NEW PRODUCT LAUNCH

HAZARDOUS LOCATION ENCLOSURES – T&B EX

SALES CHAMPION TRAINING

Thomas&Betts
A Member of the ABB Group

8155 T&B Blvd, Memphis, TN 38125
http://TnB-hazardous.com

Course Materialization

This section will detail the history, beginnings, and direction of this entire collection of courses. The facilitator should be very familiar not only with this material, having a generalized knowledge of the Electrical Products manufacturing business & markets, have a working knowledge of the Hazardous Location standards (and what makes this sub-section of electrical products different than standard Commercial & Industrial equipment), and have a large pool of product specialists upon which to call to aid in this course work.

Problem Statement & Gap Analysis

As has been typical of most large electrical equipment manufacturing companies today, we have grown through acquisition of smaller companies and now have a wide basket of product offerings (currently 70+ different brands with thousands of different products). One such group of products that we'll focus on are designed to work in areas that are classified as 'Hazardous'. What makes this group of electrical products specialized is that they have to operate in areas where petroleum products are being refined (and a single spark could cause an explosion), large amounts of air-borne dusts (which are highly flammable/explosion ready) could exist, and/or processes produce by-products that could explode (like the methane gas released from Waste Water treatment) and not cause/initiate the sparks or heat necessary to start a catastrophic event.

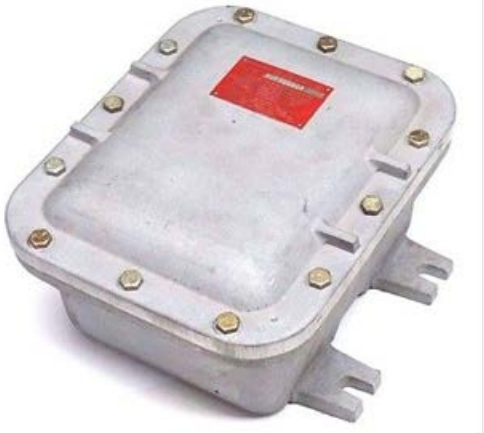


Figure 1 - Basic 'empty' HazLoc Enclosure

The Hazardous Location Product Group has developed a new product offering (that will help augment some of our other existing products moving them from being 'components' into being an integrated system) and needs to develop a training program to take a variety of our existing sales people and turn them into 'Local Champions'. The new product can be thought of as an 'enclosure' in which some of our other product(s) will be designed/customized to be pre-installed for more of the complete system approach and include pull-thru items that we currently sell to complete the system. The facilitator will be relying on the other Subject Matter Experts (i.e. other Product Mangers & Tech Support within the company) that currently sell/support these various 'to be installed' products to expose our new Product Champions to generalized product knowledge, what competitors are doing in the

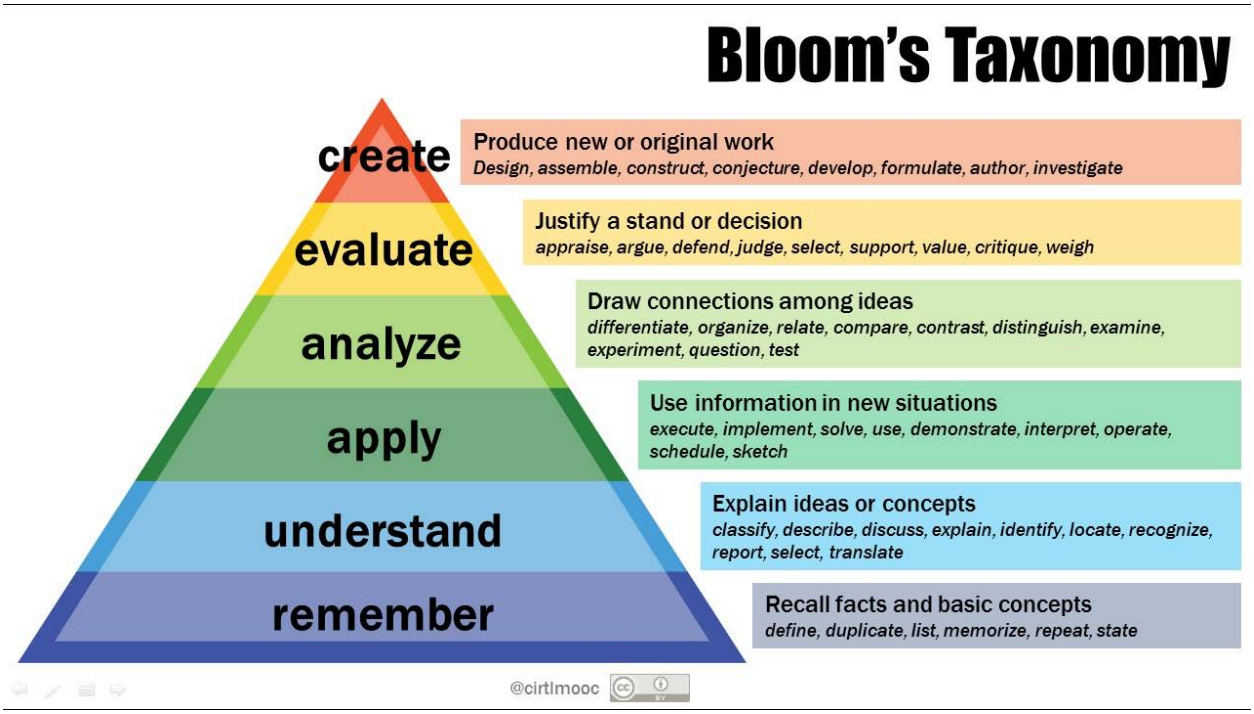
Figure 2 - Enclosure with ABB Disconnect Installed

field/differences, nomenclature that this industry uses, and overall the electrical standards that these types of products must adhere to in the industry. The learners will have a variety of strengths, pre-existing knowledge, and learning styles at the beginning but after the time spent with the 6 to 8 Subject Matter Experts, real-world role-play sales opportunities, and a factory visit they should be transformed to take 'head-on' this new responsibility and role with confidence.

Brown and Green (2016) state that "*There are three commonly used learning domains that refer to specific types of learning – cognitive, affective, and psychomotor*" (34). The facilitator will focus on these three areas as I believe this will not only give them the general background knowledge to answer questions, but also the cognitive ability to take our base information and mold it into the real value statement that the customer will see value in.

