

# WITHDRAWN

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## IEEE Recommended Practice for Precipitator and Baghouse Hopper Heating Systems

Sponsor

**Energy Development and Power Generation Committee  
of the  
IEEE Power Engineering Society**

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**IEEE-SA Standards Board**

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**Abstract:** Recommendations on hopper heating system performance and equipment requirements necessary to provide an economical and effective hopper heating system are presented. System characteristics are described, and heat transfer analysis is covered. Heating module design considerations are presented. Control, monitoring, and alarm systems are discussed. Insulation, installation, operation, and maintenance are addressed.

**Keywords:** Baghouse hoppers, fly ash removal from boiler flue gas, hopper heating systems, precipitators

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## Foreword

(This Foreword is not a part of IEEE Std 1069-1991, IEEE Recommended Practice for Precipitator and Baghouse Hopper Heating Systems.)

Precipitators and baghouses are two equipment systems designed to remove particulate (i.e., fly ash) from coal- and oil-fired boiler flue gas streams. The fly ash is collected in hoppers and transferred out of the hoppers for disposal. The reliable operation of the precipitator or baghouse and the removal of fly ash from the collection hoppers is essential to the efficiency of overall plant operation.

If the hoppers are not heated prior to the introduction of fly ash, the fly ash can cool down and plug the hopper throat, which will cause severe maintenance problems. If the hopper temperatures are not maintained above the flue gas acid dewpoint temperature, the fly ash could adsorb moisture and then agglomerate and plug the hopper throat, which could cause additional maintenance problems.

If these hopper plugging problems are not cleared, the fly ash could build up in the hoppers to the level where the performance and efficiency of the precipitator or baghouse is affected. Boiler de-ratings and even shutdowns may be required until the hopper plugging problems are resolved. Effectively designed hopper heating systems can minimize or completely eliminate the maintenance required to ensure proper fly ash removal from hoppers.

IEEE Std 1069-1991 presents recommendations on hopper heating system performance requirements and covers the following topics: heater design; control, monitoring, and alarm systems; installation and hopper insulation techniques; and system maintenance.

This recommended practice is consistent with industry practice and identifies the major areas that should be addressed when designing a hopper heating system. It is not the intent of this recommended practice to survey every style of heater that is available. Because the modular type of heater has been used in the majority of successful operating systems, this recommended practice addresses the design features required for modular heating systems.

Annex A includes a specification guideline for hopper heating systems. Since operating companies have differing design, control, and alarm requirements, the specification guideline should be adapted for each individual situation.

This document was prepared by the Station Design Subcommittee Working Group of the Energy Development and Power Generation Committee of the IEEE Power Engineering Society.

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# WITHDRAWN

| CLAUSE                                                   | PAGE |
|----------------------------------------------------------|------|
| 1. Scope .....                                           | 1    |
| 2. Purpose .....                                         | 1    |
| 3. System Characteristics .....                          | 1    |
| 3.1 Fuel, Flue Gas, and Fly Ash .....                    | 2    |
| 3.2 Hopper Temperature Requirements .....                | 3    |
| 3.3 Flue Gas Temperature Excursions .....                | 3    |
| 3.4 Hopper Design .....                                  | 3    |
| 3.5 Insulation .....                                     | 4    |
| 3.6 Long-Term Performance .....                          | 4    |
| 4. Heat Transfer Analysis .....                          | 4    |
| 4.1 Equipment Operating Conditions .....                 | 4    |
| 4.2 Physical Properties .....                            | 4    |
| 4.3 Start-Up Dynamics .....                              | 5    |
| 4.4 Normal Operating Heating Loads .....                 | 6    |
| 4.5 Low-Load or Upset Conditions .....                   | 7    |
| 4.6 Hopper Wall Temperature Profiles .....               | 7    |
| 4.7 Special Design Considerations .....                  | 8    |
| 5. Heating Module Design Considerations .....            | 8    |
| 5.1 Vibration/Impact Loading Exposure .....              | 9    |
| 5.2 Maximum Temperature Exposure .....                   | 9    |
| 5.3 Power Supply Voltage .....                           | 9    |
| 5.4 Moisture/Humidity Resistance .....                   | 9    |
| 5.5 Hopper Walls .....                                   | 9    |
| 5.6 Fly Ash Levels .....                                 | 10   |
| 5.7 Handling and Installation .....                      | 10   |
| 6. Control, Monitoring, and Alarm Systems .....          | 10   |
| 6.1 Power Distribution .....                             | 10   |
| 6.2 Temperature Controllers .....                        | 12   |
| 6.3 Monitoring and Alarm Systems .....                   | 13   |
| 7. Insulation .....                                      | 14   |
| 7.1 Insulating Material Considerations .....             | 14   |
| 7.2 Insulation System Design .....                       | 14   |
| 7.3 Installation Factors .....                           | 15   |
| 8. Installation Considerations .....                     | 15   |
| 8.1 Field Environment .....                              | 15   |
| 8.2 Pre-Installation Review .....                        | 15   |
| 8.3 Locating Mounting Equipment .....                    | 15   |
| 8.4 Heating Module and Blanket Heater Installation ..... | 16   |
| 8.5 Lead Wire Routing .....                              | 16   |

