ME-30 Thesis

To explain the Mecha Heat Sink in trek terminology, with text and graphics. In addition, design a post Dominion War - Triple Heat Sink, with text and graphics.

The basis of all Battle Mech technology is based on a tri-pod of advance technology: the cold fusion engine core, the Neuro-Helmet, and the Heat Sink.

This thesis will define, explain, and diagram the Heat Sink used by the Starfleet Marine Battle Mechs. Without the Heat Sink, the Mech would quickly overheat, shutdown, even face a catastrophic meltdown or explode. The temperatures generated by a cold fusion engine are so great, that without a massive cooling system, or the vacuum of space, would buildup within seconds. Add to that the heat generated by movement of the Mech, heat generated by energy and projectile weapons, and heat received when struck by opposing weapons, beam or otherwise. The thermal energy is measured not in kilo-calories but mega-calories, or megacals.

The entire coolant system of the Mech is based on three sub-systems. The Coolant Fluid itself, the Transfer Lines, and the actual heat sink radiators.

The coolant fluid and transfer lines, which run throughout the entire Mech, are part of the internal structure of the Mech and add no further weight to the system.

The Coolant Fluid is a new binary compound, mixing the venerable Quad Ethylene Glycol, (C14 H30 O2 – Molecular Weight 178.22) with liquefied Carbon Dioxide (C2 O6 – Molecular Weight 60.08). This thus reduces the temperature of the fluid, and increases the caloric transfer from the heat sources to the fluid, and then across the transfer lines to the radiating fins of the heat sinks, this will also be shown later to be useful in making the fluid its own sealant in case of ruptures of the Transfer Lines during combat or other operations. The exact formula of the Quad Ethylene – Carbon Dioxide mixture was discovered first by the Benzites, which they use as part of their respiration equipment while serving onboard Starfleet Vessels.

The transfer lines which one along the outside of the cold fusion containment chamber, and through the actuators of the limbs, and throughout the weapons systems, parallel the lymphatic system of the human body, with heat being picked up by radiated transfer from each of the heat generating systems of the Mech, transferring outward through the use of venturri nozzles acting as a series of heat pumps, until the lines pass through the super-cooled transfer coils the base of the Heat Sink Radiators.

The transfer lines and transfer œoils are composed of Sandoz's Alloy otherwise known as Tri-bauxite Sterling, with an oxidized platinum paint. The alloy of Aluminum and Silver is currently the best conduit of heat, in the Federation and was discovered by Kahlil Sandoz of New Lakota almost ninety years ago. This metal is also a fundamental component (along with anodized Bi-Cobalt alloy) in the radiating fins of the heat sinks.

The oxidized platinum paint is a key element in the rupture protection provided the new coolant system. The Binary Compound of the Quad Ethylene and Carbon Dioxide when exposed to any nitrogen laden atmosphere of 6% or higher (Earth atmosphere for example is 70% Nitrogen) will when properly catalyzed merge to form the following byproducts, Nitrous Oxide, Water and Styrene. The NO2 and Water will escape to atmosphere, further cooling the Mech, while the styrene will quickly harden and form a seal on the outside AND inside of the ruptured line. The platinum paint is that catalyzing agent. While not a permanent repair, this ability of self-sealing will extend the battle worthiness of a Mech for minutes if not hours, vital during combat operations.

Finally: the Heat Sink itself. Each Triple Sink, like the Double Sinks and Standard Sinks before them masses 1 metric ton. This includes the coils, heat pump powered fans, and the 19 radiators contained within the sink, and the armored cover protecting the fins.

Heat Sink Total	
Armored Covered (Triple Strength One Weigh Transparent Aluminum)	50 Kg
19 radiator units 50kg each	950 Kg
Total Mass	1000 Kg

Radiator Total	
Heat Transfer Coils	5 Kg
Cabinet with Internal Structure to hold Radiator	5 Kg
Bi Cobalt Base	10 Kg
Radiator Fin Assembly	25 Kg
Heat Pump Fan System	5 Kg
Total Mass	50 Kg

Total Fin Area per Radiator: 2500 separate Fins 1cm wide, and 1 meter long produces a total surface area of 100 square meters per radiator and thus 1900 square meters per

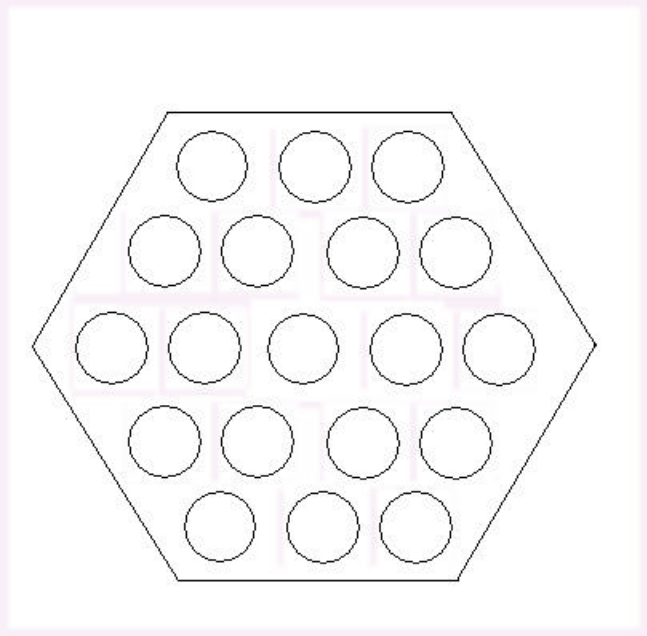
Heat sink. Due to the Tri-bauxite material, and the sine curve base wave of the fins themselves, each Heat Sink is capable of shedding 3 Megacals of heat energy per minute, three times what a standard heat sink is capable of.

