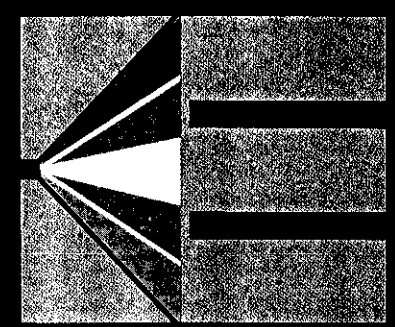


SAFETY CONSIDERATIONS

FOR
POWDER
COATINGS

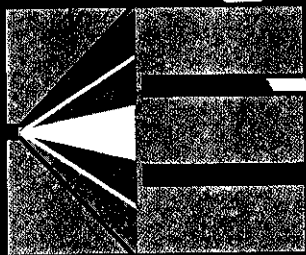
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EVTECH

9103 Forsyth Park Drive
P. O. Box 7369
Charlotte, NC 28241-7369
Telephone 800-333-8236
Fax 704-588-2280

FPC M6321

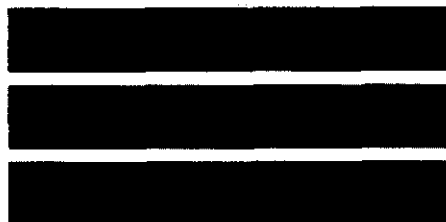
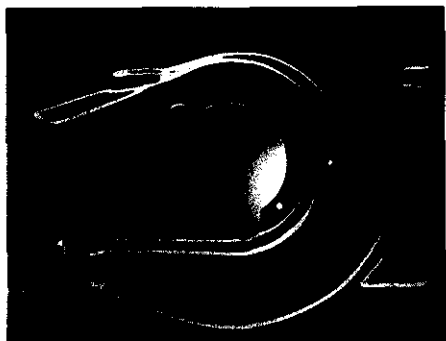
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SAFETY CONSIDERATIONS FOR USING POWDER COATINGS

This publication contains a partial list of suggested safety precautions that should be observed when using powder coatings. Users of these coatings must determine for themselves the appropriate procedures and facilities for their operations.

Other resources include suppliers' Material Safety Data Sheets (MSDS) and equipment suppliers' manuals which need to be reviewed and understood to help assure the safe use of powders. The federal Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), National Fire Protection Association (NFPA), and a user's insurance company also impose safety standards. Knowledge of these and other appropriate federal, state, and local laws and regulations as well as consultation with the proper authority should provide guidance for developing adequate procedures for using and storing powder coatings.



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Powder Coating is a Safe Technology

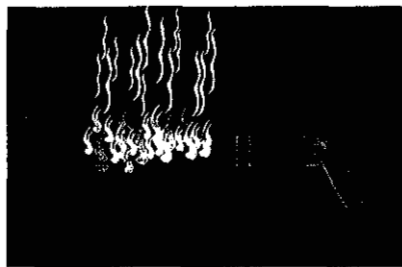
Properly designed and maintained powder systems rate high on the safety scale compared with other metal finishing systems primarily because:

- POWDER DOES NOT SUPPORT COMBUSTION UNLESS IT IS MIXED WITH AIR. POWDER STORAGE AREAS NORMALLY DO NOT POSE A FIRE OR EXPLOSION HAZARD.
- POWDER AND AIR MIXTURES EXTINGUISHING THE SPRAY GUN WILL IGNITE WITH AN IGNITION SOURCE, BUT THE FLAME WILL EXPIRE AS SOON AS FEED TO THE GUN IS SHUT OFF.
- FLAMMABLE SOLVENTS USED FOR VISCOSITY CONTROL IN LIQUID SYSTEMS ARE NOT USED IN POWDER SYSTEMS.
- POTENTIAL FOR EMPLOYEE EXPOSURE TO SOLVENT FUMES IS GREATLY REDUCED OR ELIMINATED WITH POWDER SYSTEMS.
- MOST POWDER FORMULATIONS ARE NOT CLASSIFIED AS HAZARDOUS WASTE ACCORDING TO DEFINITIONS ESTABLISHED BY THE RESOURCE CONSERVATION RECOVERY ACT (RCRA).

As with most industrial processes, safety considerations in design, maintenance, and daily operation are important with powder systems. The objectives of these safety considerations are to minimize employee exposure to, and inhalation of, powder and to avoid conditions favorable to fires and/or dust explosions. Consult National Fire Protection Association, Inc. (NFPA Bulletin 33) as well as equipment suppliers' recommendations for guidance in the design and operation of powder coating systems.



