Intrinsic Safety

How are Hazardous Locations Defined?
Answer: According to the National Electrical Code, Article 500, hazardous locations are defined by Class, Group and Division. Differentiation by Class and Group is in accordance with the laws of physics, while Division classification is based on environmental and physical plant conditions.

Relative to the application of Intrinsic Safety, it is important to define the actual Class, Group and Division into which any proposed Intrinsically Safe electrical circuits are to be installed. As shown by the ignition curves, all flammable mixtures do not require the same energy levels to ignite. Because Intrinsic Safety requires maintaining an energy level lower than that required to ignite a specific hazardous mixture, it is important to know what the energy allowances are for operational and safety considerations.

Typical Resistance Circuit Ignition Currents Identify Only Four Hazardous Substances: Hydrogen, Ethylene, Propane and Methane. Aren't There More Flammable or Combustible Materials Than That?
Answer: Yes, but those four hazardous mixtures represent the basis for all flammable or combustible mixtures subject to ignition from electrical sources. All are found, as shown in the Hazardous (Classified) Locations chart following, in Class I, with Hydrogen identified as Group B; Ethylene identified as Group C; Propane being Group D and, as a separate curve within Group D, Methane.

Acetylene: Group A and Hydrogen: Group B share the same required energy levels relative to ignition. They require less energy for ignition than does Group C, which requires less energy for ignition than Group D. Within Class II Group E, metal or electrically conductive dusts, Group F, Coal Dust and Group G, electrically nonconductive dusts, generally grain or agricultural dusts are identified. As Groups A and B share the same ignition curve, Group C, Ethylene, and Group E, metal or electrically conductive dusts, share the same ignition curve. Groups D, Propane, F, Coal Dust, and G, electrically nonconductive dusts, share the same ignition curve.

A complete listing of hazardous mixtures defined by Group can be found in National Fire Protection Association document NFPA 497 M.

The Definition of Intrinsic Safety Identifies Both Electrical and Thermal Energy as Potential Causes of Ignition. How Does Thermal Energy Relate to the Ignition of a Specific Flammable or Combustible Mixture?

Answer: There are temperatures at which a flammable or combustible mixture will ignite. The minimum temperature at which ignition takes place is called the "Auto-Ignition Temperature." Intrinsically Safe systems will not allow thermal energy to reach levels at which a specific flammable or combustible mixture will auto-ignite.

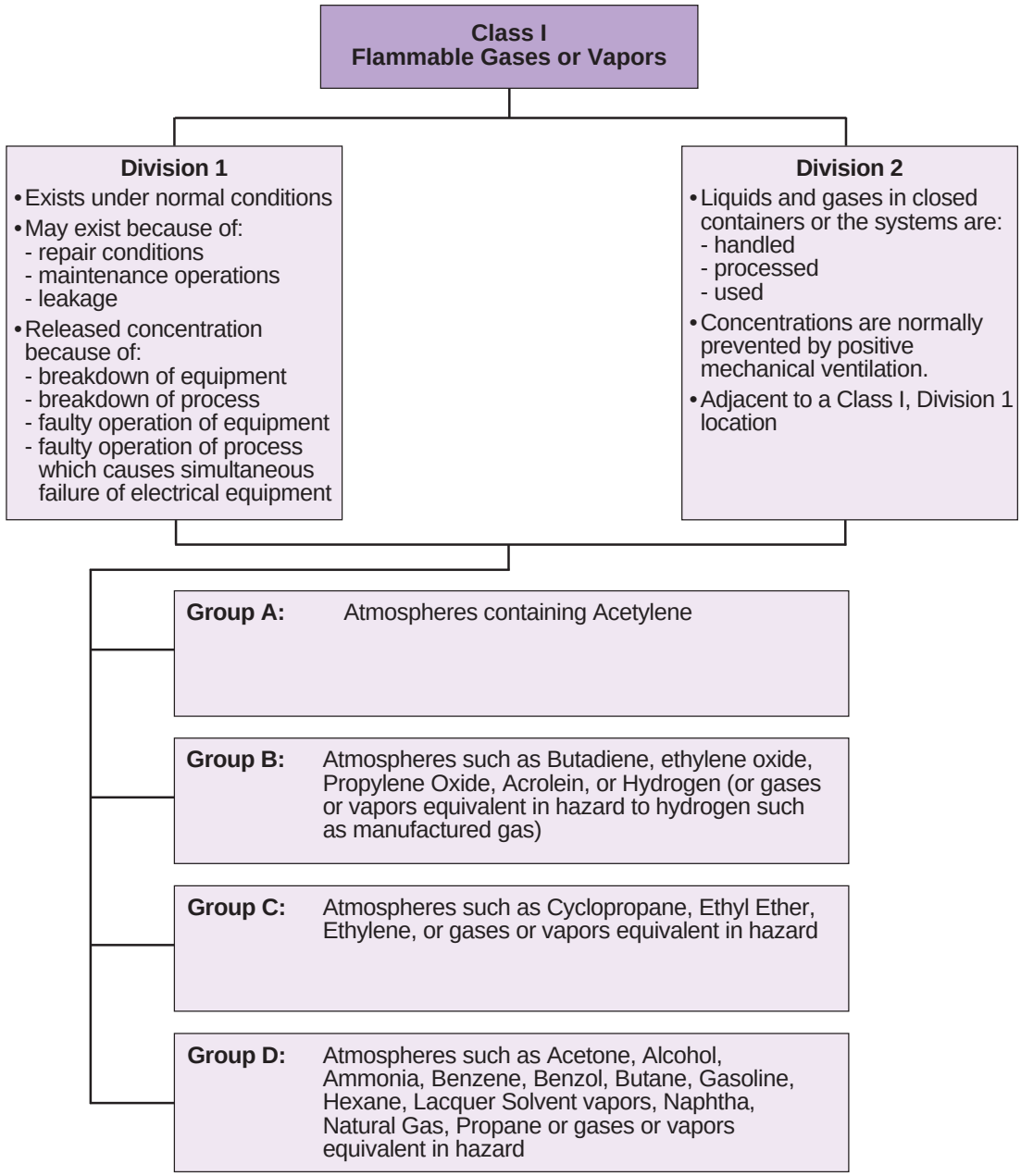
Figure 1 identifies common hazardous mixtures and their auto-ignition temperatures.