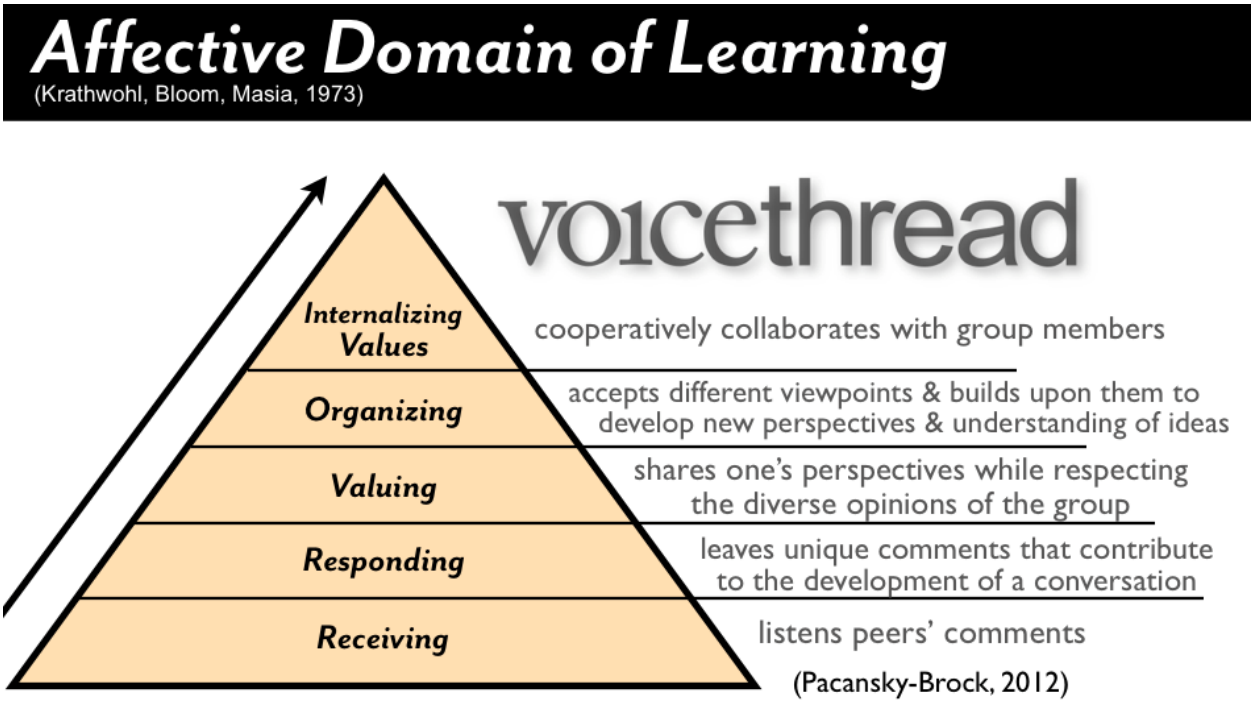
A generalized approach and need for each is stated as:

- **<u>Cognitive</u>** – While it makes sense that these individuals will have some preexisting knowledge; it is imperative that they share with each other and determine the best way upon which to 'build' the hierarchy while discussing with customers. Bloom's Taxonomy of the Cognitive Domain (originally 1956, updated in 2001) helps to illustrate each level and how they build on each other:

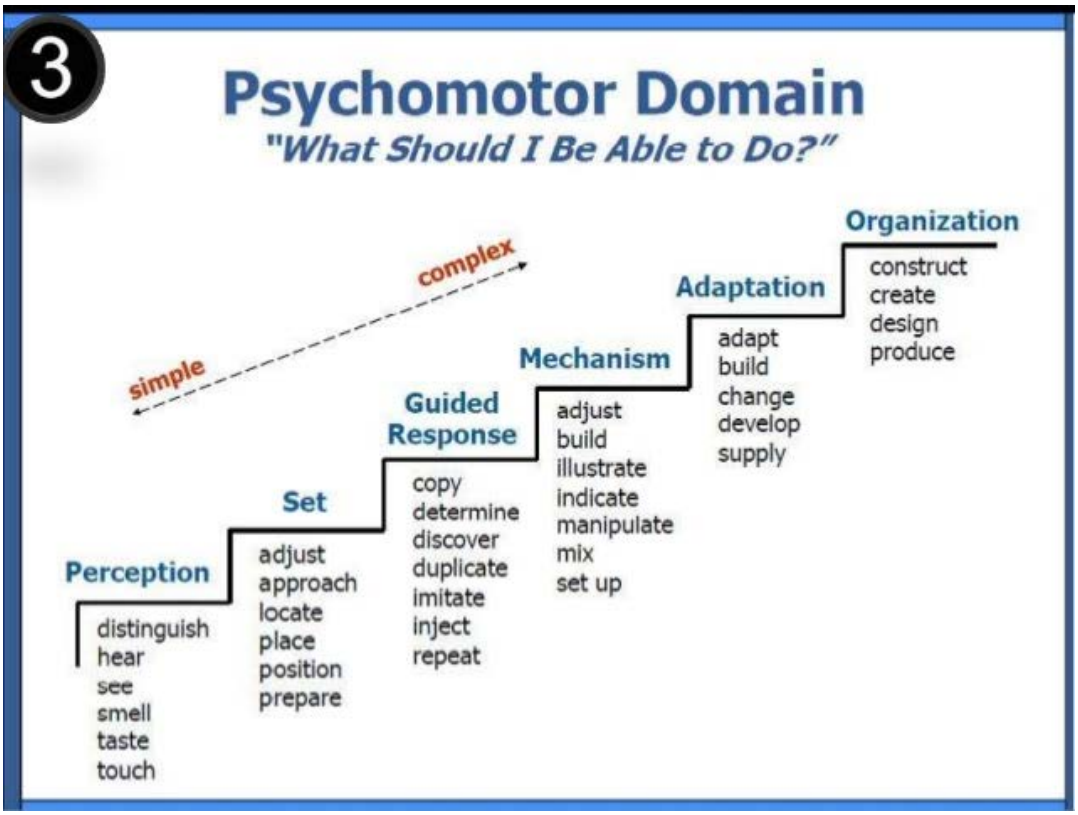


Which means that we will be presenting a wide variety of generalized information about components, assembly, customization, etc. but it will be incumbent upon them to take all of the learning and formulate higher levels of 'drawing connections among ideas', critique what value they have over the competitors, and produce 'new or original' work to meet the needs of the individual customers that will meet.

- **<u>Affective</u>** – While general & specific knowledge is essential for success, without learning Affective skills (which deals more with emotional responses) our Champions will not be as effective in 'winning' the customer over. As an example, they may be experts as to the 'what' they are selling but without understanding the 'why' (which could be that lives are literally on the line in hazardous areas) the customer would want to use our solutions they are less likely to succeed. It is the authors opinion that is typically left out of our industry's training but Is every bit needed as the cognitive skills (and so I will make it a focused aspect of our training).