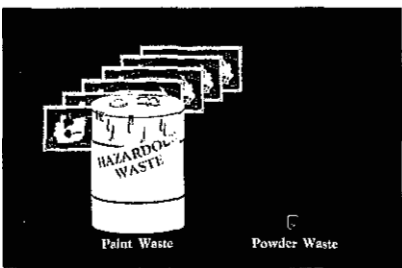
*Will Not Support
Combustion Unless
Mixed With Air*



*Powder/Air Mixture
From Guns Will Burn*



*Flames Expire When
Guns Are Shut Off*



Overspray Waste

Dust explosion occurrences are extremely rare in powder coating operations because the conditions which cause them normally do not occur when a properly designed and maintained system is used.

The conditions favorable to a dust explosion are for an ignition source to be present in a tight enclosure (such as may be found in reclaim systems) and the powder-to-air concentration equaling or exceeding the minimum explosive concentration (MEC) in that enclosure.

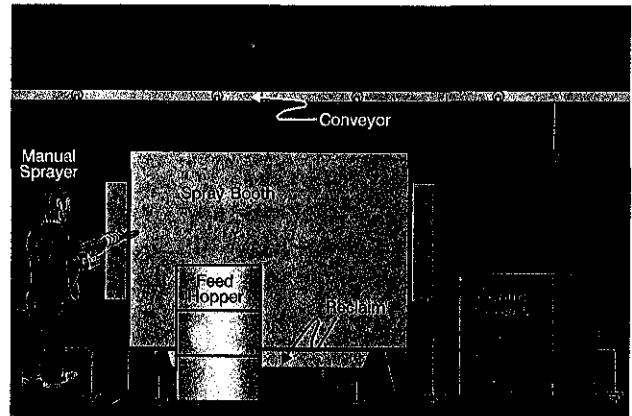
To minimize the potential for this occurrence, equipment should be designed and maintained to :

- ◀ **Minimize all ignition sources** such as a spark, a flame, or a fire in the spray booth.
- ◀ **Quickly extinguish a fire** should it occur.
- ◀ **Prevent such a fire from being drawn into tight enclosures** where an explosion could occur.
- ◀ **Minimize damage in the unlikely event of an explosion.**

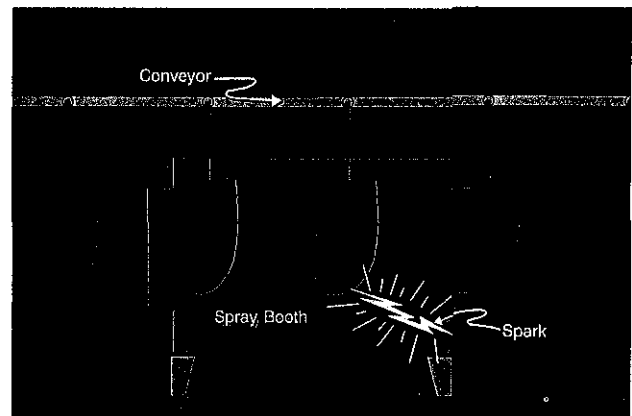
Additionally, all personnel should be trained to operate and maintain powder systems in a safe manner.

Minimize Ignition Sources

- ◀ All electrically conductive objects in the spray area must be grounded to prevent building a charge which could lead to sparks. This includes the workpieces, hooks, racks, conveyors, spray booths, reclaim systems, feed hoppers, control consoles, hand gun operators, etc. Personnel should not wear or carry metallic objects (watches, jewelry, etc.) unless connected to ground.
- ◀ Frequently check grounding connections and integrity of ground of the above conductive objects.
- ◀ If gloves are worn during spraying, cut holes in the gloves so that skin contact is made with the grounding points on the gun handle and/or trigger to provide operator grounding.
- ◀ Maintain a good ground (resistance as low as possible for good electrostatic properties; less than 1 megohm for spark avoidance) on the workpiece. Strip hooks and racks frequently. Poor workpiece ground is a primary cause of sparks or ignition in the spray booth. If sparks are noticed, immediately shut down the system and correct the problem.
- ◀ Workers and vacuum cleaner hose tips should be grounded when cleaning booths.
- ◀ Immediately remove any foreign objects (i.e., a dropped workpiece) from booths to minimize spark potential and/or restricted air flow.
- ◀ Use spark-proof and dust-ignition-proof electrical devices (i.e., exhaust fans, lights, switches, vacuum cleaners, etc.) within three (3) feet of the spray booth openings.
- ◀ Do not allow smoking, open lights, or flames in the spray area. Post "No Smoking" signs at entrances to and inside the spray room.
- ◀ Check reclaim exhaust fan motors for signs of overheating. Repair or replace motors as needed.



