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## **Question 56: What mechanical/design alterations to the "standard" crude furnace design do you require to prevent fouling when processing LTOs (light tight oils)?**

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From the various articles and presentations on this subject, plus our own experience, we have found that LTO, in itself, is not an issue. Rather, LTO mixed with crudes containing asphaltenes is the issue. Industry seems to agree that precipitation of asphaltenes is one of the main fouling mechanisms. This precipitation seems to occur at much colder temperatures than coking: in the range of 600°F inside film temperature. This results in the fouling occurring in the lower convection section tubes, the roof tubes, or high up in the radiant tubes. Vertical and horizontal tube units are both affected. Designs –new and existing –should be reviewed for proper mass velocities, flame length/stability, and fired-box dimensions and to maintain proper draft/O<sub>2</sub> readings measured at the appropriate place.

Mass velocities for crude heaters are in the range of 250 to 350 lb/ft<sup>2</sup>-s (pounds per square foot per second). For LTO mixtures, the higher end and above should be considered. This might require tube changes and a review of the pumps for higher pressure drop. Draft under the first row of convection tubes should be maintained at about -0.1" WC (water column). Oxygen should be monitored in the upper radiant section and kept in the 2 to 3% range (gas-firing assumed). All fireboxes should be sealed up to prevent air leakage that distorts these reading and causes other operational issues. Burner flames should be monitored for proper shape. Firebox designs should be reviewed for opportunities to increase distance from roof tubes to burners (tubes lower than the true roof of the firebox)

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