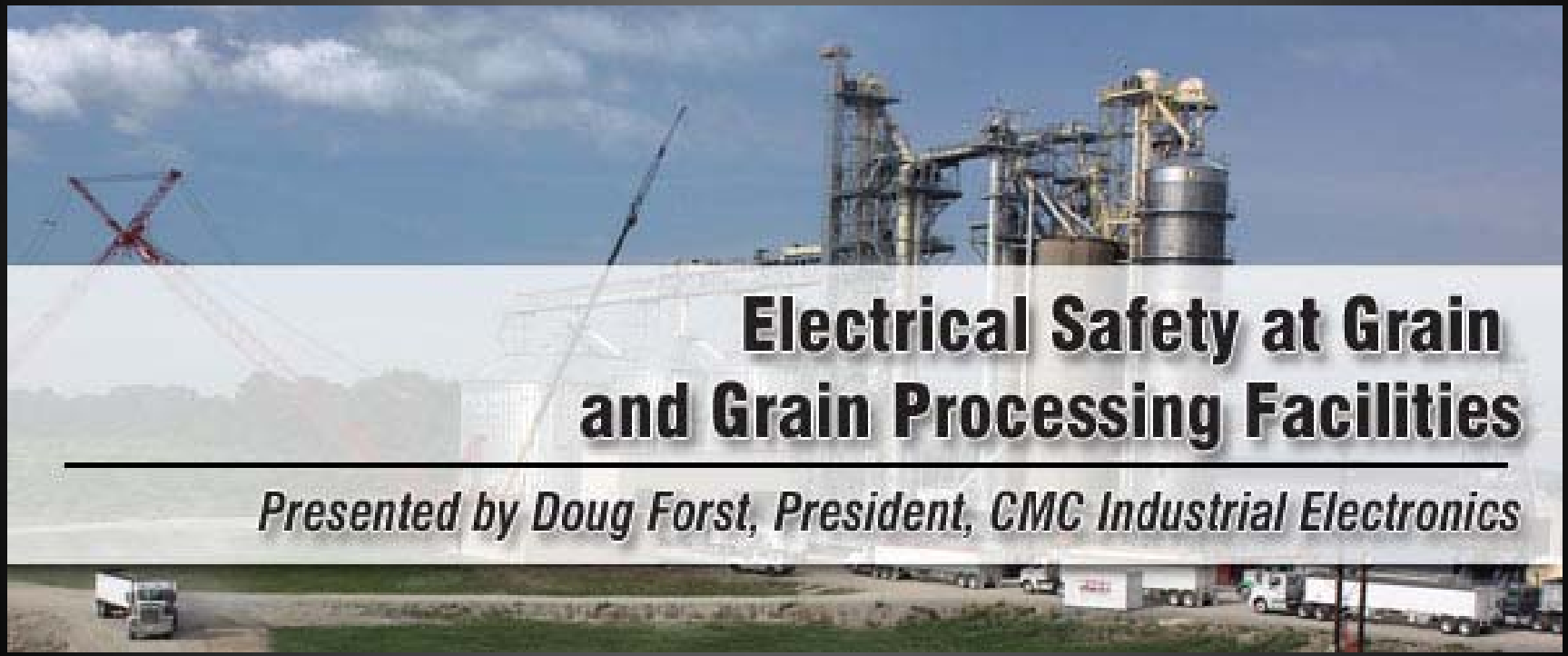
EDUCATIONAL
WEBINAR SERIES

Grain Journal

GEAPS



EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

GEAPS Distance Education Program

A comprehensive program provided to GEAPS members and others who want to further their knowledge of grain processing in the seven core competencies

GEAPS Distance Education Program

- Started in 2005
- Served 2000 students in 30 countries
- 21 courses offered
- 14 students have obtained basic credential

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

GEAPS 542
Electrical Safety for Grain Processing Facilities

- Available through GEAPS and operated by Kansas State University
- A 10 lecture distance education course that will take you 15 – 20 hours to complete

Dedication

This course is dedicated to David Brown. I spent my teenage summers with David and his sister Susan on Bowen Island just outside of Vancouver, BC Canada. David went to work on October 23, 1975 at the Burrard Terminals Elevator on the Vancouver waterfront. That afternoon there was explosion and fire at the elevator. David died at age 28, 3 months later from the extensive burns he received in the fire. Like all other elevator accidental deaths his was easily prevented!

