PRINTING INDUSTRYVOC WASTE GAS TREATMENT CASE STUDY

1. Overview

This project treats the VOC waste gas of a printing plant. The main component of the waste gas is ethyl acetate. The maximum flow rate is 50,000 m^3/h and the concentration is about 3,000 mg/m^3, which is higher than the concentration required for autothermal operation of the regenerative thermal oxidizer (RTO); the surplus heat can therefore be recovered.

2. Process Route

The project employs one 50,000 m^3/h RTO to treat the workshop exhaust gas.

The surplus heat is recovered in the form of hot water. Depending on the operating conditions, hot air, thermal oil or steam may also be used for waste heat recovery.

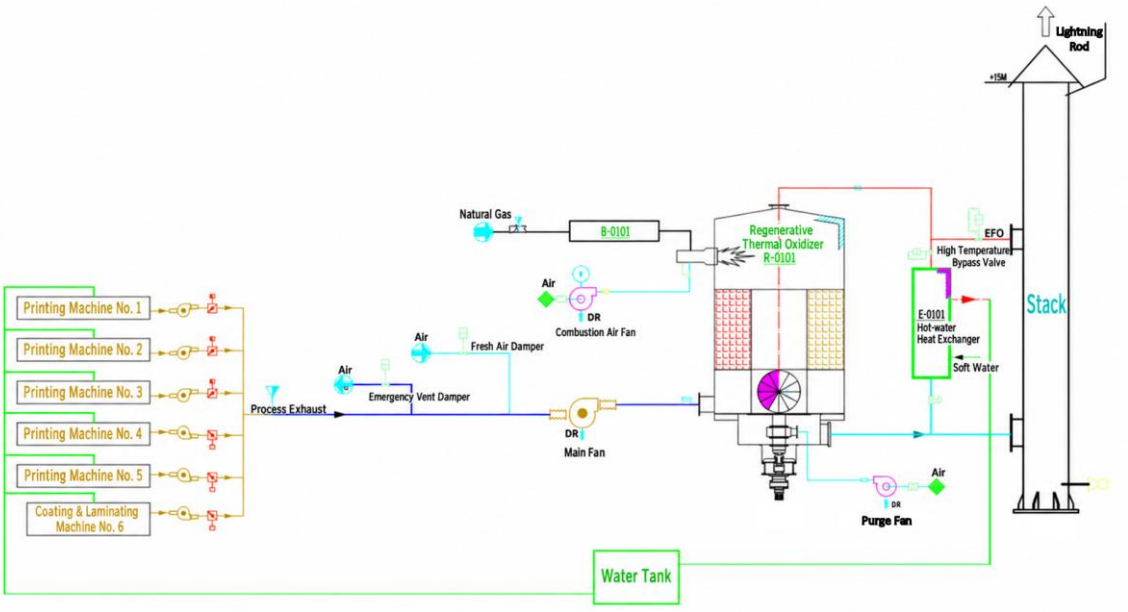

Fig. 2-1 Treatment Process Diagram

3. Working Principle

3.1 Autothermal Operation

An RTO consists of several regenerative chambers and one combustion chamber. The waste gas first passes through the regenerative chambers and is drawn into the combustion chamber. While passing through the regenerative chambers, the waste gas absorbs heat from the ceramic media and its temperature can rise to several hundred degrees Celsius, so that oxidation and decomposition can proceed smoothly. When the VOC concentration in the waste gas is sufficiently high, the energy released by VOC oxidation is enough to oxidize the subsequent incoming waste gas, so that no additional fuel is consumed — this is the autothermal operation of the RTO. After the VOCs are decomposed, the treated clean air has a high temperature and carries a large amount of thermal

energy; this clean air stream leaves the RTO through another set of regenerative chambers and transfers its thermal energy to the ceramic media in those chambers. The temperature difference between the RTO inlet and outlet gas streams can be as low as 40 °C, meaning that most of the thermal energy is retained within the RTO for reuse — this is the concrete manifestation of the RTO's high thermal efficiency.

3.2 Waste Heat Recovery

When the VOC concentration in the waste gas is high enough that the heat generated significantly exceeds the thermal energy required for autothermal operation, the surplus heat can be recovered and utilized. The high-temperature flue gas carrying the surplus heat is directed through the high-temperature bypass ductwork to the heat exchanger, where the heat is transferred to the heat-transfer medium. In this project the heat-transfer medium is hot water; water has a high specific heat capacity and offers significant heat-exchange efficiency. However, the applicable temperature range of hot water is relatively narrow, so hot air, steam or thermal oil may be used for waste heat recovery under different operating conditions.

4. Treatment Performance

NMHC ≤ 30 mg/m^3