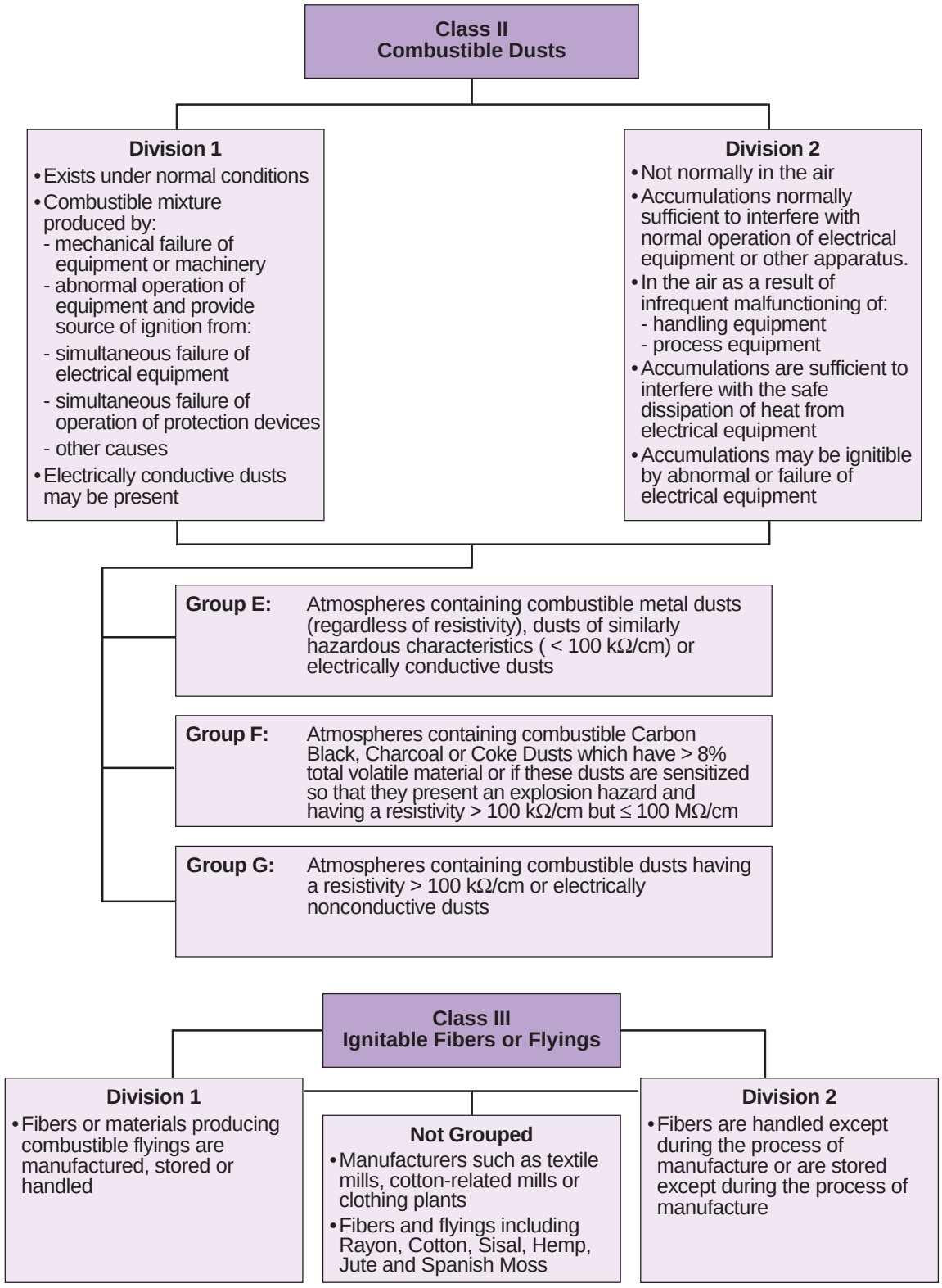
Hazardous Mixture	Autoignition Temperature	
	°C	°F
Acetone	540	1004
Acetylene	305	581
Ammonia	630	1166
Benzene	220	428
Benzol	555	1031
Butane	365	689
Butylalchohol	340	644
Carbon Disulphide	95	203
Carbon Oxide	605	1121
Cyclohexane	430	806
Diesel Fuel	220 to 300	428 to 572
Ethane	515	959
Ethylacetate	460	860
Ethylalchohol	425	797
Ethylchloride	510	950
Ethylene	425	797
Ethylether	180	356
Ethyl Glycol	235	455
Fuel Oil	220 to 300	428 to 572
Hexane	240	464
Hydrogen aeroxide	560	1040
Hydrogen disulphide	270	518
Methane	595	1103
Methanol	455	851
Methyl chloride	625	1157
Naphthalene	520	968
Phenol	595	1103
Propane	470	878
Tetraline	425	797
Toluol	535	995