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

Who should take this course?

Anyone supervising or doing maintenance in a grain facility

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

Lecture 1

Understanding the Hazard

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

This lecture discusses the conditions needed for a dust explosion to occur

EDUCATIONAL WEBINAR SERIES

Grain Journal

GEAPS

Only Four Simple Things Required

1. Containment – the concrete building you work in
2. Air – its all around us
3. Ignition – any source of heat
4. Fuel – that ever present grain dust

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

The Optimum Explosive Concentration for grain dust is 1500 to 3000 grams/cubic meter or 1.5 to 3.0 ounces/cubic foot

EDUCATIONAL WEBINAR SERIES

Grain Journal

GEAPS

Grain dust has an explosive force of 12,000 to 20,000 J/g

It is nearly equivalent to having a natural gas or gasoline explosion in a concrete building

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

Best Tools to Prevent Dust Explosions

- Electrical Systems can be the source of ignition for a grain dust explosion
- The minimum temperature of ignition is 220°C or 430°F, not very hot

WHEN WILL WE LEARN!

Omaha Nebraska, January 20, 2014

2 Dead, 10 Injured, Property Destroyed

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

Lecture 2

Electrical Standards For Grain Processing Facilities

- Electrical Standards for grain facilities differ by country
- Efforts underway to harmonize standards

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

The rest of the world, IEC & ATEX Zones 20, 21 & 22

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

The existing US & Canadian System Class / Group / Division For grain facilities: Class II, Group G, Divisions 1 & 2

The Division or Zone is based on the likelihood of dust being present

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

If you have open conveying equipment or an enclosed rail/truck loading or unload facility it is Division 1 or Zone 20

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

Any equipment used inside a grain facility must bear an approval label from an accredited testing laboratory and be marked:

Class II, Group G, Divisions 1 & 2 or Zones 20, 21, 0r 22

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

Lecture 3

What are the classifications in your facility?

- Who decides what classification your facility is
- How is the classification determined

- Usually determined at time of construction by the engineers
- In case of doubt use the next highest classification
- Fire Marshall has the final say in Canada and the USA

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

- Is the area a confined space
- Is the area well ventilated as in a partially open track shed?
- What construction methods were used for the facility
- What is the space used for

- The data is analyzed to determine the amount of dust per cubic foot (meter) of air
- This determines if there is sufficient dust in the atmosphere during normal equipment operation to cause an explosion

- Is there a dust collection system
- What types of conveying equipment are being used
- What additional equipment is installed

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

- All grain processing facilities are considered Class II, Group G locations
- Class II, Group G has two Divisions, Division 1 and Division 2

- The amount of dust in the air during normal operation of the facility
- A good rule of thumb is that if dust is in the air and collects on the floor and other horizontal surfaces during normal operation, it is a Division 1 location