- **<u>Psychomotor</u>** – While this area traditionally deals with 'physical actions to more skilled and creative movements', the author ties this mindset together with Kinesthetic and Experiential Learning through physically seeing, touching, interacting, identifying sub-components, understanding production of, and manually interacting with the individual components and the system as a whole. This learning will come in the form of visiting the factory which produces the enclosures, another location that machines & customizes the enclosures, and physically seeing each of the various components that could be assembled into the enclosures. As they will be dealing with customers that have experience with these systems, it is imperative that they have some familiarity with the manual operation of the equipment and could identify each sub-part (knowing it's operation) that comprises the system. A general model of this was created by Simpson (1972) as:



The vastness of the 'gap' will be different for each of the four people within the group (which is to be expected when approaching any learning opportunity from an Instructional Design standpoint), but in the end should place each on a 'level platform' in which to best determine how to apply this knowledge, combined with their individual regionalized territories (whether that will be physical or more 'Vertical Market' in which some will focus only on the 'Oil, Gas, and Chemical' markets), and tools to share mini-'lessons learned' continually with each other.

NEED FOR INSTRUCTIONAL EVENT

This one-time event training is needed to provide a unified 'base knowledge' of not only the systems that we're hoping to sell but also the individualized components that will possibly be assembled into the whole as a value to our current & new customers. While some of the students will have pre-existing experience with some of the 'component products' that could go into these new systems; the details of the new product (the enclosure/box) and the specific industries (hazardous) focus (with its nomenclature, applications, and national/international standards for protection) will be new to the group. It will be essential for these 'Product Champions' to understand the customer's needs (whom will often times be more experienced with these products than the Champions), ask the essential questions to reduce 'back-and-forth' discussion about the specifics, and be 'people knowledgeable' about whom to contact for all stages of sales, production, delivery, setup, and operation related to these products.

While some of the Instructional Event will be focused on imparting basic product knowledge, it is imperative that our team have the physical experience (as mentioned above) of how the product is made, constructed, customized, operated, and utilized in a real-working environment and have the opportunity to meet the vast people (from a face-to-face relationship) of their support team whom will be relying on them to be their conduit to the customers.

WHO SUPPORTS & WHY THIS INSTRUCTIONAL EVENT IS NEEDED

This initiative is supported by the executives and managers of our company (from a local level, meaning my boss / boss' boss, all the way up to the CEO whom has authorized the necessary funds to initiative this project within our company) in hopes that with this new offering we will see an increase in sales/profit of the new product and have 'pull-through' of our existing products into customer's hazardous electrical operations. It is believed that through the strong relationships that our Management / Product Champions / Sales Force initiate, through trust in their own working knowledge of these product offerings & the team supporting them, we will be successful in meeting the financial obligations/returns that any new product launch has associated with it for the group / company / stock holders / etc. While looking 'up the chain' is important, we also never lose touch with the fact that numerous production, factory, marketing, trade show, and countless others that make this industry operate are impacted by our ability to succeed in this endeavor.

OBJECTIVES

- The attending salesperson will be able to distinguish the between the various Hazardous Location ratings as defined in the National Electrical Code (NEC) Articles 500-516

- The attending salesperson will be able to specify the correct hazardous location enclosure based on customer supplied requirements

- The attending salesperson will be able to specify the correct internal industrial equipment based on customer supplied requirements

    - The individual will be able to recite the basic functionality of available internal industrial equipment by attending a form/fit/function course taught by a Subject Matter Expert (SME) of each piece of equipment (Disconnects, Contactors, Fusing, Switching, Motor Starters – Magnetic or Manual or Reversing or Non-Reversing, and Breakers)

    - They will be able to formulate questions based on missing information to determine additional specifics of the customer supplied requirements

    - The student will determine an accurate part/catalog number of the needed electrical equipment based on a role-play real-world customer scenario with the SME

    - The individual will demonstrate basic functionality (on, off, start, and stop) of each piece of possible internal equipment with their own hands

    - Each student will install accessories for each piece of internal industrial equipment

    - Each attending will construct a basic electrical layout drawing showing functionality and electrical interconnects of the customer supplied project

- The attending salesperson will be able to specify the correct factory sealed panel boards based on customer supplied requirements

- The attending salesperson will be able to specify the correct existing pull-thru products based on customer supplied requirements

- The attending salesperson will be able to describe the manufacturing process of the hazardous location enclosures from raw materials to finished goods

- The attending salesperson will be able to produce an accurate template drawing of the enclosure's operators, wiring input/output, and hinge locations based on customer supplied requirements

PROPOSED CLASS SCHEDULE

	Monday 14-Nov	Tuesday 15-Nov	Wednesday 16-Nov	Thursday 17-Nov
7:30 AM		Breakfast (2nd Floor Training)	Breakfast (2nd Floor Training)	
8:00 AM		Introduction - Mark & Dave	Existing / Pull-Thru Products - Dave	
8:30 AM		Rigid / GUB Boxes & Ocal Bogdan & Ice		
9:00 AM			Strategy & Goto Market - Dan	Meet & Drive to Factory
9:30 AM				
10:00 AM	Travel to Corp Office	Disconnects - Willington	Catalog & Order Process - Mark	
10:30 AM		Words from Sully		
11:00 AM		Disconnects (cont)		Presentation & Tour by Magellan
11:30 AM				
12:00 PM		Lunch (in room)	Lunch (on your own)	
12:30 PM				
1:00 PM		Circuit Breakers - Belshe		
1:30 PM				
2:00 PM			Travel to Factory	
2:30 PM				
3:00 PM	HazLoc Standards (4 West Inside) -Optional-	Motor Starters - Lovell		
3:30 PM				
4:00 PM				
4:30 PM				
5:00 PM				
5:30 PM				
6:00 PM	Dinner (Hickory Tavern) Some Place Somewhere 123 Mockingbird Lane Collierville, TN 38017	Dinner (Firebirds) Some Place Somewhere 123 Mockingbird Lane Collierville, TN 38017		Dinner (Der Braumeister) Another Place 911 Wonderland Ave Miami, XX 44411
6:30 PM				
7:00 PM				
7:30 PM				
8:00 PM				

INDIVIDUAL CLASS DESCRIPTIONS

Class Name: HazLoc Standards (optional)
Class Instructor(s): David Simmons – Product Marketing Manager & Gregg Steinman – UL Corporate Coordinator
Description: A presentation (which then walks through the UL HazLoc Poster) explaining the National Electrical Manufacturers Association (NEMA) Article 500+ code which classifies hazardous locations according to the properties of the flammable vapors, liquids or gases, or according to the combustible dusts or fibers which may be present and the likelihood that a flammable or combustible concentration or quantity is present. Followed by a group open discussion for Q&A and to assess if the students can determine the three major locations based on criteria.

Class Name: Rigid / GUB Boxes & Ocal
Class Instructor(s): Bogdan Diadnoid – Product Marketing & Jeff Ice – Application Engineer
Description: A Form/Fit/Function presentation of electrical Rigid / GUB Boxes & Ocal components to help the student understand how they individually operate (function), what wiring is needed, what accessories could be added, how this device interoperates within a complete electrical system, and what questions to ask potential customers so that you can correctly identify the part # and supply what the customer is looking for. You will be presented with current marketing material locations, catalogs, part number configurators, and various sales videos that may aid in understanding.

