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| **Technique** | Use of the Facility Chilled Water (FCW) System to provide the heat exchange medium for the hypergolic propellant Thermal Conditioning Units (TCU). |
| | **Facility Chilled Water for Thermal Conditioning Unit**<br><br>***This approach eliminates the cost and maintenance of a separate cooling system by utilizing other existing systems*** |
| **Benefit** | Incorporating this technique eliminates the need and cost of a separate cooling system to be designed, installed and maintained at each propellant storage area. Maintainability and reliability of the TCU is greatly enhanced since the individual cooling systems have been removed in lieu of connections to the existing FCW System. |
| **Key Words** | Thermal Conditioning Units, Chilled Water, Hypergolic Propellant |
| **Application Experience** | • Space Shuttle Program<br>• Kennedy Space Center (KSC) Hypergolic Propellant Loading System |
| **Technical Rationale** | An existing FCW system is tapped into to provide the heat exchange medium used for conditioning the hypergolic propellants to the acceptable limits for loading the Space Shuttle tanks. This eliminated a Freon conditioning unit that was previously installed at each propellant storage area there-by eliminating the associated operating and maintenance expenses. |
| **Contact Center** | **Kennedy Space Center (KSC)** |

## *Facility Chilled Water for Thermal Conditioning Unit*

*Technique OPS-15*

While at the launch pad the Space Shuttle Orbital Maneuvering System (OMS) and Reaction Control System (RCS) propellant tanks are filled with hypergolic propellant; Monomethylhydrazine (MMH) and Nitrogen Tetroxide ($N_2O_4$). The OMS/RCS is used for altitude and attitude changes required by the Shuttle during orbital flight. Loading of the tanks takes place about two weeks prior to launch. A temperature requirement is imposed on the propellant for loading to assure proper operation of the Ground Support Equipment (GSE) and to assure proper weight measurement of the loaded propellant. The temperature requirement is met by raising or lowering the propellant temperature as required by flowing through the Thermal Conditioning Unit (TCU). If the propellant temperature is below that required, the facility chilled water is heated in the TCU heater before flowing through the heat exchanger where the propellant is brought up to the required temperature (see figure 1).

If the propellant temperature is above that required, the heater is not operated and the FCW provides the heat sink needed to lower the temperature. Each MMH and $N_2O_4$ storage area has a TCU. The FCW is piped to the propellant storage areas through insulated tubing from the launch pad FCW system. Filters are provided in the pad FCW system to prevent contaminants from damaging or clogging downstream components.

Using the FCW System to provide the heat exchange medium eliminates the need for a separate conditioning unit at each TCU. The previous TCUs used a Freon conditioning unit for temperature control of the propellant. Eliminating those units eliminates the high operating and maintenance costs and environmental concerns associated with each Freon heat exchanger.

### *References*

KSC Drawing 79K05081 - Hypergol System Schematic Pad 39A.

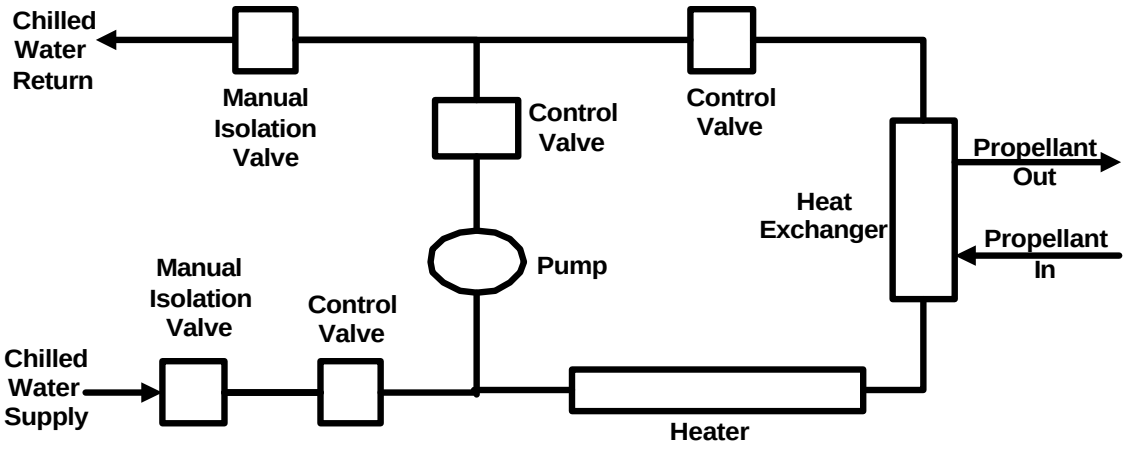


**Figure 1. Thermal Conditioning Unit Schematic**