Figure 1: Autoignition temperatures of some hazardous mixtures.

Intrinsic Safety Cont'd

Hazardous (Classified) Locations in Accordance with Article 500, National Electric Code-1990




Class II
Combustible Dusts
Division 1
• Exists under normal conditions
• Combustible mixture produced by:
- mechanical failure of equipment or machinery
- abnormal operation of equipment and provide source of ignition from:
- simultaneous failure of electrical equipment
- simultaneous failure of operation of protection devices
- other causes
• Electrically conductive dusts may be present
Division 2
• Not normally in the air
• Accumulations normally sufficient to interfere with normal operation of electrical equipment or other apparatus.
• In the air as a result of infrequent malfunctioning of:
- handling equipment
- process equipment
• Accumulations are sufficient to interfere with the safe dissipation of heat from electrical equipment
• Accumulations may be ignitible by abnormal or failure of electrical equipment
Group E: Atmospheres containing combustible metal dusts (regardless of resistivity), dusts of similarly hazardous characteristics (< 100 kΩ/cm) or electrically conductive dusts
Group F: Atmospheres containing combustible Carbon Black, Charcoal or Coke Dusts which have > 8% total volatile material or if these dusts are sensitized so that they present an explosion hazard and having a resistivity > 100 kΩ/cm but ≤ 100 MΩ/cm
Group G: Atmospheres containing combustible dusts having a resistivity > 100 kΩ/cm or electrically nonconductive dusts
Class III
Ignitable Fibers or Flyings
Division 1
• Fibers or materials producing combustible flyings are manufactured, stored or handled
Not Grouped
• Manufacturers such as textile mills, cotton-related mills or clothing plants
• Fibers and flyings including Rayon, Cotton, Sisal, Hemp, Jute and Spanish Moss
Division 2
• Fibers are handled except during the process of manufacture or are stored except during the process of manufacture