film to reduce moisture absorption, improve mechanical rigidity, and provide biocompatibility. The following standard will be utilized as a guideline for evaluation and housing materials. ASTM F2007 – 10 Standard Specification for Polycarbonate Resin for Medical Applications. The silicone septum will be molded in place from liquid silicone through a filling process utilizing a temporary stopper (wax) to isolate the refill port. Commercially available medical grade, small diameter catheter will be used.

Injection molding will proceed as an alternative manufacturing process for higher volume production of the pump housings. Design and machining of precision aluminum molds will be accomplished through a 5-axis CNC milling process (capability provided by 4th Axis, Inc., San Diego, CA). Injection molding process is favorable for high volume plastic part production (beyond scope of this Phase 1).

Pump packaging will be evaluated for moisture resistance and long term exposure to salt environments under simulated *in vivo* conditions. Validation of operation will be evaluated through long term mean-time-to-failure performance at elevated temperature (37°C) and 100% humidity. The ASTM D2247 – 11 Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity will be applied. The pump housing and actuator will be monitored to detect changes over time associated with diffusion loss, hygroscopic water absorption or skew leaks in the seals.

Production and testing of coils and circuitry: The primary transmitting coil will encompass a perimeter slightly larger than a standard cage bore and will be sized to at least 1 ampere of current carrying capacity. The primary and secondary coils will be wound using a winding apparatus we have built to guarantee precise and reproducible coils. The secondary receiving coil will utilize stranded highly-space efficient 42 AWG magnet wire. Coils will be protected against moisture through a silicone or Parylene C coating.

The transmitting circuitry will be implemented using standard circuit board technology sized to fit within the base station but outside the perimeter of the primary coil to avoid self-inductions and interference. The receiving circuitry within the pump housing will be fabricated on a polyimide flex circuit technology (0.2 mm thick) and will utilize standard surface mount components. The secondary circuit will be wrapped around the internal reservoir housing and encapsulated for moisture protection.

3.3 Objective 2A: Develop wireless controller hardware

The base station will use a plastic enclosure to house the primary transmitting circuitry and coil; plastic avoids shielding effects and induction of eddy currents within the enclosure. Efficiency and power output of the transmitting circuit will be characterized by simulating the receiver circuit with a small high power resistance in series with the primary coil.

Current generated through primary will be measured and used to evaluated overall efficiency of the resonant circuit and housing conditions. Power output efficiency will be calculated as the supply power input minus the power dissipation in the Class E driver and primary coil.

The wireless power transfer performance will be validated as follows using a test resistance in series with a tuned receiving coil. These measurements will yield maximum power transfer capability independent of the receiving circuit implementation.

1. Link range (power transfer vs. distance of secondary coil)
2. Prevention (power transfer vs. alignment angle of secondary coil)

Performance of the complete receiving circuitry will accessed by:

1. Current output homogeneity over base station footprint
2. Validation of current regulation in under and over coupling regimes.