All Fixtures In And Around Spray Booth Must Be Grounded



Ignition Source: Poorly Grounded Workpiece

Quickly Extinguish a Fire in the Booth

NFPA reports this as a critical step in damage control. Normally, flames are extinguished almost instantly, resulting in little or no damage if the supply of airborne fuel is interrupted by shutting off the guns. Prolonged booth fires (10-60 seconds) may generate airborne glowing embers of charred platelets which the fire has formed from powder deposits in the booth. These embers may be drawn through the ductwork to a dust collector where they can cause an explosion.

NFPA requirements and other considerations include:

◀ Install approved flame detection equipment to shut down energy supplies to all components of the powder system and conveyor and to close segregation dampers in the ductwork within one-half second of the presence of a flame. This is currently an NFPA requirement for automatic gun booths and is recommended for manual booths.

■ Optional LED readouts are available on some models to detect the capability of the sensor to see through a powder cloud and to detect low-energy releases (not sufficient to shut down the operation) for advance notification of ground problems.

■ Overly-dense powder clouds in the booth should be avoided because they may hide sparks from the detection device.

■ Detector lenses must be kept clean.

■ Do not bypass the shutdown capability of the detector.

◀ An approved automatic fire extinguishing system is required in the spray area.

Prevent Booth Fires from Being Drawn into Tight Enclosures

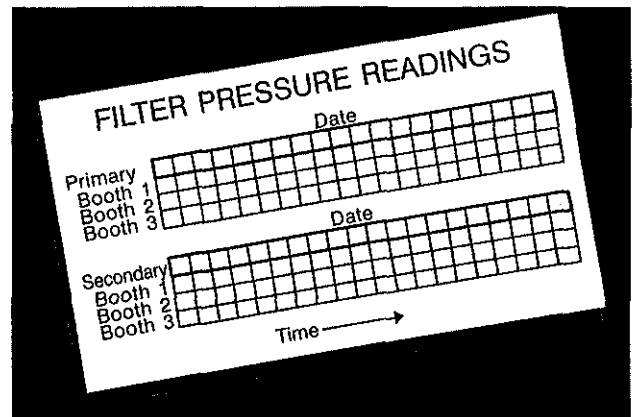
◀ Equipment design must include restricting powder-to-air concentrations in the spray booth exhaust duct to not exceed one-half the minimum explosive concentration (MEC) of the powder. Flames from booth fires do not extend into the exhaust ductwork if adequate air flow is provided to maintain maximum powder concentration in the exhaust stream below the MEC (minimum concentration to support combustion).

■ The MEC for most powders ranges from .03 to .10 oz/ft³.

■ Choosing .015 oz/ft³ as one-half MEC is typical for equipment design because it should be adequate for a wide variety of commercial powders.

■ To meet the current NFPA requirement, booth exhaust air velocities (ft³/min) are typically calculated as follows unless greater velocities are required for containing powder in the booth:

$$\frac{\text{Maximum powder output from all guns (oz/min)}}{.015 \text{ oz/ft}^3}$$



Filter Pressure Readings

◀ Gauges to measure pressure drops across primary and secondary filter media are required. Increasing pressure drop readings indicate restricted air flow which pushes the powder-to-air mixture in the ductwork closer to the MEC.

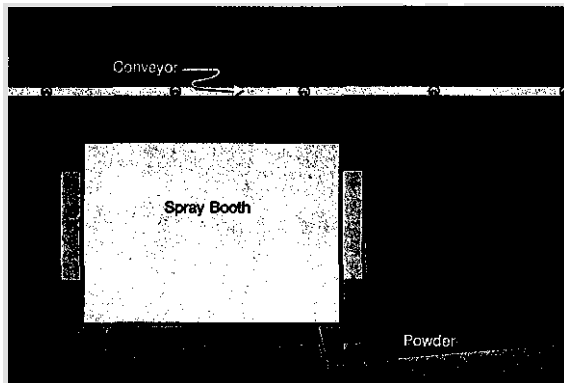
◀ Frequently check and maintain a log on pressure drops over primary and secondary filter media. Replace (or clean, if applicable) filter media immediately upon reaching the manufacturer's suggested maximum pressure drop reading.

◀ A reduction in pressure drops indicates the potential for broken filter media or leaks in the system. This should be corrected to prevent powder infiltration into the powder room and/or into motor bearings and blades of the exhaust fans. This could cause overheating and/or reduced air flow.