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

Lecture 4

Protection methods

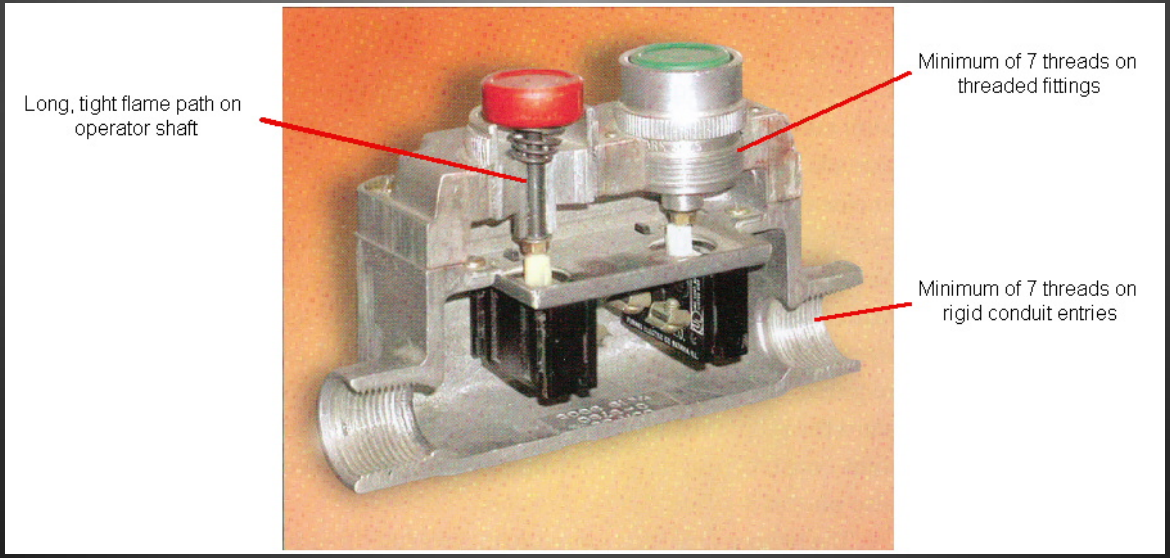
There are two basic methods of ensuring that an ignition source of sufficient energy can not be generated by an electrical device

Explosion Proof

The first method is based on containment and utilizes heavy cast metal enclosures to restrict the egress of hot gases from the device

- Most are made of cast aluminum or iron
- Enclosures must be strong enough to contain an explosion
- Overlap at seams or cover joints must be wide enough to cool any escaping gases below the ignition point

- Photo of a push button station showing long thread paths and flame path on push buttons



- Must use galvanized steel or aluminum rigid conduit and fittings or
- CSA Teck 90 or UL Metal Clad type MC cables with approved connectors
- All joints must be threaded and have 7 or more engaged threads

Intrinsic Safety

The second method is based on energy limiting technology that ensures that the electrical circuits can not have sufficient energy present to cause ignition

- Limited to low energy devices
- Typically sensors, displays or other electronics devices

Class II, Group G, Division 2

- For locations where dust is not normally present
- Lower cost equipment and wiring may be available

- Permitted equipment varies by jurisdiction
- Typically wiring devices suitable for NEMA 4/4X oil and dust tight locations are permitted
- Motors and lighting must be marked for use in Class II, Group G, Division II locations

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

All equipment must be labelled

Mark of an accredited testing agency

Suitable for use in Class II, Group G locations

Only usable under specific conditions

Devices maximum electrical ratings

Warning to remove power before opening enclosure

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

Lecture 5

Electric Motors

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

This lecture describes the special requirements for electric motors in grain facilities

- Electric motors are high energy devices with fast moving parts
- Either an electrical or mechanical failure could ignite grain dust
- Electric motors generate significant heat during their operation

- They are designed for a specific maximum outside housing temperature not to exceed 165°C or 329°F
- The housing is strong enough to contain the moving parts and any hot gases that may be generated during a failure

Old open frame induction motor not suitable for use in hazardous locations

- TEXP is short for “Totally Enclosed Explosion Proof”
- Uses TEFC or “Totally Enclosed Fan Cooled” construction
- Has the added features required to ensure it is dust tight and can contain any heat or hot gases that could be created during failure

