An incorrect blend can mean a total shutdown of operations, as well as increasing in fuel costs so the right technology must be used

Unique challenges

When it comes to blending renewable fuels it is important to consider the product's viscosity.

For example, the upper limit for the viscosity of B100 is 6.0 cst at 40 ˚C, greater than the maximum allowable viscosity of low sulphur diesel at 4.1cst at 40 ˚C. Therefore, blending B100 with diesel fuel close to its upper limits could result in an off-spec final product.

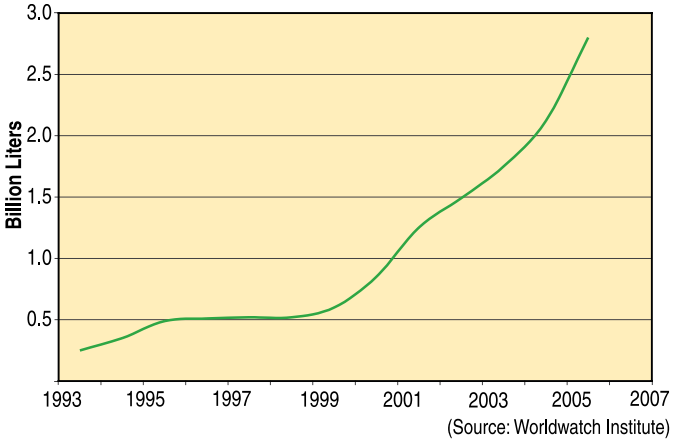
Cloud point is also of considerable importance in that it defines the temperature at which a cloud of haze comprising crystals appears in the fuel under prescribed test conditions. This generally relates to the temperature at which crystals begin to precipitate from the fuel; B100 usually has a higher cloud point than diesel fuel. The cloud point of B100 and its impact on the cold flow properties of the resulting blend should be monitored in cold climes.

It is best to keep B100 at a temperature just above its cloud point when blending with diesel fuel in cold temperatures. Most companies will heat trace and insulate all components of the B100 piping system, including the tank, piping to the rack, metering equipment up to the loading arm and maintain the B100 at approximately 21˚C when it is cold.

Similarly, one should be aware that ash forming materials may be present in B100 in three forms: abrasive solids; soluble metallic soaps; and unremoved catalysts. For these reasons, using a filtering process prior to pumping product to the rack may be necessary.

As B100 is organic, fungi and bacteria can form at any fuel-water interface and give high particulate concentrations in the fuel. In storage, the use of biocides or biostats will destroy or inhibit the growth of fungi and bacteria. These reagents are soluble in either the fuel or water phase.

Biodiesel growth 1993-2007



Types of blending

Splash blending: Loading the individual products into the truck through dedicated product meters one after the other. Products will not mix well in the truck and stratification will occur, causing poor fuel quality.

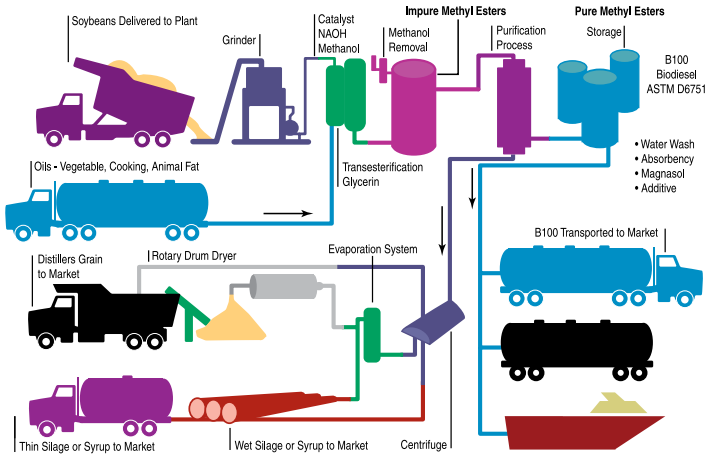
Sequential blending: Loading the individual products through the same meter sequentially.

