

High-Performance Hvac

When the College of Cardinals assembled at the Vatican's Sistine Chapel this March to choose a new pope, there was no clear front-runner and the outcome was very much in doubt. But the method that would be used to communicate the result was not: The cardinals would rely on a much-adapted system of ductwork and solid-fuel combustion equipment that has been evolving at least since the papal conclave of 1903.

Maintaining proper clearance between stovepipe and combustibles is especially important in the Sistine Chapel (right). The Vatican fire brigade installs the guy-wired vent stack on the centuries-old tile roof (below). The cylindrical metal stove in the photo at bottom right was first used to signal the 1939 election of Pope Pius XII; the boxier high-tech appliance to its left was added in 2005.



Traditionally, just-counted ballots from each inconclusive round of papal voting are burned with damp straw, which limits combustion and produces thick black smoke. The announcement of a successful vote — and of the elevation of a new pope — is made by burning the ballots without straw, which is supposed to yield clean-burning white smoke.

In practice, though, the result of both kinds of combustion has often been an unreadable shade of gray, plunging onlookers into confusion. After two embarrassing false alarms during the 1958 conclave that elected Pope John XXIII, Vatican experts began experimenting with methods of generating reliably black or white smoke.

At the 1963 and 1978 conclaves, technicians tried tinting the smoke with military flares and chemical additives. The results were mixed — spilled fumes from the chemicals used at one of the two 1978 conclaves reportedly left the cardinals coughing and choking — but a breakthrough came in 2005, when the two-stove system used this year was introduced: Completed ballots are burned in the original cylindrical cast-iron stove, while a boxier satellite appliance — which joins the main copper vent stack at a wye fitting several feet above the ballot burner — supplies additional smoke from electrically ignited colorant cartridges. (The black cartridges, the Vatican disclosed this year, are compounded from potassium perchlorate, sulphur, and a coal-tar-based black dye called anthracene; the white from potassium chlorate, lactose, and pine rosin.)

Some commissioning problems cropped up during the system's 2005 debut. At one point the main stove backdrafted when opened, sending smoke swirling over Michelangelo's priceless frescoes, although it's not clear whether the mishap resulted from improper system design or operator error. (As church historian Christopher Bellito observed to NBC News, "These cardinals are not exactly handymen.")

Perhaps in response to the spillage problem, the Vatican confirmed that the 2013 system included an electrical resistance heating unit for warming the flue and a backup blower. The adjustments worked: The black smoke from this year's conclave was unmistakably dark, and its white smoke brilliantly so. — *Jon Vara*