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

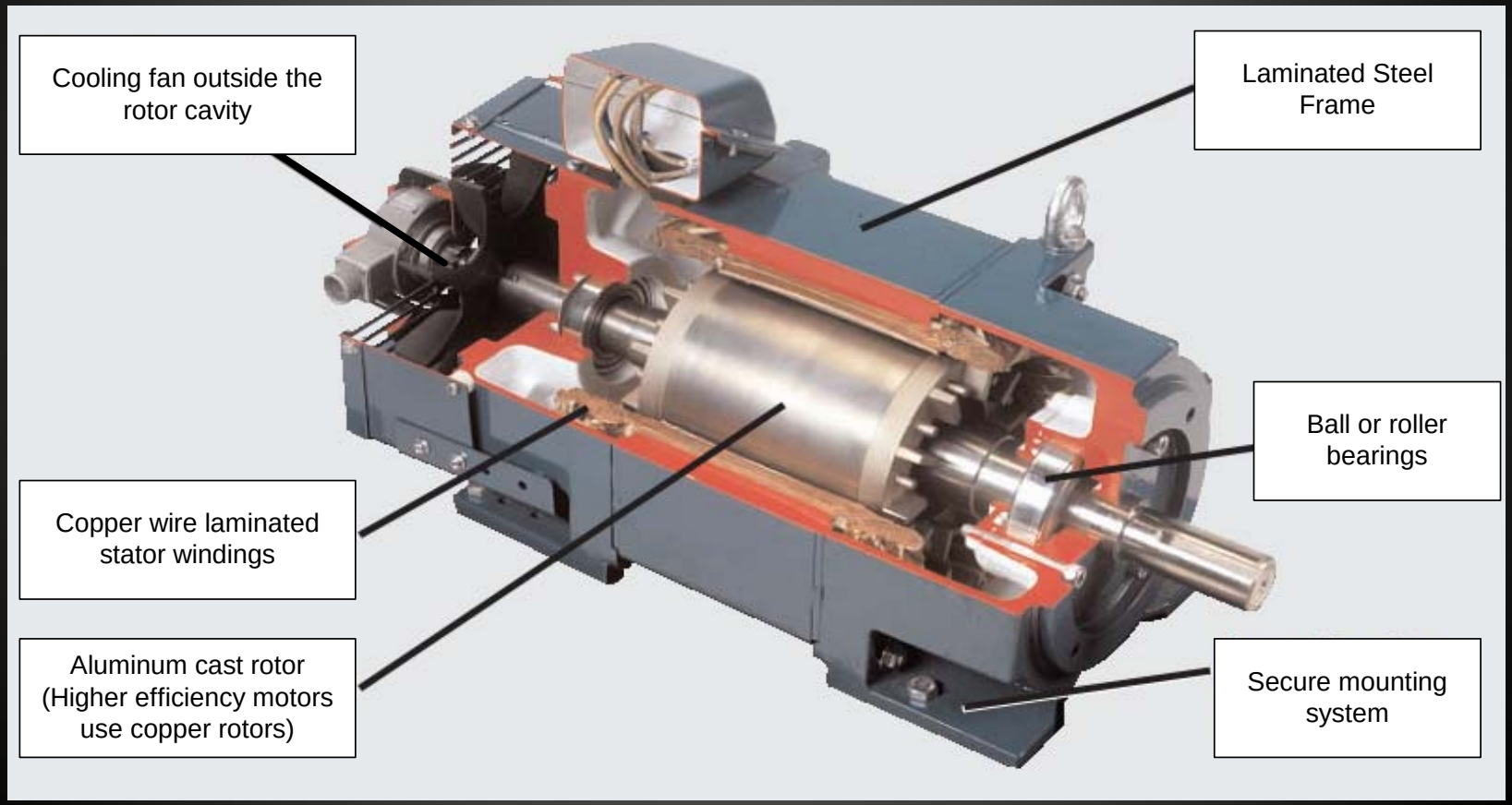
GEAPS

Modern 50HP electric motor rated TEXP for use in Class II, Group G, Division 1 locations