Class Name: Disconnects
Class Instructor(s): Wellington Rodrigues – Product Marketing Manager
Description: A Form/Fit/Function presentation of electrical Fusible / Non-fusible Disconnects, Switches, & Contactors to help the student understand how they individually operate (function), what wiring is needed, what accessories could be added, how this device interoperates within a complete electrical system, and what questions to ask potential customers so that you can correctly identify the part # and supply what the customer is looking for. You will be presented with current marketing material locations, catalogs, part number configurators, and various sales videos that may aid in understanding.

Class Name: Circuit Breakers
Class Instructor(s): John Belshe – Product Marketing Manager
Description: A Form/Fit/Function presentation of electrical Circuit Breakers to help the student understand how they individually operate (function), what wiring is needed, what accessories could be added, how this device interoperates within a complete electrical system, and what questions to ask potential customers so that you can correctly identify the part # and supply what the customer is looking for. You will be presented with current marketing material locations, catalogs, part number configurators, and various sales videos that may aid in understanding.

Class Name: Motor Starters
Class Instructor(s): Chris Lovell – Product Marketing Manager
Description: A Form/Fit/Function presentation of electrical Motor Starters (including manual, magnetic, reversing, and non-reversing) to help the student understand how they individually operate (function), what wiring is needed, what accessories could be added, how this device interoperates within a complete electrical system, and what questions to ask potential customers so that you can correctly identify the part # and supply what the customer is looking for. You will be presented with current

marketing material locations, catalogs, part number configurators, and various sales videos that may aid in understanding.

Class Name: Existing / Pull-Thru Products
Class Instructor(s): David Simmons, P.E. – Product Marketing Manager
Description: A Form/Fit/Function presentation of our stand-alone products that are usually used in conjunction with other Hazardous Location products to help the student understand how they individually operate (function), what wiring is needed, what accessories could be added, how this device interoperates within a complete electrical system, and what questions to ask potential customers so that you can correctly identify the part # and supply what the customer is looking for. You will be presented with current marketing material locations, catalogs, part number configurators, and various sales videos that may aid in understanding.

Class Name: Strategy & Go to Market
Class Instructor(s): Dan Michalis – Lead Product Marketing Manager
Description: A round-table / open discussion about what our current product & market strategy looks like along with expectations (from the field, factory, and marketing team) will be discussed. A brief overview of involvement for the next six months and the tools we are going to be implementing for team collaboration and communication will be presented.

Class Name: Catalog & Order Entry Process
Class Instructor(s): Mark Novak – Global Product Marketing Manager
Description: An essential marketing tool to detail the various products with the T&B EX line will be the catalog. It will contain the 'base' part numbers and show the extents of the manufacturing capabilities from a sizing standpoint and will also include templates detailing how many & where customizations can be made to the enclosures (holes for operators, entrance / exit holes for wiring, visual windows for non-opening inspection of internal equipment, etc). This class will review section by section of our proposed catalog and solicit feedback from the class about content, layout, and possible ways to optimize the material presented. A detailed run-thru of how orders will be entered (for both the 'basic product' with standardized part #s & custom configurations which will entail a 'back-n-forth' of proposal drawings needing review & signing). A presentation of the 'who' will also be given so that the student will understand the correct person to contact for initial orders, expedited shipping, returns/damage issues, etc.

Class Name: Factory Presentation & Tour
Class Instructor(s): Matthew McGulliney – Marketing & Stan Poulinton – Factory Floor Manager
Description: This will be a special opportunity to witness the creation of the Hazardous Location enclosures from raw materials to finished-goods. The specialized molding and castings will be viewed along with the various attention to detail that the factory employees use to create the products will be witnessed firsthand. The team will also be able to view first-hand the customization process and become familiar with the attention-to-detail even down to the shipping pallet / materials being used in shipping.

Facilitator Guide

This section will detail for the facilitator the various 'behind the scenes' information necessary to make the coursework successful. Please familiarize yourself with the entirely of this learning material and start searching early for the necessary Subject Matter Experts (SMEs) necessary to bring the 'material to life' passing onto them:

- the objectives for the courses
- the extent of their product offering that will be included with the T&B EX product offering (typically <400A)
- the expectation for them to bring/provide the class with all of the necessary handouts, materials, product configurators, catalogs, etc that will enable the students' success now in learning and for future reference

- the need to bring demo equipment to increase familiarity and perform 'hands-on' operation and installation of accessories
- the style of assessment & evaluation use that will be a Role-Play between them and the students of Real-World customer requests for equipment (leaving some pertinent information out so that can become familiar with the types of formatives questions they will need to generate & ask of the customer) in order for them to determine accurate part numbers to fulfill the customer needs.

Remember that this three-day training course will include not only the necessary technical information about products, ways of inter-connecting the products, the technical standards that the equipment is designed to work in, but also include times of 'team-building' to build a sense of unity amongst the group. When planning your time with the team, it is also important to communicate beforehand all aspects the 'visiting students' might have from a logistical standpoint – such as transportation, appropriate dress (and or needed equipment like safety glasses and/or steel-toed shoes), and location address' for those that are independently traveling or coordinating meetings outside of just the training times.

Listed in the Course Materialization section is a sample Training Schedule you might consider in which we're providing material so that the student can better understand the specific products but also how we will move forward with planning & strategy as a group.

All of the classes will probably be taught with an instructor utilizing some sort of visual (which is typically PowerPoint) and providing information relating to that visual (while not necessarily the most effective – it has become 'the norm' for Corporate Training). Feel free to include various aspects of Adult Learning Techniques into the class that will enhance student engagement & learning retention. As an example of a typical class, I've included the actual verbiage to be used for the optional Hazardous Locations Standards course (listed below in the INSTRUCTIONAL CONTENT & ASSESSMENT sub-section) and the evaluation to be used to determine if learning transfer has occurred. You will find the additional materials (the PowerPoint & HazLoc Poster) in the 'Sample Content' section of this coursework.

In the 'Learning Assessment & Evaluations' section, you will find LEARNER ASSESSMENT & FORMATIVE EVALUATION – PRECLASS EVENT & SUMMATIVE EVALUATION to be used with the students. At the end of this Facilitator's Guide – you will find an appendix which repeats the questions and provides a visual of how student answers may appear & be summated. You'll also find commentary / reflection of how to interpret the results and take-into-action for the courses before, during, & for future course-times.

<u>During the time – please remember that:</u>

- We're having specialists within the company take time to help build any product knowledge gaps that the students might have and interrelate how their products will work to fill customer requests for enclosures.

