

SPX 388

Fitting Side Entry Mixers to large storage tanks – Now, in the future or never

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A question that is often asked when considering processing or mixing, particularly when the products projected to be stored are 'clean' or white oils: is 'Are mixers needed on these tanks?' It is already common practice to fit mixers (swivel angle) onto crude oil or other product tanks that contain sludge of some kind. The answer to the question is a very positive yes.

Mixers have three major application regimes in respect of large storage tanks, these being Bottoms, Sludge & Water (BS&W), Product Blending and Temperature Uniformity/Homogeneity.

BS&W

By operating these mixers and changing the angle either continuously or regularly, the Bottoms, Sludge & Water is maintained in suspension so that what goes in – comes out, leaving the tank floor clean. With ~ 1.5% BS&W in Crude Oil a tank containing 160,000 CuM of Crude (1 million bbl), a potential sludge deposit of 2400CuM could be left on each emptying of the tank. This deposit reduces the storage capacity and efficiency of the tank along with other issues of corrosion and risks to the floating roof.

Product Blending

There is an ever increasing need to blend two or more products to get a third. Producing Bunker 'C' fuel by cutting back a VHFO with a lighter hydrocarbon has been a requirement in recent years. Blending additives in lighter fuels is also a common requirement.

Temperature Uniformity/Homogeneity

Although there is only one product in these tanks at any one time, the batch system of filling has the potential for layering. This layering creates a product with slightly differing properties. Quality control especially for gasoline and jet fuels demands that the whole tank is uniform to strict specifications. This can be achieved by fitting side entry mixers. Temperature uniformity has great benefits when products such as Bitumen/Asphalt or Palm Oil are stored. Good circulation ensures there are no hotspots around the heating coil that can easily 'coke' the product or that the cold spots around the tank walls do not encourage the products to harden off and stick to the walls. Constant flow can take advantage of the sun's heat on the tank wall and mitigate cooler night-time temperatures in the body of the product.

These conditions justify the fitting of mixers on all large storage tanks. The question then is whether to fit mixers during the tank build or as a retrofit on existing tanks. Not fitting mixers loses all the advantages.

Mixer selection

In order to achieve the best solution, selecting and sizing of mixers needs to be a joint effort between the mixer manufacturer and the end user. Identifying and working with a mixer manufacturer with the necessary technical expertise backed up with

many years of experience and with thousands of units operating across a broad spectrum of applications will ensure that the best and most cost effective solutions are reached. Manufacturers' support should be available for the life of the mixer, which typically will equal that of the tank and may reach or exceed 40 years.

Although the application may change during that time, a good working relationship between the customer and supplier will ensure that the best advice is given regarding the suitability or modification of the mixers to meet the new circumstances.

When the need for tanks is recognised, the end user will often select either a specialist E&C contractor if the project is a large one, or a specialist tank manufacturer to supply and build the tanks. The contractor and tank manufacturer will identify mixer suppliers using either the end user's preferred list of suppliers or opt to work with those companies with which they have had previous experience. Using the mixer manufacturers' technical knowledge and process experience in selecting the mixers should achieve the desired result. Selecting the mixers is typically completed fairly quickly and the delivery of the mixers rarely exceeds 4/5 months.

Installing mixers



The ideal time to fit the mixers is when the tanks are under construction. The cost of fitting mixers at this stage is low within the whole project as there is no tank

cleaning to be done and optimum-sized mixer mounting nozzles can be fitted and positioned on the tank wall. If heaters are required in the tank, they can be taken into consideration in relation to the height of the mounting nozzles. Furthermore, mixer power shut-off positions can be decided to protect the floating roof.

Occasionally the need for mixers is only recognised once the tank is already in service. Fitting mixers at this time is usually more expensive and disruptive.

During the site preparation period laying the cables for the mixers can be undertaken and is relatively straightforward. Adding the control rooms can also be done as the methodology for operating the mixers will already have been decided and built in to the control system. Time is not usually an issue as the time to build a tank is typically far in excess of the period required to build and deliver the mixers to site. All the skills for installing the mixers will also be readily available at this stage of the project. The mixer manufacturer can supply a technical supervisor if necessary to ensure that the installation and commissioning of the mixers is carried out satisfactorily.