EDUCATIONAL WEBINAR SERIES

Grain Journal

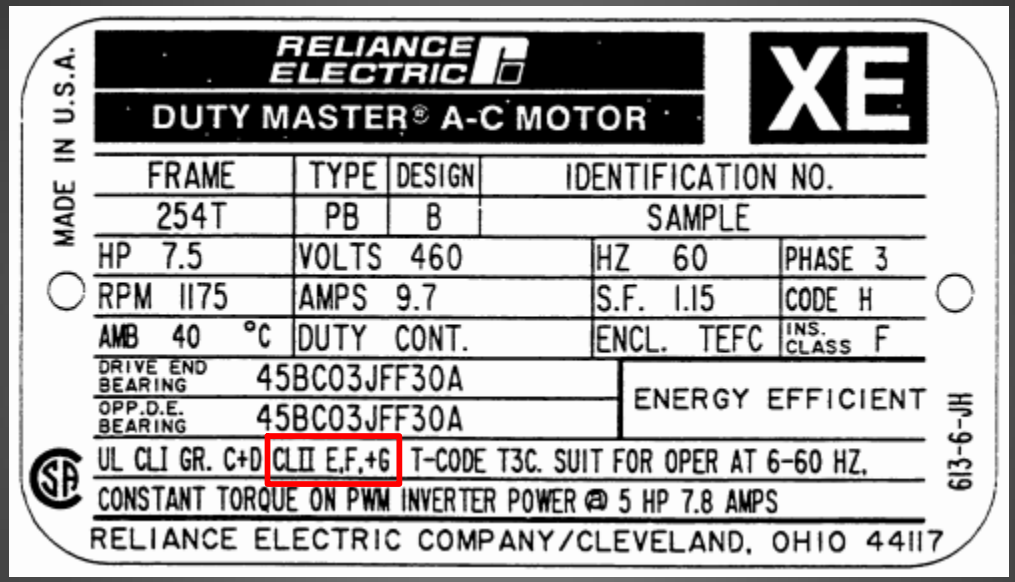
GEAPS



EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS



- This motor is certified for use in a Class II, Group G location such as a grain processing facility

- Class II, Group G, Division 2 motors must also be rated
- These motors are to be totally enclosed, with maximum external surface temperatures not exceeding the ignition temperature of the specific dust to be encountered

- A key criteria for Division 2 motors includes no sparking or arcing devices outside the motor housing
- Some standard TEFC motors have metal fans which can cause sparking on failure
- Temperature rating must be T3B or 165°C or 329°F or less

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

- Motor repair sops must be certified
- Today most motor 40HP or less are not economical to repair
- If a motor must be repaired because of an unusual frame size or other issues only an approved motor repair facility may make the repairs

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

Lecture 6

Lighting

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

This lecture describes the special requirements for lighting in grain facilities

- The wrong fixture can destroy your facility
- Workplace accidents can occur due to inadequate lighting
- You can pay to much both upfront and during the life of the fixture

- Conventional incandescent
- Compact fluorescent (CFL)
- Standard linear fluorescent
- HID and other high pressure systems
- LED fixtures for all applications

- Class II, Group G, Division 1 and 2 fixtures have a lower temperature limit than is permitted for some Class I locations
- Temperature code T3B – maximum surface temperature of 165°C (329°F) is required
- Check the manufacture's agency listing file to be sure

- Incandescent lighting is obsolete
- Incandescent bulbs over 60W are no longer manufactured
- If you have incandescent lighting it needs to be retrofitted
- Utility companies have generous rebate programs in place to upgrade lighting

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

- Compact Fluorescent or CFL lighting
- Available with 13, 26 or 39W CFL bulbs
- Explosion proof cast aluminum housing with guard
- Suitable for wet and marine locations

Class I, Div. 2, Groups A,B,C,D*
Class I, Zone 2, Groups IIC,IIB,IIA
Class II, Div. 1 & 2, Groups E,F,G*
Class III
Suitable for wet locations
Marine
NEMA 3, 4X

UL Listed - Files E10514 and E91793 (Marine)

SA Certified - File LR11713

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

- High Intensity Discharge or HID lighting
- Mercury vapor, sodium vapor and metal Halide types
- Available 50 – 175 W sizes
- Explosion proof cast aluminum housing with guard
- Suitable for wet and marine locations

