

Introduction

Fuel systems for data centers are characterized by generally large loads and run time durations requiring substantial quantities of fuel on the site. The systems are designed with standard components but with redundancy to avoid single points of failure. The redundancy requires monitoring of component status and auto-switch to alternate components when failure is indicated. These monitoring and auto-switch functions require advanced PLC control systems. The systems are also highly monitored by BMS systems.

Tier Design

People often speak of Tier Design to explain the level of redundancy and reliability in a data center facility. These Tiers are simply described as follows:

- Tier 1: Single flow and power path without redundancy. Manual bypass of components allows for operator over-ride.
- Tier 2: Single flow and power path with dual components.
- Tier 3: Dual flow and power paths with one active. Dual components such that one can be maintained while the other is active.
- Tier 4: Dual flow and power paths with dual active. Dual components such that one can be maintained while the other is active.

Fuel System Elements

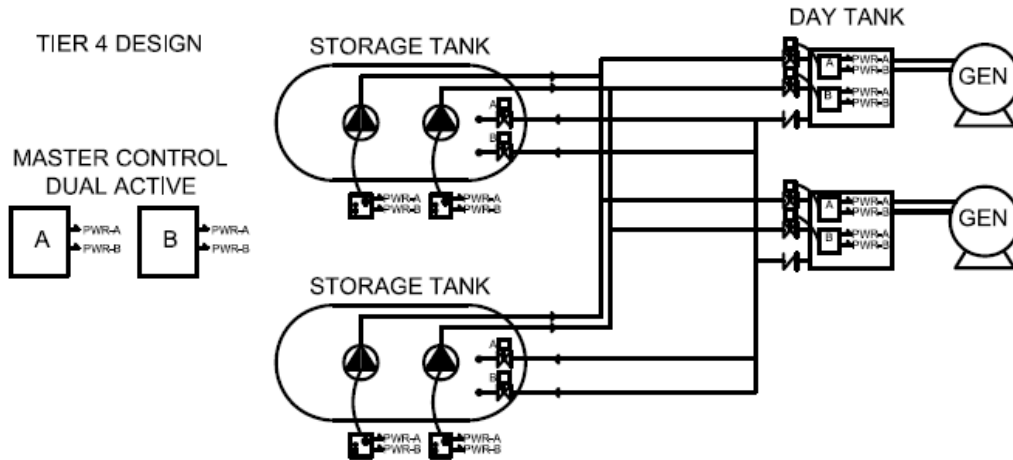
The fuel system is designed to safely store fuel and transfer it to the generators when needed. The combustible nature of diesel fuel means that the bulk fuel storage is often separated from the generators and the buildings. However large generator sub-base tanks are sometimes used with packaged generator enclosures.

Standard Fuel System Elements will include:

- Storage Tanks: To safely store fuel for required generator run time
- M200 Duplex Pumps: To move fuel from storage tanks to point of use
- M300 Filtration Unit: To filter dirt and water from fuel during long term storage.
- M400 Tank Fill Station: To receive fuel from delivery trucks and transfer to tanks.
- M500 Day Tank Units: To store limited fuel quantities adjacent to generators.