- Be sure to communicate what dress type should be expected (and if steel-toed shoes are needed for the factory visit). It could be stated, "Dress will be business casual (except for those only going to the first evening dinner – which is jeans)"

- The students will be provided with various catalogs & sales materials. If they don't have room in luggage – remember to communicate and arrange shipping back to their home address' if/as needed

- Be sure to scout the areas for training & dinners to highlight other important locations that students may want to visit on your own (and possibly some 'danger' areas they might want to avoid)

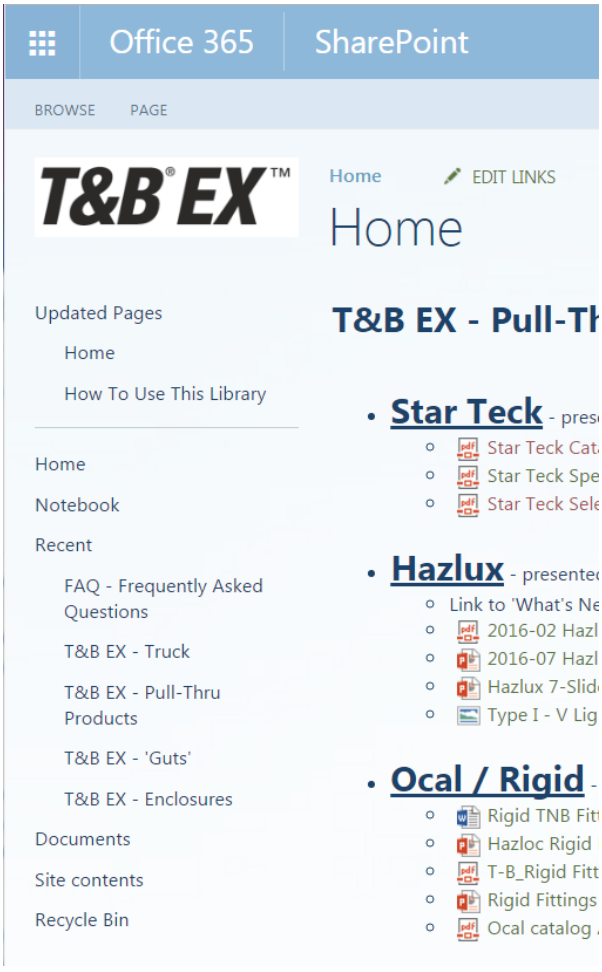
- Include information if/when taxi transportation maybe be necessary to highlight from the airport to your hotel and afterwards if there will be hotel shuttles or arranged vehicles to get everyone around. Include information about needing a rental car if they are staying at non-listed hotels.

FOLLOW-UP / NEEDED MATERIALS

This course-work will include numerous 'factual/data' reference type documents that the students will need access to but should not be covered in-depth within the course-time (for fear of 'losing' the group). This feeds back to the mindset of car selling, "Do you need to know how an engine works or just the keys, gas, and brakes"? This area should have a Wiki mindset in which multiple people could edit/update/upload/etc the content.

For more information:

> **What is a wiki library?**
>
> *Wikiwiki* means quick in Hawaiian. A wiki library is a document library in which users can easily edit any page. The library grows organically by linking existing pages together or by creating links to new pages. If a user finds a link to an uncreated page, he or she can follow the link and create the page.
>
> In business environments, a wiki library provides a low-maintenance way to record knowledge. Information that is usually traded in e-mail messages, gleaned from hallway conversations, or written on paper can instead be recorded in a wiki library, in context with similar knowledge.
>
> Other example uses of wiki libraries include brainstorming ideas, collaborating on designs, creating an instruction guide, gathering data from the field, tracking call center knowledge, and building an encyclopedia of knowledge. (Microsoft, 2016 Office 365 SharePoint Wiki App)



An example of this type of tool is Office 365 SharePoint tool in which the following attributes are used:

- Continuous 24/7 access via the internet for everyone involved
- Include ways to easily access reference, presentation, catalog, and configurator tools
- Consider adding a Frequently Asked Questions (FAQ) area so when an issue comes up with a single person; they can share with the group such that the community knowledge level increases

INSTRUCTIONAL CONTENT & ASSESSMENT

FULL INSTRUCTIONAL CONTENT – HAZLOC STANDARDS (OPTIONAL)

To begin this three days of intense product training, it is essential for all of the students to have a very thorough understanding of the industry standards that govern the use, specialty, and requirements necessary for the equipment, personnel, and day-to-day expectations these dangerous Hazardous Locations. While most of the students may already have this experience from previous work with similar electrical products – you should offer a 'refresher' course which lays the foundation for those new (and those who might have forgotten). A knowledge of these standards will help the students to better understand the nomenclature spoken amongst industry professionals, the need for the product differentiation from more basic / commodity type equipment, and will help raise awareness of the dangers in this industry and how to safely operate equipment in them.

The materials used in this course are located in the 'Sample Content' section under the 'Hazardous Location Industry Standards' section with the components:

- PowerPoint presentation
- a 'take home' for further study/reinforcement document/poster entitled, "UL HazLoc Poster 2016 v4"

The details/discussion of each of the presentation slides is given below:

1. The standards give customers, engineers, equipment manufacturers, operators a 'level playing field' of knowledge in-which to operate their industry safely. For Hazardous Locations, those are found in the National Electrical Code (NEC) Articles 500 (specifically 501-516)

2. These Articles detail three different areas in which people/equipment must operate and differentiated by the designations "Class 1 (in which there could be dangerous/explosive opportunities due to Gases, Vapors, and Liquids), Class 2 (in which dusts could mix with air creating a very fast burning/explosive mix), and Class 3 (areas that could have floating fibers and flyings like those found in textile, paper production, carpet manufacturing). Each will be detailed in the following slides.

3. Class 1 areas (in which there could exist flammable Gases, Vapors, and Liquids) are common in petroleum refining, Wastewater treatment (chlorine, fluorine, and methane), and paint booth areas (due to the chemicals in the paint). All of these areas could have electrical equipment within them that could spark or heat up causing a flame which would then cause a chain-reaction & possibly an explosion. Our goal is to supply equipment to safely operate in these areas that will not interact with the environment from a spark/heat standpoint).

4. Class 2 areas are those that contain dusts. While dust may sound fairly safe, we have all heard of stories in which the grain silos exploded. Remember that it wasn't the grain – but instead the air-borne dust that quickly burns that could cause the explosion. We also find coal/metals dusts in power generation along with pharmaceutical & food production areas.

5. Class 3 areas (which are not as prevalent in the United States as much anymore) are those areas in which small fibers would float in the air (which would be quick burning and could cause an explosion).

6. Time for a test! With these three areas being shown & the equipment being designed to operate in those areas, a question arises which could be, "If I have a Class 2 required product in this area – will a Class 1 suffice or supersede the base requirements"? This should really get the students thinking because their 'gut' wants to believe that the Class 1 areas are the 'most dangerous' therefore they should be 'king'. After giving them time to squirm and internally wrestle with the question – state that "Any explosion is dangerous / deadly" and one area is NOT more dangerous than another. Also, remember that per the standards equipment is required to be tested per that specific area. How a piece of equipment 'breathes', its wiring, wash-down, etc are all different per each area and MUST be tested (and pass) per the specific requirements of the customer's hazardous location. BUT there is some help in that most equipment is multi-class rated – it has been designed, built, and tested to operate in Class 2 AND Class 3 areas. But you must ensure that the catalog specifically lists as compliant the area listed in the customer specifications (no assumptions in this business).

