NIBA
NIBA–The Belting Association
6737 W. Washington St. #1300
Milwaukee, WI 53214
Ph: 414-389-8606
www.niba.org

Tech Note
Technical Notes from the Technical Committee, NIBA – The Belting Association

#9 Static Electricity Considerations

NATURE OF STATIC ELECTRICITY

Static electricity is defined as **electrical charge at rest**. It can be generated by the triboelectric effect and can be accumulated by conductive and inductive charging.

SOURCES OF STATIC ELECTRICITY

When two surfaces in close proximity are moved relative to one another, a static charge is generated (the triboelectric effect). Conveyor and elevator installations are classic examples. In operation, the belt surface is continually leaving the pulley surface, generating static electricity. The surfaces can be similar, dissimilar, conductive or non-conductive and static electricity will be generated. Varying the types of surfaces can vary the amount of static charge generated (this is relatively insignificant), but the generation of static electricity cannot be eliminated.

Further, as the conveyor or elevator continues to operate, the static charge will continue to accumulate and increase unless it is bled off in some manner. In a grain elevator application, probably the greatest source of static electricity is the sliding of grain down a chute that has been lined with urethane or UHMW polyethylene. The individual grain particle which is now charged will carry that charge onto the conveyor or elevator belt where it very well may be accumulated.

HOW CAN WE CONTROL STATIC?

In a conveyor or elevator belt installation, it is apparent that from the physics of the situation, we cannot control static by eliminating generation. However, it would appear that accumulation and storage of static electricity can be controlled. First of all, we must keep in mind that static electricity is being continuously bled out of the system by the surrounding atmosphere. This is not an insignificant effect.

For example, a person walking across a carpet can generate 35,000 electrostatic volts at a relative humidity in the 10-20% range. That same person walking across that same carpet would only exhibit 1,500 electrostatic volts if the relative humidity were in the 65-90% range (reference D.O.D. -- H.D.B.K -- 263*), due to the high bleed off of static charges by the humid air.

Accumulation and storage of static charges can be controlled by making the entire system **sufficiently conductive** and **contiguously** and **properly grounded**. This means that the belt, pulley lagging, pulley, bearing, structure, and electrical ground must all be connected electrically. It also means that conductive grease

would be essential in the bearings. But **how conductive is enough,** and **is there such a thing as too conductive?**

CONDUCTIVITY

Surface resistivity is an inverse measure of the conductivity of a material. Materials, in general, can be classified* relative to their conductive properties as follows:

1. Insulative material --> 10^{14} ohms per square
2. Anti-static material -- $\geq$ to 10^{9} to $\leq 10^{14}$
3. Static dissipative materials -- $> 10^{5}$ to $< 10^{9}$
4. Conductive material -- $\leq$ to 10^{5}

* (Reference D.O.D -- H.D.B.K. -- 263)

WHAT ARE THE HARMFUL EFFECTS OF STATIC ELECTRICITY?

The effects of static electricity stem from the **voltage** accumulated, a subsequent electrostatic discharge resulting in an **electromagnetic pulse**, and **discharge current**.

Certain electronic components and assemblies are voltage sensitive -- 20 volts being sufficient in some cases to cause damage.

Other electronic gears (such as memory systems) can be upset by an electromagnetic pulse which is the result of an electrostatic discharge. Still other gear can experience failure mechanisms which are power, and hence current, dependent.

Finally, the heat of a spark discharge (spark discharge energy) can ignite a gaseous or dusty explosive atmosphere, provided the spark discharge energy exceeds the minimum ignition energy requirement. It should be noted that an explosive atmosphere of certain types of starch dust can be ignited with a minimum ignition energy of 20 millijoules (reference: Explosibility of Agricultural Dusts, Murray Jacobsen, John Nagy, Austin R. Cooper and Frank J. Ball, Bureau of Mines, R.I. 5753--1961).

HOW CONDUCTIVE IS ENOUGH?

Extensive studies by the British National Coal Board (1950-1966), reported by Barclay and summarized by Norman, found that belts with a surface electrical resistance of 1 x 10^{9} ohms or under did not retain a static

charge when run on a typical grounded conveyor. While those with a surface electrical resistance of 6×10^9 ohms and greater did retain static charges. As a result of this work, the B.N.C.B. concluded that a maximum of 3×10^8 resistance was a safe condition in new conveyor belts in underground coal mines.

WHAT STANDARDS ARE GENERALLY ACCEPTED?

The International Standards Organization (ISO), the National Coal Board (NCB) of Britain, and the Canadian Standards Association (CSA) have selected 300 meg-ohms (300×10^6) as their definition of Static Conductive.

In the United States, OSHA has also selected 300 meg-ohms (300×10^6) or (3×10^8) as the definition of Static Conductive for grain applications.

Accordingly, in our markets, any belt with a surface resistivity of 300 meg-ohms or less is said to be static conductive.

ISO	3×10^8 ohms	=
NCB	300×10^6 ohms	=
CSA	300 meg-ohms	=
OSHA	300×10^6 ohms.	