**

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| Inlet Cartridge Filters | : Bank of 3 horizontal Pall GRP filter vessels to ASME code each with single 5 micron element.   |
| Reverse Osmosis Unit    | : Single pass, 2 array, skid mounted unit with 21 no. GRP housings and 126 no. high rejection seawater membranes type SW30HR – 380, complete with flushing and CIP systems.  |
| RO High Pressure Pump   | : Flowserve horizontal multi-stage centrifugal pump in Duplex stainless steel rated 156 m <sup>3</sup> /hr at 38 bar g with 250 kW variable speed drive.   |
| RO Interstage Pump      | : Flowserve horizontal multi-stage centrifugal pump in Duplex stainless steel rated 81m <sup>3</sup> /hr at 20 bar g with 75 kW fixed speed, soft start drive.   |
| Degasser Tower          | : Forbes forced draught degasser in GRP, 1400 mm dia x 6900 mm height with packing of polypropylene Pall rings for 96% reduction of hydrogen sulphide. Duty / standby fans rated 4520 Nm <sup>3</sup> /hr at 1300 Pa |

- Reaction Tank : 3 Stage reaction tank in lined reinforced concrete, each stage 50m<sup>3</sup> capacity, 30 minutes retention for contact with hypochlorite and bisulphite for removal of hydrogen sulphide traces.
- Filter Feed Pumps : 2 No. Weir Pumps Isoglide, horizontal centrifugal pumps rated 156 m<sup>3</sup>/hr at 4.0 bar g with 30 kW motor.  
Casing in SG iron with stainless steel impeller.
- Pre-ACF Cartridge Filters : Bank of 3 horizontal Pall GRP filter vessels to ASME code each with single 5 micron element.
- Activated Carbon Filters : 3 No. Vertical pressure filters 2500 mm diameter x 2000 mm tan / tan in lined carbon steel, design pressure 6.0 bar g with 3000 kg GAC.
- Chemical Dosing : **98% Sulphuric acid** : 12,500 litre C.S. bulk tank with 2 no. cabinet mounted Prominent solenoid metering pumps 0-6 l/hr.
- Antiscalant** : 1000 litre polypropylene tank with 2 no cabinet mounted Prominent solenoid metering pumps 0-4.4 l/hr.
- Hypochlorite** : 10,000 litre lined GRP tank with 4 no cabinet mounted Prominent solenoid metering pumps 0-10.5 l/hr, 2 no. rated 0-3.6 l/hr
- Bisulphite** : 1000 litre polypropylene tank with 2 no cabinet mounted Prominent solenoid metering pumps 0-11 l/hr.
- Lime** : 5000 kg silo storage with 5000 litre slurry tank and 2 no. 0-330 l/hr Milton Roy diaphragm metering pumps with auto flush system.
- Carbon Dioxide** : Air Liquide 0-15 kg/hr gas carbon dioxide injection system.