7. When discussing 'Classes' you'll also always hear the additional phrase, "Division 1 or Division 2". These define if the hazard is 'Always Present' (and therefore a constant threat) or 'Maybe Present' (which means that is it not-normally present and only through some mishap will the hazard be present). While it might seem diminutive between the two – the Division 1 product is typically twice as heavy (and subsequently twice as expensive) as a Division 2 product. It is very important to understand from the customer the required Class and Division specifications before recommending ANY products. Additional, you might hear a customer discussing a 'Group Requirement'. This means they need to specify the actual gas/vapor/dust to ensure testing/compliance for. The A & B gases have a tougher equipment requirement/testing than the C & D gases (so, often if they are including it means they are looking for the tougher builds). While it is not important that you memorize the specifics of each group – understanding the generalities will help you be more comfortable in discussions about these products with customers.

8. Whereas the earlier slides deal with all HazLoc type products, some products will have additional ratings based on the fact that they product heat and in doing so, must detail their 'hottest spot' on their product. This knowledge is very important because you may be operating in an environment with a gas that has a low 'auto-ignition' temperature and while you may have met the proper Class, Division, and Group; the equipment may run hot enough to auto-ignite the gas. This information is displayed as 'T-Ratings'. Say you have a motor, transformer, or lighting fixture that has a T-Rating of T2. That means that the 'hottest spot' on that fixture could reach 300C so the operational gases in that environment must not auto-ignite at a temperature much higher.

9. & 10. Due to the fact that the above presentation on standards can be a bit over-whelming for a new-comer (and as an always needed in this industry, a double-check) we have detailed the Four Step selection method for a piece of electrical equipment.
    a. Understand the customer's requirements from a Class, Division, and Group standpoint. Select a fixture that meets & shows that it has been tested to meet those specific entries.
    b. Consult the catalog of the equipment and determine the manufacturer's listed T-Rating expected in operation.
    c. Consult the listed standards/charts for the gas/dust/material and locate its auto-ignition temperature
    d. Compare those temperatures vs. T-Rating to ensure that the auto-ignition temperature is will outside of the equipment T-Rating temperature based on tolerances set by the local inspectors or end-user, whichever is more stringent.

At this point it is time to determine if learning transfer has occurred with the students. I would suggest Role-Playing with the students (which will mimic the real-world skills they will need to work in this field, be compliant with standards, and successfully suggest the correct equipment for the customer to operate safely. Have the students refer to the above mentioned UL-Poster and pose the following questions/assessments:

Real-World Example - Question 1: "We are working with a company that launches rockets – their fueling area fills the rockets with hydrogen. What are the Class, Division, and Grouping for this area?"

Missing Information: none

Answer: This is a trick question. Remember that over and over we (as product manufacturing) do NOT specify what the Hazardous Location should be (we should/could have a general idea) but it is incumbent upon the customer to supply that information (which typically is supplied by their engineering design group and/or insurance group). We (product suppliers) are not licensed or have liability insurance to answer this question. Now, with that out of the way – what do you *think* the customer will answer? The area is probably going to be Class I, Division 2 (remember that the gas is NOT always present – only there when refueling), Group B

Real-World Example - Question 2: "I need to hang a light over some areas of my manufacturing that makes Butane. According NFPA497M, the gas is Group D and auto-ignites as 550°F. What lighting would you recommend? "

Missing Information: The customer hasn't listed the lumen requirements for the area and also hasn't listed mounting height, ceiling reflectance, color temperature required, or preferred lighting technology (incandescent, fluorescent, High-Intensity Discharge, LED, etc). To not become too off-target, respond with, "My engineers say that I need Class I, Div 2 fixture that is equal to a 400W Metal-Halide lighting".

Answer: Ok – we now refer to the Four-Step method discussed in the presentation:

1. Customer requirement is: Class I, Div 2, Group D
2. My Hazlux catalog (which the seasoned sales guys will already have) shows that the LED equal to a 400W Metal-Halide is a DL015 (which does show it is compliant with Class I, Div 2, Group D) and has a T-Rating of T4 (with a 40 ˚C ambient).

3. The customer has told us that NFPA497M lists his specific Gas (Butane) as auto-igniting at 550°F. The tricky part is that the T-Ratings tables only show ˚C so converting 550°F to degree Celsius yields 288 ˚C.
4. Since T4 (which has a maximum hotspot of 135˚C) is well below the auto-ignition temperature of 288˚C, then the DL015 Series fixture can be recommended.

COMPLETE LEARNING ASSESSMENT – DISCONNECTS

This learning assessment will be typical of the various 'Internal Equipment' classes and represents one of the most basic/easiest electrical products to understand; the Disconnect. After a detailed presentation discussing the basic operation of the disconnect, how it used within Real-World examples, the numerous accessories that can included to expand functionality, shown access to where catalogs and online selling guides and product configurators are located, the facilitator or SME should list the details of the proper 'Selection Parameters' for this product – which are:

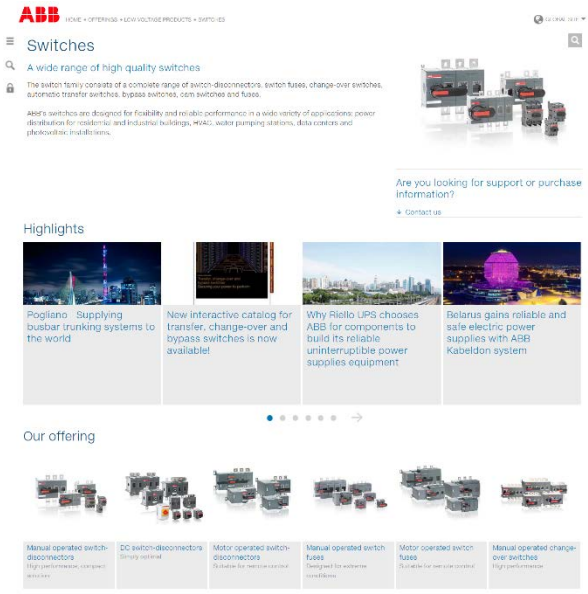


Figure 4 Sample Online Area detailing Variety of Products Available

- UL Standard required (UL98, UL508, etc)
- Fusible or Non-fusible
- Voltage and whether AC or DC
- Ampacity
- Number of poles (2, 3, 4, 5, 8)
- If motor, HP and/or FLA
- For shaft and handle:
  - NEMA class (NEMA 1, 12, 3R, 4, 4X SS)
  - Panel depth
- If enclosed, NEMA Class and enclosure material (plastic, metal sheet, SS)
- For OTDC – Solar Switches – Grounded or non-grounded (OTDC_US_ or OTDCU_)

The SME will now role-play with the students these two Real-World examples (conveniently leaving some necessary information out so that the students will have to formulate what information is missing and ask the proper questions) and request from the students to determine the correct part # to sell to meet the customer's requirements.

