Procedure to Regenerate the STAR TPC Gas System Purifier

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PURPOSE: To remove impurities and increase the efficiency of the STAR TPC gas purifier located in Rack 2 in the STAR gas mixing room.

BACKGROUND: To control the level of O2 and H2O contamination in the TPC ~ 10% of the gas in circulation is sent through a purifier/dryer path. (Flow through the purifier = 50 lpm.) The combination of 17 lpm of fresh gas that is introduced into the recirculation stream, and the purifier/dryer serves to hold the TPC O2 contamination to ~ 30 ppm. The current purifier has been in use since 1998 and we are starting to get evidence that its efficiency is deteriorating. We would therefore like to attempt to regenerate this purifier rather than replace it.

The purifier is installed in the TPC gas system in Rack 2. During normal operation the purifier is heated to 220 deg C using a heating coil and insulating blanket. The temperature is held constant by a TIC (temperature indicating controller.) For the regeneration procedure we will also heat the purifier to 220 deg C using the same system.

The regeneration will occur by passing a continuous flow of 95% Argon - 5% H2 gas through the heated purifier. Two chemical reactions will serve to regenerate the catalyst:

$$NiO + H2 = Ni + H2O$$

$$Cr2O3 + 3H2 = 2\ Cr + 3\ H2O$$

Thus, the byproduct is water. The flow rate of the Ar-H2 mixture will be 180-200 ccm and the regeneration time is estimated to be 48 hours.

The Ar-H2 mixture will be purchased pre-mixed from Spectra-Gas and the gas from the exhaust of the purifier will be either vented out the normal TPC gas stack or through an auxilliary vent line to the outdoors. The purifier already has a pressure relief valve installed to prevent accidental overpressure.

Note that this procedure is similar to the one that is used to regenerate the dryer which is done before each run. In that case the gas used is Ar only.

PROCEDURE:

1. Set MV3A to (Ar/5%H2 to Purifier) direction in Mixing Room
2. Set MV3B to (Ar/5%H2 to Purifier) direction on STAR Gas Pad

3. Open the gas cylinder
4. Set the regulator PCV50 to ~5 PSIG PI52 delivery pressure.
5. Turn on the purifier heater using the toggle switch in Rack 2.
6. Confirm that the Temperature Indicator Controller (TIC) has a set point of 220 degrees C. If not, adjust the set point using the push buttons on the front of the TIC (located in Rack 2).
7. Open MV2B inside Gas Rack 2.
8. Open MV2A inside Gas Rack 2.
9. Open MV3 inside Gas Rack 2.
10. Wait for the purifier to heat to the setpoint (usually 2-3 hours).
11. Adjust FI8A flow to 180-200 ccm
12. When regeneration is complete (estimate 48 hours) turn off the purifier heater using the toggle switch.
13. Reduce FI8A flow to 50ccm
14. Wait when the purifier will be cooled (estimate 24 hours)
15. Set MV3B to (P10 to SV16) direction on STAR Gas Pad.
16. Close the gas cylinder
17. Set MV3A to (P10 to SV16) direction in Mixing Room
18. Close FI8A manual valve.
19. Close MV3 inside Gas Rack 2.
20. Close MV2A inside Gas Rack 2.
21. Close MV2B . inside Gas Rack 2

EXPERTS:

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