

American Eco Systems Elmosa Next Generation Seawater Intake and Outfall Systems

The hyperbolic paraboloidal InvisiHead intake head and outfall diffuser specifications 2020

THE NATURAL SEAWATER INTAKE SYSTEM
 Mother-Nature takes over the operation. Need for maintenance ceases. No pumps, no screens, no backwash or air bursting, O&M-free, No O&M expense, Gravity flow System
 The only water intake system that makes money and pays its capital costs

US EPA: Best Technology Available, the InvisiHead meets and exceeds the Final Cooling Water Intake 316(b) Rule requirements; EU: BAT to Industrial Cooling Systems

Do you have problems in your intake with:

- Zebra Mussels?
- Fish, Fish larvae and eggs, Jellyfish, Algae, Sand, Trash and Debris?
- Sea grass or algae?
- Potential for oil spills?

The NEW InvisiHead®

O&M Free

The NatSep® Basin
 The Natural Pump

Users: Power & Desalination Plants, Oil Refineries, Mining, Fish Farms, Aquaculture, District Cooling, Municipalities and Others

Velocities: approach 0.002m/s (0.0066 fps), inlet 0.09m/s (0.295 fps, No environmental adverse impacts are associated with the seawater intake, cooling water or concentrate discharges; low on SDI, ideal for RO systems, aquaculture, and condenser systems.

Our Design Philosophy is based on:

- Pro action rather than Reaction; unattractive to biomass, sediments, seaweed or debris
- Prevention rather than Curing; selective system; marine currents sweep out SS to the ambient
- Exclusion & Preservation rather than Eradication; no impingement or fish mortality

Promotes Biodiversity, protects the ecosystem

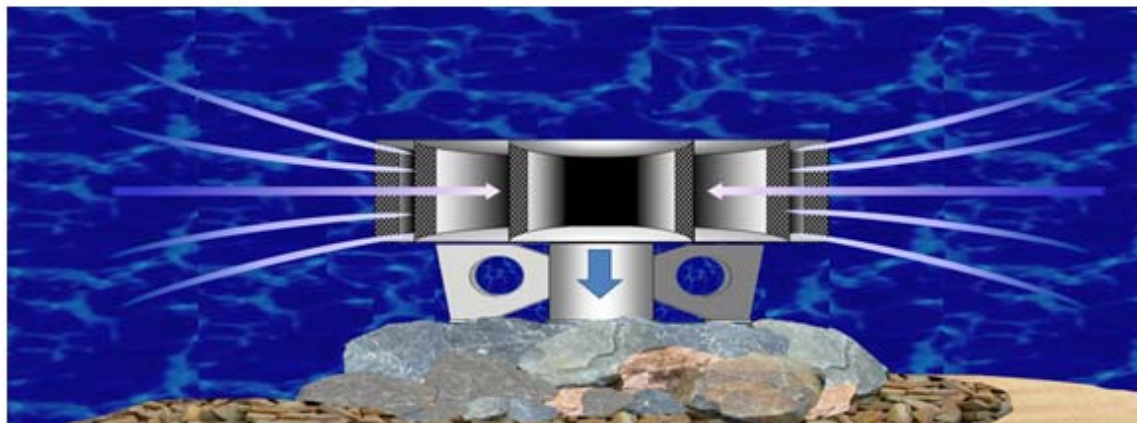
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The InvisiHead Sea Outfall; flow attains local ambient conditions as soon as it is out
 Wastewater, cooling water, brine, etc.