EDUCATIONAL
WEBINAR SERIES

GRAIN JOURNAL

GEAPS

Class I, Div. 1 & 2 Groups C,D
Class I, Zone 1 & 2, Groups IIB,IIA
Class I, Zone 1, AEx d IIB
Class II, Div. 1 & 2, Groups E,F,G
Class III, Div. 1 & 2
Suitable for wet locations
Marine
NEMA 3, 4, 4X
Factory Sealed

Listed - File E10514 and E91793 (Marine)

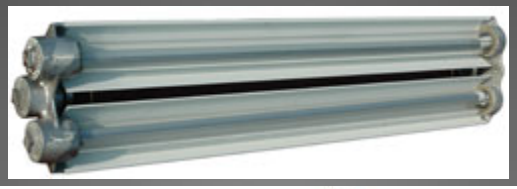
Certified - File LR11713

- LED lighting now available to replace all forms of lighting in grain processing facilities
- From bare bulbs, to flood lights, to work lights, to flashlights
- High initial cost but extremely low life time cost of ownership
- Many power companies offer generous rebate programs to switch to LED lighting

EDUCATIONAL
WEBINAR SERIES

GRAIN JOURNAL

GEAPS



The Industry Leader in HazMon Technology

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

Lamp Type	Conversion Efficiency (Lumens per Watt)	Life (Hours)
Incandescent	10	1000
Low Voltage Halogen	20	2000 to 5000
Mercury Vapor	40 to 60	22000
Fluorescent	64 t0 90	7000 +
Metal Halide	70 to 90	12000 +
High Pressure Sodium	90 to 125	25000
Low Pressure Sodium	120 to 200	20000
LED	Exceed 150	50000

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

Even flashlights need to be certified

IN2-MS**	2 Cell D Size Orange Industrial Safety Flashlight with safety head and ring hanger

For Use in Hazardous Locations

**Approved by U.S. Department of Labor, MSHA and Underwriters Laboratories (UL) for Class I Groups C and D and Class II Group G. Meets U.S. Coast Guard ASTM F1014-86 Type II requirements for flashlights for use in hazardous locations on vessels.

- One of the most common causes of fires and explosions is unapproved lighting fixtures
- Most of these incidents are caused by contractors bringing unapproved lighting onto the site
- All lighting devices, even flashlights, used on your site must have a valid agency certification with no exceptions

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

Lecture 7

Intrinsically Safe Systems

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

This lecture describes Intrinsically Safe Systems and the special requirements for installing and maintaining them

- Intrinsic Safety (IS) is a concept developed in Europe to provide a new class of equipment for use in hazardous locations
- The designs limit the available energy in the field devices below the level required to ignite the hazardous substance

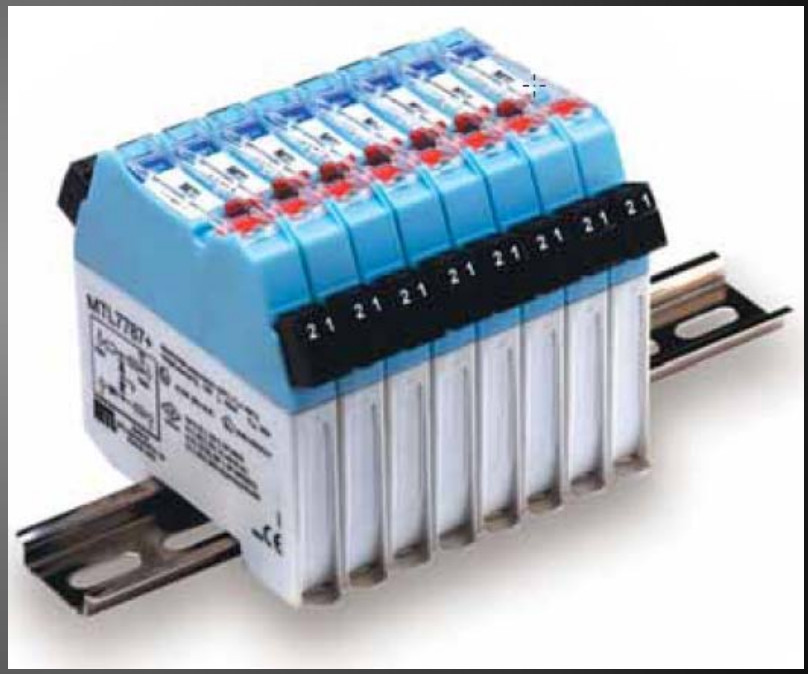
- These are all “Low Voltage” systems with available current in the milliamps (thousands of an amp)
- As a result IS systems can not run motors, light rooms or other high energy tasks
- Primary advantage is that they can be worked on with the power applied