Super Heat Sinks

Super heat sinks are exclusively supplied to the Starfleet Marines to utilize similar configurations to the standard bonded heat sinks except that fins are augmented to enhance heat transfer beyond what can be normally expected from standard heat sinks

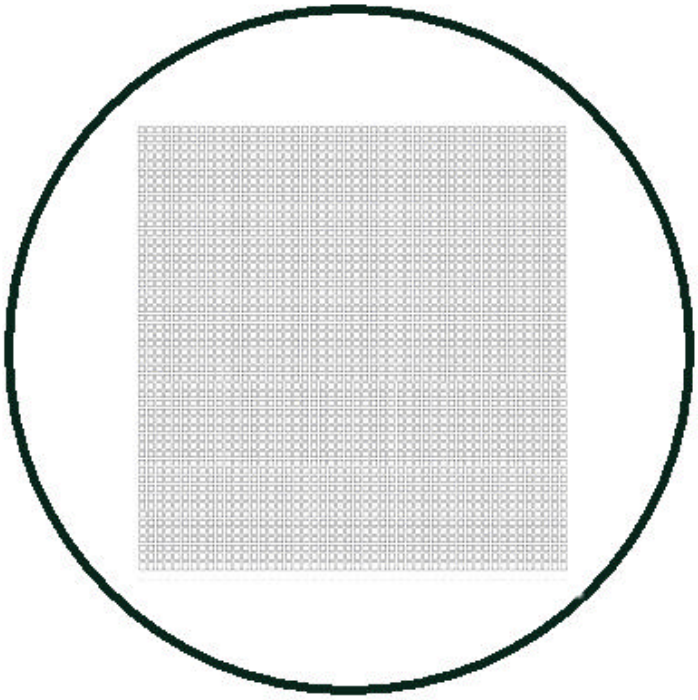
Heat Sink External View with Armored Cap Removed

.8 meter Diagonal and width, .72 meter in height



Individual radiator External View

.1 meter length and width, 1 meter in height



Warning of potential health effects associated with exposure to Quad Ethylene Glycol.

Inhalation:

Low inhalation hazard unless heated because of low vapor pressure.

Ingestion:

Low acute toxicity. Probable lethal dose to humans is 0.5-5 g/kg. Causes nerve depression, liver and kidney lesions and anuria (urination retardation). Causes irritation to the gastrointestinal tract. Symptoms may include nausea, vomiting and diarrhea.

Skin Contact:

May be an irritant to skin on prolonged exposure.

Eye Contact:

May be an irritant to eyes and surrounding tissue.

Chronic Exposure:

Liver and kidney lesions and damage.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or eye problems or impaired liver or kidney function may be more susceptible to the effects of the substance.

First Aid Measures

Inhalation:

Remove to fresh air. Not expected to require first aid measures.

Ingestion:

Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Call a physician.

Skin Contact:

Remove any contaminated clothing. Wash skin with soap and water for at least 15 minutes. Get medical attention if irritation develops or persists.

Eye Contact:

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids occasionally. Call a physician if irritation persists.

Fire Fighting Measures

Fire:

Flash point: 236C (457F) CC

Autoignition temperature: 412C (774F)

Flammable limits in air % by volume: lel: 1.6; uel: 10.8

Fire is possible at elevated temperatures or by contact with an ignition source.

Explosion:

Above flash point, vapor-air mixtures are explosive within flammable limits noted above.

Fire Extinguishing Media:

Powder, alcohol foam, water spray or carbon dioxide.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained

breathing apparatus with full face piece operated in the pressure demand or other positive pressure mode.

Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer!

Handling and Storage

Keep in a tightly closed container. Protect from physical damage. Store in a cool, dry, ventilated area away from sources of heat, moisture and incompatibilities. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Odorless.

Solubility:

Infinitely soluble.

Specific Gravity:

1.18 @ 20C/20C

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

416 C (780F)

Melting Point:

-6.5C (21F)

Vapor Density (Air=1):

3.66

Vapor Pressure (mm Hg):

1 @ 91.8C (198F)

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

Toxic gases and vapors may be released if involved in a fire. Carbon dioxide and carbon monoxide may form when heated to decomposition.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Strong oxidizers, strong acids and strong bases.

Conditions to Avoid:

Incompatibles.