In a study, qualitative visual observations of sequential blending B100 with diesel showed clouding and possible crystallisation of the fuel due to inadequate mixing. This type of blending normally requires one meter and one control valve and a recipe contains the percentage of each component. When a recipe is selected, the controller calculates the exact amount of each component and delivers it in user programmed order as a type of 'mini batch,' complete with the specific product measurement and product flow profiles. The mini batches and product sequence are converted automatically by opening and closing the appropriate product block valve. The product block valves should be motor operated to minimise sequence loading time. Check valves should be installed in each product line and should be as close to the blend connection as possible to prevent backflow and contamination.

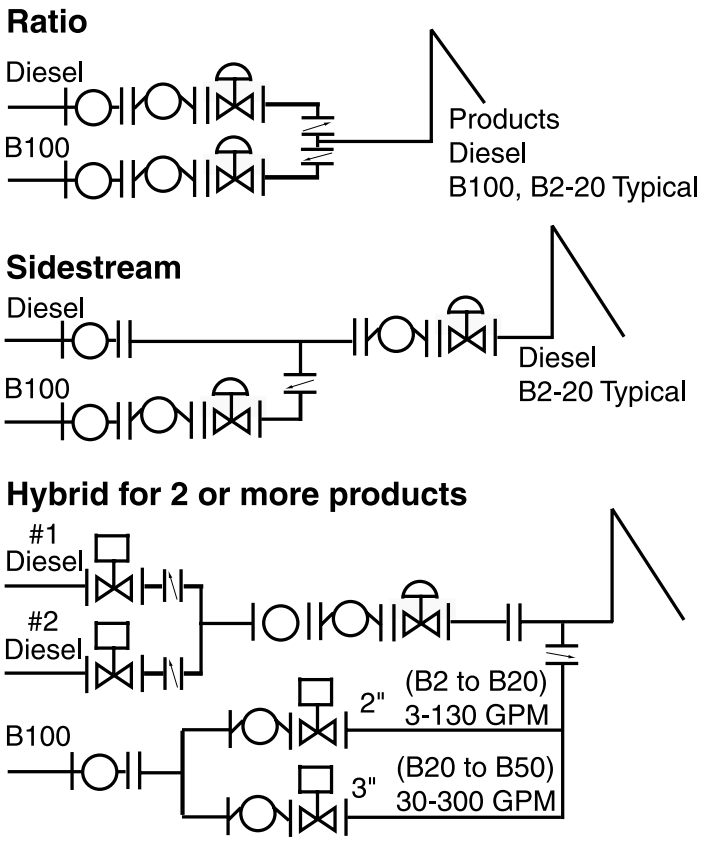
Ratio blending: Loading the individual products through dedicated product meters simultaneously and blending in a downstream connection. This scenario works well for general blending but may require additional mixing prior to loading the truck, such as an inline mixer. Unlike sequential blending, ratio blending has a meter and control valve for each product. Because the products are blended at the same time, they have a tendency to mix better than with sequential blending. Furthermore, because all products are running during the entire batch, the blend should be on spec at any time during the batch. Therefore, if a batch is aborted, whatever product is loaded should be a deliverable product. This contrasts to sequential blending when the entire batch must be completed to be on spec.

Wild stream or sidestream: Metering the B100 into the main diesel line where the blending occurs directly upstream of the larger delivery meter. This scenario works well and will also aid in mixing as the blend passes through a meter that mechanically mixes or integrates the fuel.