Real-World Example – Question 1: "I have a downstream motor that I need to control manually but also have fused protection……but no exposed switch – because I'm putting it into an already existing enclosure."

Missing Information: 3-phase motor 480VAC, 30HP

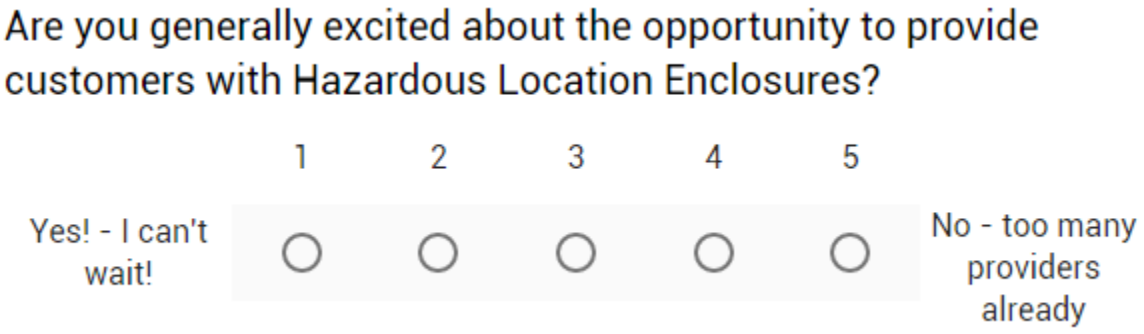
Answer: OS60GJ12

Real-World Example – Question 2: "I've changed my mind and would like a flange switch & can I get 'CC' type fusing?"

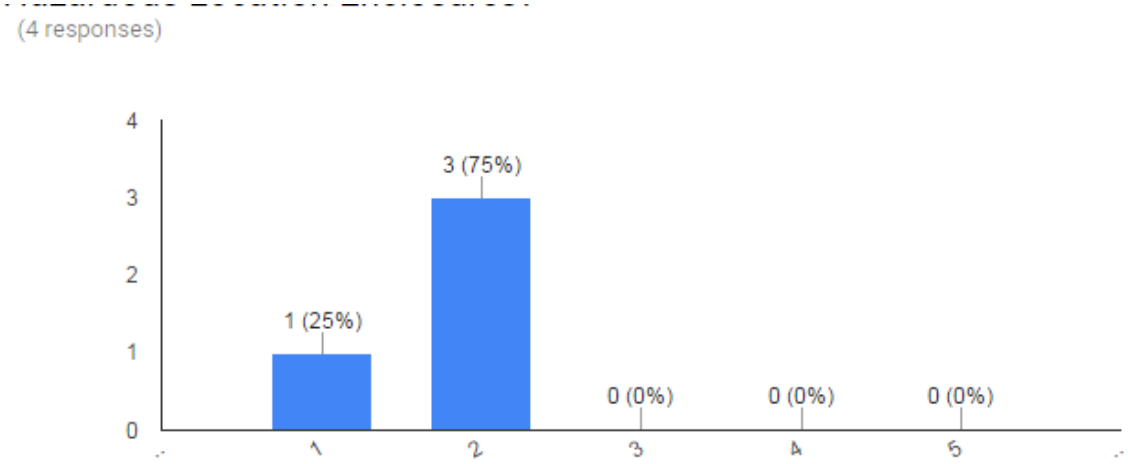
Missing Information: NEMA 4X type handle, cable length 60"

Answer: OS60GJ30 (fusible disconnect) + DSFHN-HS4 (handle) + OXC1L60 (flexible cables) + MKCS4 (operating mechanism). And 'No' on the fusing as that size is only available with 'J' fuse types.

APPENDIX – BEFORE QUESTIONS / RATIONALE / AUDIENCE RESPONSES EXAMPLE



1.



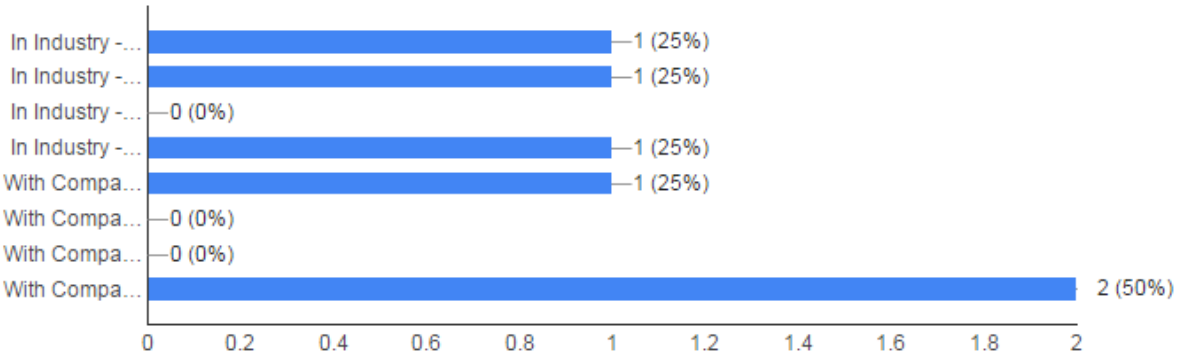
With the majority being positive, I believe that this will set a 'general mindset' throughout the rest of the questions and helps me to understand that audience is fairly excited about the learning opportunity.

How long have you been in the electrical products industry (in some capacity) & how long have you worked for T&B / ABB? (choose two boxes)

- [ ] In Industry - 0 to 5 years
- [ ] In Industry - 6 to 10 years
- [ ] In Industry - 11 to 15 years
- [ ] In Industry - 16+ years
- [ ] With Company - 0 to 5 years
- [ ] With Company - 6 to 10 years
- [ ] With Company - 11 to 15 years
- [ ] With Company - 16+ years

2.

(4 responses)