SWRO Brine Discharge

Paraboloidal InvisiHead diffuser

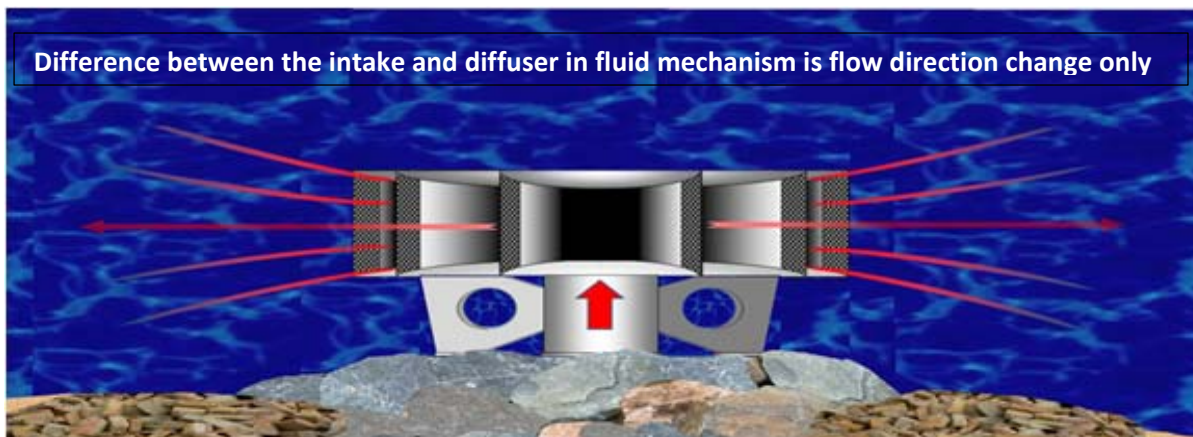
AES The Home of the InvisiHead
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Technical:

- **Intake flow Pattern:**
 - Intake entrance and outfall exit velocity: 0.09 m/s max., outlet velocity at the upstream InvisiHead/intake pipe inlet interface region: 0.11-0.14 m/s;
 - Flow controlling mechanism: Potential flow;
 - Intake flow pattern:
 - Round surround, curving up, straight in sideways, curving down, Omnidirectional,
 - Flaring or funneling in, fades away into the surrounding environment,

- Continuous hyperbolic round surround, up, sideways, and down paraboloidal action,
- Phasing in,
- Marine currents take supremacy over the flow and maintains self-cleansing conditions as per Elmosa Velocity Envelop (EVE) principle;
- Flow management and control;



- **Outfall Flow Pattern:**
 - Omni directional,
 - Flaring or funneling out,
 - Continuous parabolic round surround solid diffusion,
 - Achieves the required dilution early in the near field mixing zone,
 - Effluent fades out and disappears into the ambient within the vicinity of the structure;
- Flow Domain:
 - 4-D-spatial and temporal;
 - Continuous exponential expansion;
- Flow streamline regime:
 - Curved upward – straight – curved downward
 - Symmetrical or asymmetrical around central disc as per the site characteristics and requirements;
- Flow velocity regime:
 - Decelerating away from entrance or exist,
 - asymptotic to horizontal plane,
 - velocity approaches 0 m/s after a short span (5-10 m away);
- Flow velocity profile:
 - Almost flat with uniform velocity at the entry or exit line;
- Pressure distribution:
 - Uniform at the entry or exit line (no eddies) or head loss due to friction,
 - Head loss is negligibly small – 0.017 mm,
 - Pressure drop is less than 0.002 mb.

Physical:

- Exclusion zone envelopes 4-phase flow pattern:
 - Approach,
 - Stabilization,

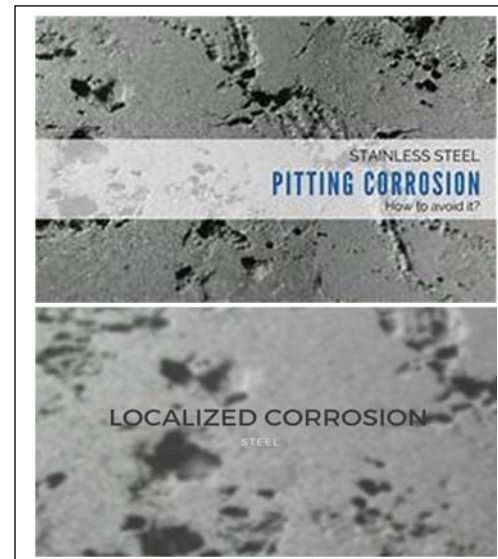
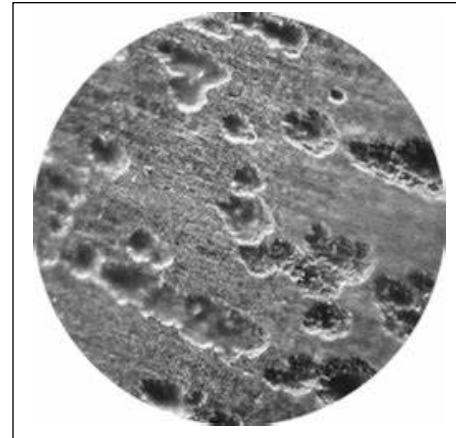