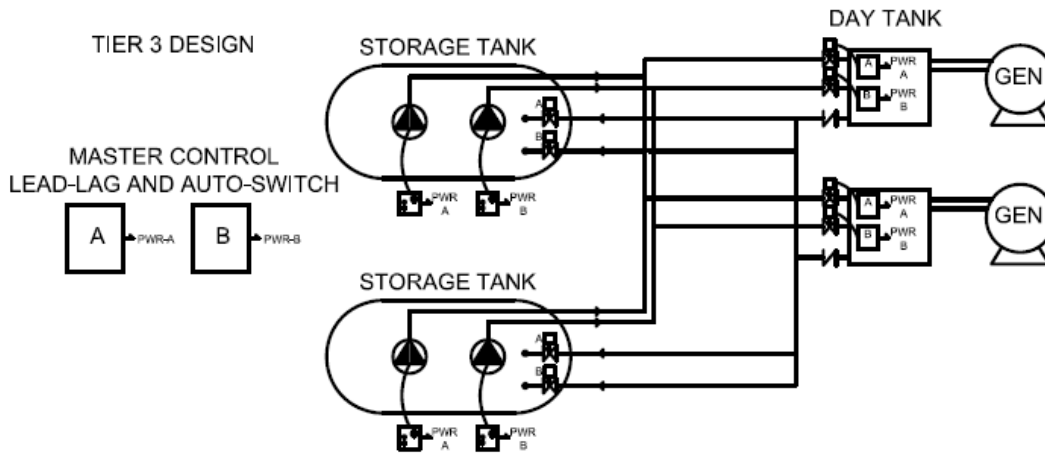
Tier 4 Fuel System

Highest Reliability. The Tier 4 fuel system has dual elements and flow paths which both operate in active mode when there is a requirement for generator fuel. The system shown has both A and B power supplies on each control panel,



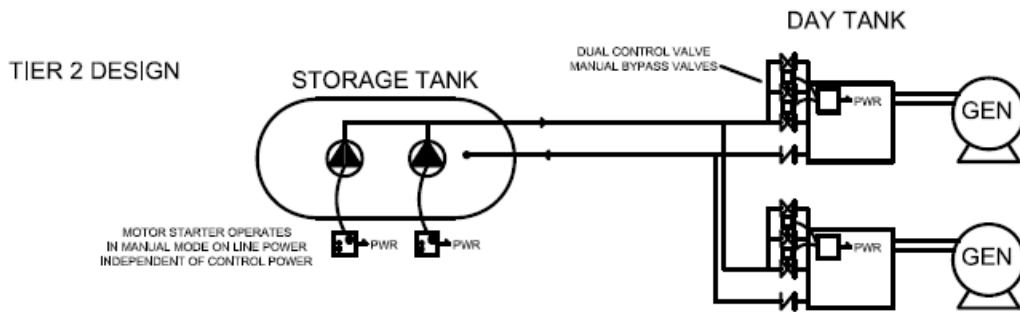
Tier 3 Fuel System

High Reliability. The Tier 3 fuel system has dual elements and flow paths which both operate in a lead – lag mode with auto-switch on failure. The system shown has A or B Power supplies on each control panel..



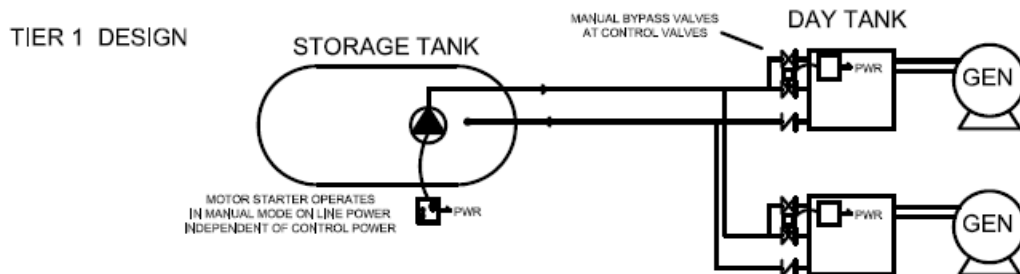
Tier 2 Fuel System

Reliable. The Tier 2 fuel system has dual elements with single flow paths.



Tier 1 Fuel System

Standard. The Tier 1 fuel system has single elements with single flow paths. The example does include 2 important features for backup manual operation: (a) the pump motor starter has an HOA switch with manual mode functional based on line power alone independent of control power, and (b) manual valves to bypass control valves,



A Good Design for Large Generator Sub-Base Tanks

Generator designs may provide for large sub-base tanks without supplemental fuel storage. In this design there are 2 main considerations: (a) redundant and fast receipt of fuel from delivery trucks, and (b) a filter polisher system with the ability to transfer fuel between tanks as needed.