It should be noted that if the mixers were to be jet mixers, this period would allow the associated complicated piping to be completed as well as the purchase of and set up for the high power, high volume and high pressure pump(s) to be installed. It has to be recognised that a jet mixer can only operate on one tank at a time to ensure the product and the tank levels are not compromised. General refinery tank farm pumping arrangements are usually incapable to achieve the flows and pressures required for jet mixer operations.

It is the other aspects of fitting mixers that can cause issues. Tank farms by their nature are spread out and are usually a significant distance from the main source of

power. Assuming sufficient power is available, the cables have to be laid back to the control centre, making it necessary for control panels to be added and control mechanisms to be set up. The cost of this electrical work will far exceed the cost of the mixers themselves. Alternative drive mechanisms such as air and hydraulics have been investigated, but either impracticality or cost has given preference to the electric motor drive.

It is rare that the tanks will have been built with a sufficient number of correctly-sized and located mounting nozzles on the tank wall to fit the mixers. It is an issue that has to be addressed and many times a less than satisfactory compromise is reached. As the bigger mixers require support lugs being welded to the tank wall, this adds difficulties to the project due to 'Hot Work requirements'. As an alternative a support leg can be supplied by the manufacturer from the mixer to the floor around the tank.

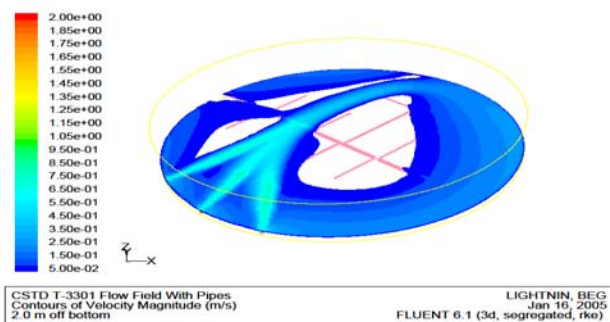
As the major part of the work is electrical it is rare that experienced mechanical personnel are available for the installation and commissioning of the equipment. Fortunately, the mixer supplier can usually provide the supervisory staff to ensure that this work is carried out correctly.

Refurbishment and upgrading existing mixers.

If the tanks are already fitted with mixers, but there is a requirement to change duties or up-grade the system, other obstacles may be encountered which have to be overcome. The need for higher power mixers could mean existing mounting nozzles may not be big or strong enough and need to be replaced along with up-rated support structures. There may be insufficient power available for the motor.

Replacing and upgrading cable and control systems is expensive. In many cases the more experienced manufacturers can, with small modifications, achieve the requirements of the new process by using modern process technology.

The change from crude oil duties to blending or homogeneity duties may only require the locking of the swivel actuator into the 10° left (blending) position. Efficiency improvement can be made by using the Plenty® up-pointing nozzle and can be retrofitted to all older Plenty brand Fixed Angle Mixers. Checking for process results for new duties can now be confirmed with the use of Computational Fluid Dynamics (CFD).



It is common for both tanks and mixers to remain undisturbed for up to 20 years, so when checking needs to be done the tank is taken out of service. The mixers can be serviced at this

time and upgraded to meet modern specifications such as ATEX. Replacing old style 'V' Belts with modern Tooth Belts and upgrading the sealing system can also be done.

Summary

The most effective and cost efficient way of fitting mixers is at the time of design and build. In addition, failing to fit mixers is not a good policy. However, it is perfectly feasible to retrofit the mixers throughout a tank's service life.

The decision making process for including mixers on the tanks should involve the mixer supplier from the earliest possible point in the project, whether it is a simple upgrade, a retrofit or a major new project. Experienced Side Entry Mixer manufacturers have a wealth of knowledge gained over many years and can offer this experience to the benefit of the end-user.

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