- Acceleration to depart,
- Steady state;
- Dimensions vary with:
 - Flow capacity,
 - Height – to – diameter flow tuning ratios,
 - Dimensions of each flow phase,
 - Wave height,
 - Submarine currents,
 - Local site conditions such as stratifications and presence of layers of plankton;
 - Type of seafloor sediment decides how to tune the streamline takeoff velocity not to be disturbing.

Mechanical:

- Design approach:
 - proaction: The natural order manages the flow and removes suspension;
 - robust and durable.
- Design philosophy:
 - exclude,
 - prevent,
 - preserve;
 - peaceful coexistence
- Process:
 - Natural – no O&M;
- Flow type:
 - Passive;
- Flow area:
 - None restricted flow,
 - No mechanical screens:
 - moving or,
 - stationary;
- Operation:
 - Self-operating;
 - reliable
- Maintenance:
 - Self-maintaining:
 - No backwash,
 - No air purging or bursting,
 - No manual or mechanical interference,
 - No traveling or drum screens,
 - No mesh;
 - No controls,
 - No sensors,
 - No alarms;
 - No moving parts.
- Chemical dispensing:
 - Built-in anti biofouling (optional);
- Material:
 - Made of high grade stainless steel as per site, application, and customer requirements:
 - 316L or Duplex or Super Duplex for the intake,

- 316L SS for cooling, Duplex or Super Duplex for brine diffuser;
- Assembly:
 - Factory assembled or assembles at site;
- Fabrication:
 - Mill finished,
 - Electro polishing,
 - Welding stains removed;
- Weight:
 - A function of size;
- Stability:
 - Robust heavy-duty structure;
 - Outstands Cat5 hurricane force;
- Floor anchorage:
 - Through built-in support legs and robust concrete base imbedded L bolts;
- Life span:
 - In full operation for over 50 years-the worst that can happen is progressive cervix corrosion but performance will not deteriorate unless the upper and bottom plates are all perforated.
- Maintenance:
 - None;
- Operation:
 - None – ‘Plug N’ Play’ approach;
- InvisiHead/intake or outfall pipe connection:
 - InvisiHead flange is made to match the pipe flange and flange adapter.



Environmental (a breakthrough):

- Compliance:
 - Meets and exceeds US EPA and international standards and requirements;
- Fish Mortality:
 - Zero;
- Biodiversity:
 - Promotes and stimulates biodiversity
 - **Natural diversion:** If the following comes into the InvisiHead and does not make a U-turn out of the IH after the tour is over, it flows straight through and out of it from the opposite end and into the ambient seawater again because through current velocities are much higher than the velocity at the IH outlet:
 - Adult fish,
 - Juvenal fish,
 - Fish shoals,
 - Fish larvae,
 - Jelly fish,
 - Seaweed, and the rest of marine life,

Cervix corrosion is the worst that can happen to a SS plate. We make the InvisiHead of robust relatively thick plates that will survive many decades under a progressive Cervix corrosion attack before it fails

- Sediments, debris, and trash.
- Dilution:
 - As an outfall discharges, disperses, blends and dilutes effluents like:
 - RO brine,
 - Cooling water,
 - Aquaculture and fish farms effluents,
 - Municipal wastewater discharges,
 - Community cooling systems
 - Discharges fade away in the ambient early in the near-field mixing zone.

*Issued and updated by Elmosa Seawater Intake and Outfall Systems on Jan.31, 2020
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