CRITERION
CATALYSTS & TECHNOLOGIES

**TECHNICAL BULLETIN:**

# CRITERION* Hydrogen Stripping Procedure

The objective of hot hydrogen stripping is to remove "soft" coke which has formed on the catalyst. When coke first begins to laydown on the catalyst, it is characterized as "soft" coke. Over time, "soft" coke slowly condenses to form a more hydrogen deficient "hard" coke, which can only be removed through catalyst regeneration. Successful removal of "soft" coke can have two advantages:

1. It can restore some lost catalyst activity, although this may only be temporary (especially at end of run conditions).

2. It can help reduce pressure drop. It should be noted that it will not aid in reducing pressure drop due to the deposition of inorganic materials on top of the catalyst bed.

During the hot hydrogen strip, it is possible under low H2S partial pressures to strip sulfide from the active metals and consequently reduce them. This is an inactive state for desulphurization and most other desired hydrotreating reactions. For this reason, care must be taken to maintain an adequate hydrogen sulphide (H2S) concentration in the recycle gas. We recommend a minimum of 1000 ppm of H2S in the recycle gas at all time during the procedure. This can be assured by introducing sour hydrogen as make-up, or by injecting a sulphiding compound during the procedure.

## PROCEDURE:

**1.** Shut down the recycle gas treating system (if any) and allow the hydrogen sulphide level in the recycle hydrogen to increase to a minimum of 1000 ppm vol. There is no limit on maximum hydrogen sulphide concentrations except those set by hydrogen sulphide partial pressure/metallurgical/temperature limitations. Also discontinue venting hydrogen at the high pressure vent to retain hydrogen sulphide.

**2.** At reaction temperatures, reduce oil feed to minimum rate and shut down the oil feed. Maximise the hydrogen circulation rate. Only make up fresh hydrogen as needed to maintain system pressure.

**NOTE:** If the reaction temperatures are greater than 385°C (725°F), the temperature must be reduced to less than 385°C (725°F) before discontinuing oil feeding.

**NOTE:** Unit pressure can be allowed to vary X50 PSI within equipment limits with no detriment to the catalyst or success of the procedure.

**3.** When all oil is swept from the reactor, raise temperature at a rate no greater than 28°C (50°F) per hour to 385°C (725°F) or the maximum reactor metallurgical limit, whichever is least. The maximum recommended hot hydrogen stripping temperature is 385°C (725°F). Maintain the maximum temperature for 12 to 16 hours, monitoring the recycle hydrogen sulphide concentration at the high pressure separator frequently.

**NOTE:** Should the hydrogen sulphide concentration fall below 1000 ppm vol, immediately begin reducing reactor temperatures at a rate of 28°C (50°F) per hour to protect against reducing catalyst metals.

**4.** After 12 to 16 hours at 385°C (725°F) or the maximum temperature, reduce the reactor temperature at 50°F per hour. If the feed is straight run, line out at 50°F below the prior normal operating temperature. If the feed contains cracked stocks, line out at a minimum of 56°C (100°F) below the prior normal operating temperature.

**5.** If time allows, it is recommended to perform a catalyst "presoak" for trickle phase hydrotreaters. This is accomplished by reducing catalyst temperatures to 138°C (250°F) maximum and discontinuing or reducing to a minimum the hydrogen circulation. Oil feed is then circulated at ambient temperature and maximum rates for four hours to wet the catalyst particles to insure optimum utilisation of the catalyst bed. After four hours, normal hydrogen circulation is carefully reestablished and startup proceeds as normal.

**6.** If there is any question whether adequate $H_2S$ was maintained in the hydrogen recycle gas during hot hydrogen stripping or if the unit has been shut down for an extended period, it is recommended to "proof" presulphide the catalyst before going to the normal operating temperature. A "proof" presulphiding follows the normal presulphiding procedures.

**7.** Start feed at minimum rate and establish normal flows through the process equipment. Closely monitor reactor temperature differentials for signs of temperature runaway. If higher than normal delta temperatures occur, immediately discontinue oil feed and cut charge furnace temperatures while maintaining maximum hydrogen circulation rates cool the catalyst.

**8.** Once the normal liquid flows have been established, start the high pressure vent and make up hydrogen on normal pressure control. Restart the recycle gas treating system.

## ADDITIONAL INFORMATION

All catalyst information supplied by CRITERION is considered accurate but is furnished with the express understanding that the customer receiving such information shall make its own assessments to determine suitability of such information for customer's particular purpose. All purchases of catalyst from CRITERION are subject to CRITERION's standard terms and conditions of sale (including CRITERION's product warranties) set forth in a sales proposal, sales contract, order acknowledgement, and/or bill of lading.


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