NEUNDORFER
PARTICULATE KNOWLEDGE

SMART PURGE™ Theory of Operation

Neundorfer's Smart Purge™ is a heater-blower skid especially designed for use on electrostatic precipitators, ESP's.

ESP's are pollution control devices, intended to remove particulate from gaseous emissions of coal fired boilers, and other industrial dust generating process equipment. The particulate laden gas enters the ESP and the particles are electro-statically charged by discharge electrodes maintained at very high voltage, and collected on grounded electrodes. The discharge electrodes are supported and electrically isolated from the grounded ESP casing by insulators. The insulators are generally installed within a compartment, often called a penthouse, which is isolated from the dirty flue gas.

The purpose of the Smart Purge™ is to maintain a purging airflow from the insulator compartment into the ESP to prevent migration of particulate into the insulator compartment, and thus should be in operation whenever dust laden gas is conveyed through the ESP, or whenever convection currents or other mechanisms may convey gas from within the ESP into the insulator compartments. This purge air is also intended to prevent contamination of insulator surfaces with particulate to protect them from electrical leakage and/or surface tracking. The purge air is heated in order to ensure the insulators are dry, particularly during startup of the ESP, and it is recommended that the Smart Purge™ is operated for a minimum of 6 hours prior to energizing the ESP. The purge air is also heated in order to protect ESP components exposed to both the purge air and the boiler flue gas from condensation of corrosive compounds within the flue gas, which may result in what is called dew-point corrosion.

The required purge air flow rate for the skid is a function of the number of ESP casing penetrations for the discharge electrode system, the purge area at each

penetration, and the purge air velocity. This purge velocity is maintained through the annular opening in the ESP casing “hot roof” for the discharge electrode support elements. The purge velocity is generally 45 to 90 feet per minute.

The required purge temperature is generally a function of the amount of condensable corrosive compounds in the dirty gas. For coal fired boiler applications it often is a function of the sulfur content of the fuel, and generally not less than 180ºF.

Design requirements include the ambient air temperature. For skids located outdoors, or for skids drawing purge air from the outdoors, the cold air design temperature is generally 15^{O}F above the area record cold temperature and the hot air design temperature is generally 15ºF below the area record hot temperature.

Balanced draft boilers also present additional design requirements for a purge air skid. Under varying boiler loads the static pressure within the ESP, into which the Smart Purge™ ultimately discharges, may vary over a very broad range. The Smart Purge™ compensates for these changes in the ESP static pressure by utilizing a variable frequency drive (VFD) to vary motor speed and a modulating damper to fix the mass flow rate of purge air.

The skid includes a filter element to protect the blowers, the electric heaters and other control devices. The Smart Purge™ is designed to compensate for gradual fouling of the inlet filter, until minimum flow conditions cannot be met.

Finally, by delivering a fixed mass flow rate of purge air, the Smart Purge™ compensates for the considerable change in air density over the range of inlet ambient air temperatures.

The ability to maintain a fixed purge air flow rate results in considerable energy savings with the Smart Purge™ as compared to a conventional heater blower skid.