

## Optimization of crude oil desalting facilities

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Desalting of crude oil is the process of removing water and salt from crude oil to meet the shipping requirements. Shipped crude should contain less than 0.2 BS&W% and 10 pounds of salt per thousand barrels. Desalting is performed through two stages, dehydrator then desalter vessels, both are equipped with electrical grids applying electrostatic fields for coalescing. Upstream from the desalting train, high pressure production traps (HPPTs) perform three phase separation, using chemical demulsifier, to break the bonds between the water and oil droplets. The small water droplets then coalesce, get larger in size, and are then separated from the oil by gravity. The ease of separation is determined by original water droplet size and tightness of the emulsion. In the desalting train, electrical grids are installed in elevations higher than the interface level, to work in the oil phase with a typical electrical voltage of 24,000 or 16,000 KV. As oil and water separation goes lower, more water droplets pass through the oil phase, which increases the conductivity and reduces the voltage with a constant power supply, equation (1).

$$I = \frac{V}{R} \tag{1}$$

Frequent low voltages on the desalting train impacts the shipped crude specification, in terms of water and salt content. Higher demulsifier consumption will be required to rectify the oil and water separation process. High pressure production trap separation performance, dehydrator efficiency, and operating level, were found to be the root causes for frequent low voltages in Fig.1.

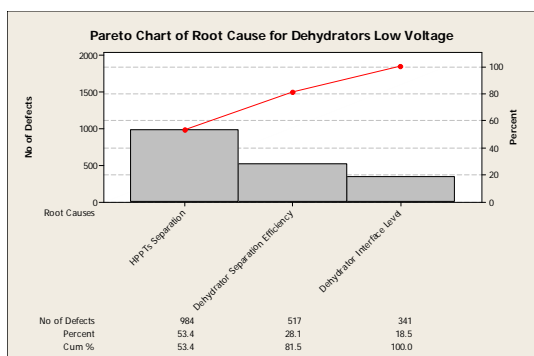


Fig.1. Pareto Chart for Dehydrators Frequent Low Voltages

Optimization for the crude oil desalting process was achieved by maintaining a steady separation process, with stable performance; in the desalting train with

minimum demulsifier consumption. The analysis identified the three main factors affecting the whole process: demulsifier formula effectiveness, demulsifier control criteria, and vessels' retention times. The demulsifier formula was changed through field testing until reaching the optimum batch, which reduced demulsifier consumption. Control criteria for the demulsifier were changed to consider enhancing oil and water separation upstream of the desalting train, i.e., in the high pressure production traps. This enhancement ensured that the amount of water in the crude coming into desalting train was within the operating capability for the dehydrator, Fig.2. The third factor was to maintain the vessels' operating levels and meet the retention time requirements, set by the international standards and manufacturer recommendations.

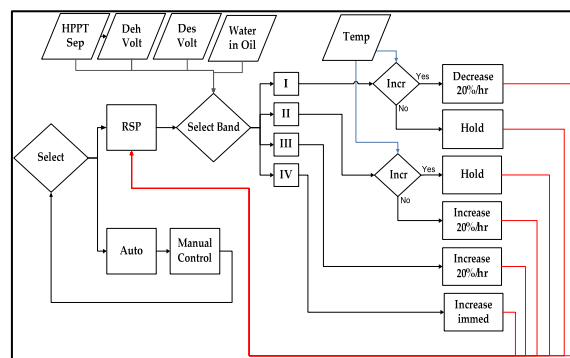


Fig.2. Demulsifier Automation System Utilized for Optimizing the Desalting Separation Process

The adjusted process parameters improved the desalting process by minimizing the frequency of low voltages in the dehydrators, and lowering the chemical demulsifier consumption by 60%. Additional technologies were explored to enhance the separation process, e.g., installing mixing valves to enhance the demulsifier mixing with the crude upstream of the desalting train. In addition, internal electrical coalescers were proposed for use in the high pressure production traps. The coalescers would promote water-oil separation by applying electrostatic field perpendicular to the liquid flow, to coalesce the water droplets into larger sizes.

### References

- [1] API Specification 12J, Sepcification for Oil and Gas Separators
- [2] Implementing Six Sigma by Forrest. W. BreyForge ISBN:0-471-29659-7