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

- Free standing IS barriers used to protect analog and low level digital signals



- IS wiring can not share a conduit or raceway with any other cables not rated IS
- If IS cables and unprotected cables enter the same junction, box a physical barrier, grounded if it is metal, must exist between the two wiring systems

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

- The products agency certification is shown below
- The Exi symbol is the international symbol for Intrinsically Safe systems

- Control drawings contain device specific information about the product
- Reference are made to additional drawings that may be needed to safely install the product
- The hazardous locations information and product temperature code are also listed

- The contractor should have experience with IS systems
- The contractor must read all of the documentation from the equipment supplier before starting the installation
- Upon completion, a certified professional with knowledge of IS systems should verify the installation

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

Lecture 8

Performing an Audit

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

This lecture describes how to perform a basic audit of your facility to identify areas of non-compliance

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

Lecture 9

Hiring an Electrical Contractor

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

Hiring the right contractor is the single most important decision you will make in ensuring quality workmanship and compliance with the electrical code

- You will need an electrical engineer if you are:
  - changing the electrical service to your facility
  - adding significant equipment to the existing service
  - Adding new floor space
- Electricians do not design electrical systems, they only install them

- The engineer should have experience in grain processing facilities and be prepared to sign all drawings to be used for construction

- Electricians who have not had significant experience in wring hazardous locations should not be hired to work in your facility
- At minimum, the lead hand on the project must be fully experienced with wiring hazardous locations and especially grain facilities

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

- The lecture describes 6 key requirements for hiring an electrical contractor
- Purchase order or contract requirements are also described
- Every project needs a permit
- The work must be inspected by a qualified professional

- Site orientation and safety training must be mandatory
- All contractors must be fully familiar with hazardous locations and what tools and lighting are permitted on site
- Hot permits must be required for any out of scope work

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

Lecture 10

Inspections and Repairs

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

Every electrical contract executed in a grain facility should be inspected by an impartial, qualified third party

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

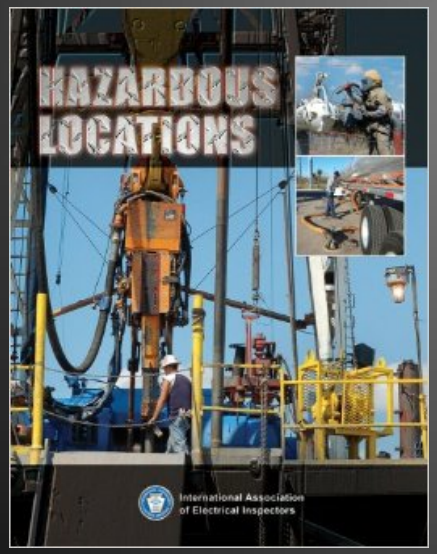
Don’t take your contractors word that the repairs they have made meet the code; get it inspected

EDUCATIONAL WEBINAR SERIES

GRAIN JOURNAL

GEAPS

- Well presented information for anyone working on electrical systems in hazardous locations



Hazardous Locations, 2008, NEC
Item No. 351006
Price: $50.00 | Member Price: $45.00

GEAPS Distance Education Program

For further information on

GEAPS Distance Education Programs

Chuck House

(952) 928-4640

chuckh@geaps.com