◀ It is a current OSHA requirement that automatic warning and shutdown devices be incorporated at predetermined pressure drops (per manufacturer's instruction) as well as for ventilation failure.

Minimize Damage in Case of an Explosion

- ◀ “Tight” enclosures require pressure relief openings to safely relieve internal pressure in case of mixture ignition.
- ◀ Relief venting should be directed away from principal area of work activity and ignitable materials.



Avoid Powder Drifting From Booth

Minimize Worker Exposure

- ◀ Intake air velocity at booth openings is necessary to contain powder within the booth and to minimize operator exposure to powder dust.
 - NFPA requirement currently is 60 ft/min minimum at each opening. A higher average face velocity is normally needed because the air velocity may vary from opening to opening.
 - Equipment suppliers generally recommend an average face velocity of:
 - 100 ft/min minimum for manual booths
 - 110-150 ft/min for automatic booths
 - Air velocities within the booth near the guns should not exceed 75 ft/min to avoid interference with spray patterns.

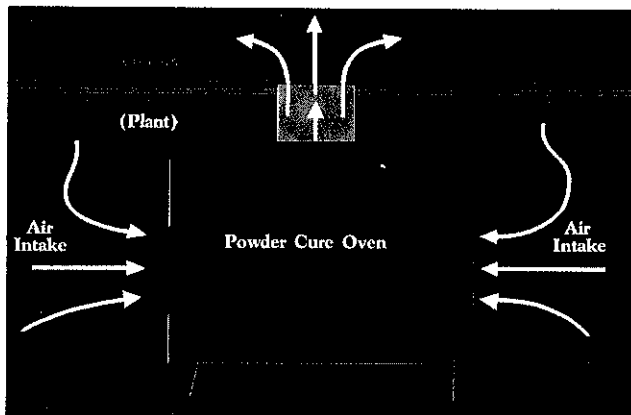
- ◀ Air exhausted from recovery systems must be free of particulate matter. Monitoring equipment must be installed to automatically shut down the operation in the event of **filtration failure**.

- ◀ Gloves, dust masks, protective clothing and safety glasses should be worn when powder exposure is possible, e.g. when:

- Opening/closing powder containers
- Loading feed hoppers
- Spraying powder
- Cleaning spray booths, reclaim systems, feed hoppers, hoses, floors, etc.

Always consult individual Material Safety Data Sheets (MSDS) for instructions on the specific powder(s) used.

- ◀ Do not allow workers inside spray booths while spray guns are in operation.
- ◀ Do not allow food storage or eating and drinking in the spray room.
- ◀ Reclaim exhaust fans must be turned on when booths are being cleaned or when spray guns are in operation.
- ◀ Powder should be washed frequently from the skin with soap and water. Never use solvents or compressed air for cleaning powder from skin.
- ◀ Avoid conditions which cause powder drifts from spray booths (plugged filter media, side drafts, compressed air for cleaning booth interior, etc.)
- ◀ Keep the powder coating equipment and surrounding area clean. Clean up powder spills immediately.
- ◀ Always consult powder supplier's Material Safety Data Sheet (MSDS) for specific instructions for individual powder formulations.



Venting - Powder Coating Oven

- ◀ Oven venting is required to remove combustion by-products of the fuel used as the energy source and for removal of potential volatile compounds from powder curing. Some of the NFPA 86 recommendations (air intake basis @ 70°F) and other considerations are as follows:
 - One ft³/min for every 5700 Btu/hr oven capacity rating for removal of by-products of combustion of natural gas, plus:
 - 2.20 ft³/min for every lb/hr of powder through the oven for removal of potential volatile compounds which may be generated in the powder curing operation.
 - The workplace environment should be monitored to ensure that the combination of bake oven venting and room air turnover is sufficient to meet Permissible Exposure Limits (PEL) and other exposure limits for regulated substances as outlined on the powder Material Safety Data Sheet (MSDS).

NFPA 86 should be reviewed in its entirety.

Disposal of Powder

- ◀ Most powder formulations are not classified as hazardous waste according to the definition established by RCRA (Resource Conservation Recovery Act).
- ◀ Many local municipalities allow disposal of nonhazardous powder formulations via normal refuse handling (check local rules and regulations).
- ◀ Some municipalities require powder to be dedusted (through melting or mixing with water) prior to disposal.
- ◀ Powder formulations which meet the RCRA definition of hazardous waste must be disposed of according to federal, state, and local regulations.

Material Safety Data Sheets providing safety precautions that should be observed in handling and storing Eastman products are available on request. You should obtain and review the available material-safety information before handling any of these products. If any materials are mentioned that are not Eastman products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be observed.

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