Hybrid: A combination of sequential and ratio that is primarily designed for ratio blending soyabean oil into existing number 1 and number 2 diesel oil sequential blenders. In any ratio or hybrid blender, meter and flow control valve

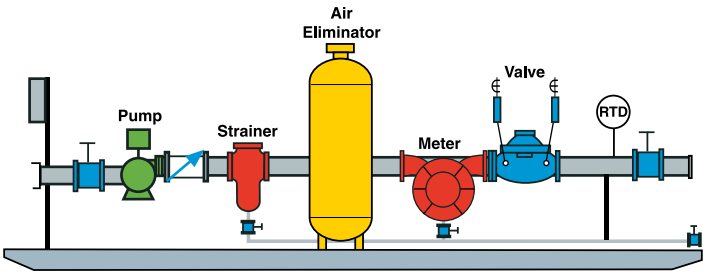


The biodiesel process (oleo chemical purification)



Typical B100 blending configurations

sizing are critical. The system hydraulics in ratio blending must be carefully designed to ensure accurate blending. Once again, check valves need to be installed to prevent backflow and contamination



B100 unloading skid

Blending considerations

- The blending of two or more products by any method requires a recipe derived from the blend's components as well as percentages of each component. When sizing equipment, it is necessary to calculate the flow range of each component using the component percentage(s) and the loading arm flow range (minimum to maximum). These calculations will determine meter and valve sizes and indicate any problematic flow control issues.
- Each product has its own unique set of characteristics, or product measurement profiles, which affect measurement. Parameters such as meter factors, API tables and density will need to be identified for the individual components in the recipe in order to deliver an accurate blend and maintain component inventories.
- Any product delivery (including straight product loading), or any type of blending requires that each component, is capable of accurately flowing in a controlled mode throughout the delivery batch. This product flow profile is most critical for ratio or hybrid blenders. If pumps and flow control valves are not sized properly, the process will result in erratic operation and off spec blends. In addition, complete pressure profile analysis should be done for all operating conditions to ensure accurate blending.
- Product mixing is easier when the products have similar characteristics, such as density and viscosity, which generally enable them to blend well. However, products with different characteristics, or when blended simply, do not mix or stay mixed and may dictate the blending method.

Delivery/unloading

Delivery of B100 to the terminal should be metered. The process must be accurate, safe and fast. In order to accomplish this there are a number of issues to consider.

US-based FMC Technologies produces the Smith Meter AccuLoad III, an electronics package that has all the necessary controls to perform a successful unloading.

Control delivery is accomplished by the use of three digital inputs, configured as stop, low and high flow switches. These switches are located on a float installed in an air elimination tank upstream of the meter. The inputs define when to open the control valve, when to advance from low flow to high flow and when to close the valve. The settings are based on the product/air interface in the air eliminator tank.

In addition to the meter and control valve, another critical piece of equipment is the unloading pump, which must unload the truck completely and quickly. Centrifugal pumps become problematic in unloading the truck completely once air has entered the pump casing.

It is critical to make certain the proper pump has been chosen for the installation and unloading conditions. A positive displacement pump or a self priming centrifugal pump is recommended to efficiently and completely offload trucks. The AccuLoad control valve and air elimination system are designed to handle the operating conditions when air is encountered at the end of the load.

The AccuLoad can be set up as a single arm device or up to a six arm device in a single Class I, Division I housing or, using the Split Architecture platform, can accommodate up to 18 loading arms. Any of the AccuLoad III controller configurations can be set up as a unique blender. Arms can be configured as sequential, ratio, sidestream or hybrid. The AccuLoad III can use any combination blender types with a specific type assigned to any given loading arm. ●

For more information:
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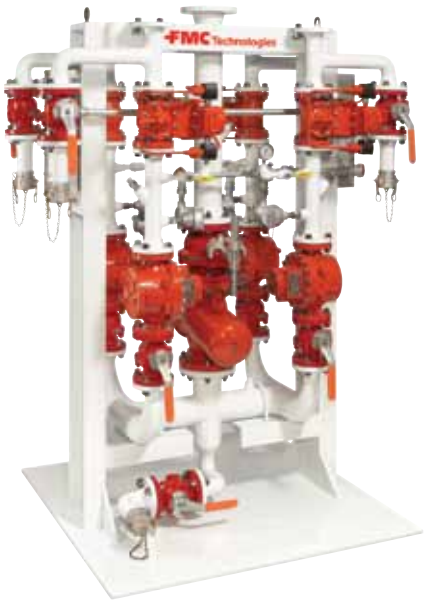

Biofuels skid