# WITHDRAWN

| CLAUSE                                                                                                  | PAGE |
|---------------------------------------------------------------------------------------------------------|------|
| 8.6 Junction Box and Temperature Sensor Installation .....                                              | 16   |
| 8.7 Heating Module Checkout .....                                                                       | 16   |
| 8.8 Insulation Installation.....                                                                        | 16   |
| 8.9 Final Checkout and Energization.....                                                                | 17   |
| 9. Operation and Maintenance of Precipitator/Baghouse Hopper Heating Systems .....                      | 17   |
| 9.1 Initial Pre-Operational Checkout .....                                                              | 17   |
| 9.2 Initial Energization.....                                                                           | 18   |
| 9.3 Normal Operations .....                                                                             | 18   |
| 9.4 Periodic Maintenance.....                                                                           | 18   |
| 9.5 Troubleshooting .....                                                                               | 19   |
| Annex A Specification Guideline for Precipitator and Baghouse Hopper Heating Systems (Informative)..... | 20   |

## IEEE Recommended Practice for Precipitator and Baghouse Hopper Heating Systems

### 1. Scope

Precipitators and baghouses are two systems designed to remove fly ash from boiler flue gas. Air pollution control regulations require that these precipitators and baghouses operate efficiently and reliably. Malfunctions or equipment failures could lead to boiler de-rating or complete shutdown, which increase the operation and maintenance expenses for the operating company.

Problems related to fly ash collection in the hoppers, such as fly ash agglomeration and fly ash solidification, can lead to precipitator and baghouse shutdowns. The proper design and installation of hopper heating systems can significantly reduce the maintenance problems associated with fly ash plugging in hoppers.

### 2. Purpose

This recommended practice is intended to define the system performance and equipment requirements to provide an economical and effective hopper heating system.

### 3. System Characteristics

For the purposes of this recommended practice, the hopper will be defined as “the structure below either the precipitator casing or baghouse flue gas inlet.” The hopper ash collection area does not ordinarily have flue gas passage within it and is intended to temporarily collect fly ash for removal and disposal (see Fig 1).

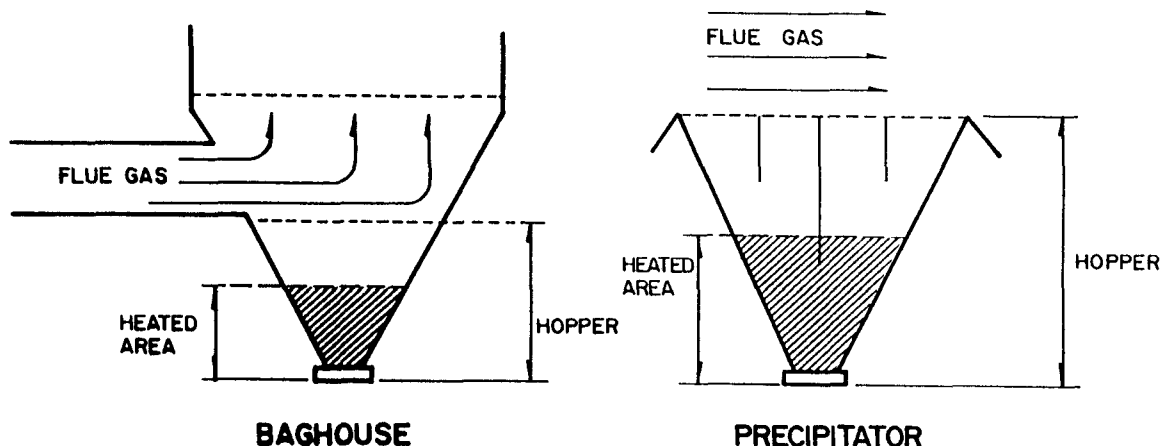


Figure 1—Hopper Definition for Hopper Heating Systems

### 3.1 Fuel, Flue Gas, and Fly Ash

Hopper heating requirements are affected by the type of fuel and the resulting flue gas and fly ash characteristics. Therefore, the design and application of the hopper heating system should consider the expected conditions of the flue gas and fly ash in order to successfully keep the fly ash in a state that allows for its easy removal from the hopper.

#### 3.1.1 Flue Gas Characteristics

The primary flue gas characteristics that influence the design of the hopper heating system are its  $\text{SO}_2/\text{SO}_3$  content and its moisture content. These characteristics change from one fuel to another.

Moisture dewpoints normally range from 90 °F–150 °F (32.2 °C–65.5 °C) dependent on the combustion air moisture content and the hydrogen content of the fuel.

Acid dewpoints normally range from 200 °F–300 °F (93.3 °C–148.8 °C) and are primarily dependent on the sulfur content of the fuel and the moisture content of the flue gas.

#### 3.1.2 Fly Ash Characteristics

The type of fuel and boiler design used affect the fly ash characteristics. Typical fuels include western coals, eastern coals, lignite, solid wastes, fuel oils, and petroleum residuals.

Fly ash particles can range in size from submicron to over 10 microns. Fly ash composition includes silicas; sulfates; carbonates; oxides of sodium, magnesium, calcium, iron, and aluminum; and other trace elements. These fly ash components will vary from one fuel to another. The relative quantity of these components affects the fly ash characteristics during both accumulation in the hopper and evacuation from the hopper.

##### 3.1.2.1 Compaction

Compaction results from fly ash settlement and is generally caused by hopper vibration when the fly ash evacuation is not operating. It can produce bridging across the lower portion of the hopper near the hopper throat.