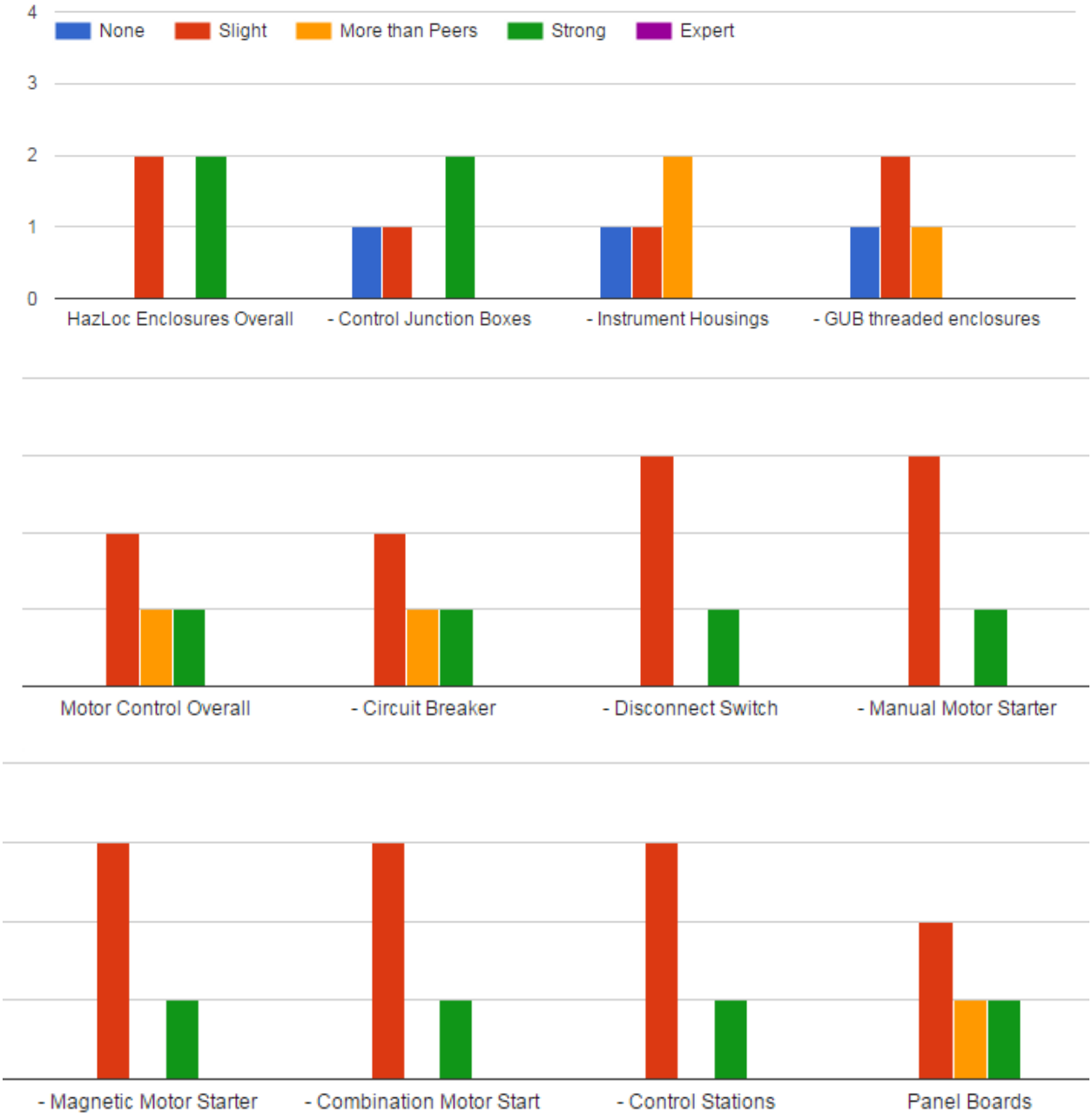


The audience has a reported wide variety of experience 'in the field' but longer experience 'With our Company'. It is my belief that this question (requiring two answers) was misunderstood by the audience as I would expect more 'experience in the industry' (as time with 'our company' should be a subset of the 'industry experience') which the data shown doesn't correlate properly (and was not answered by everyone).

What is your current understanding of: *

	None	Slight	More than Peers	Strong	Expert
HazLoc Enclosures Overall	○	○	○	○	○
- Control Junction Boxes	○	○	○	○	○
- Instrument Housings	○	○	○	○	○
- GUB threaded enclosures	○	○	○	○	○
Motor Control Overall	○	○	○	○	○
- Circuit Breaker	○	○	○	○	○
- Disconnect Switch	○	○	○	○	○
- Manual Motor Starter	○	○	○	○	○
- Magnetic Motor Starter	○	○	○	○	○
- Combination Motor Start	○	○	○	○	○
- Control Stations	○	○	○	○	○
Panel Boards	○	○	○	○	○

3.



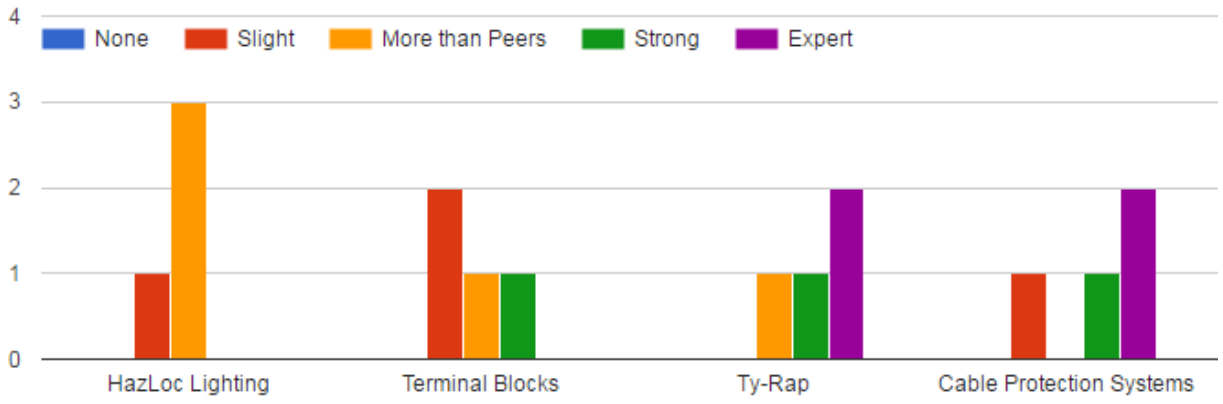
While I understand that the specifics of this question will contain industry specific terminology – the 'take away' from this is that I have a variety of students rate themselves on the range of 'none/slight to more-than-peers/strong'. This means to me that it will be very important to have open, group discussions to help the classmates determine who is their own 'internal champion' of that specific information. This also 'sets the bar' as a BEFORE measurement which I can balance with an AFTER analysis to determine if they have experienced a learning experience and no-long feel ignorant of the information.

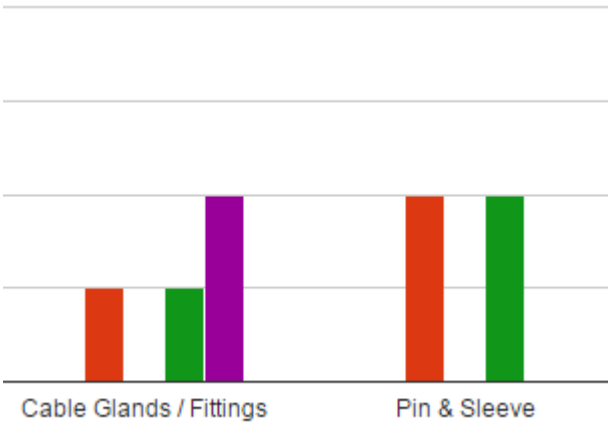
It is also important to note that all four of the participants answered each and every sub-section of this question. I believe they understand and are gearing up for what is going to be taught.

What is your current understanding of: *

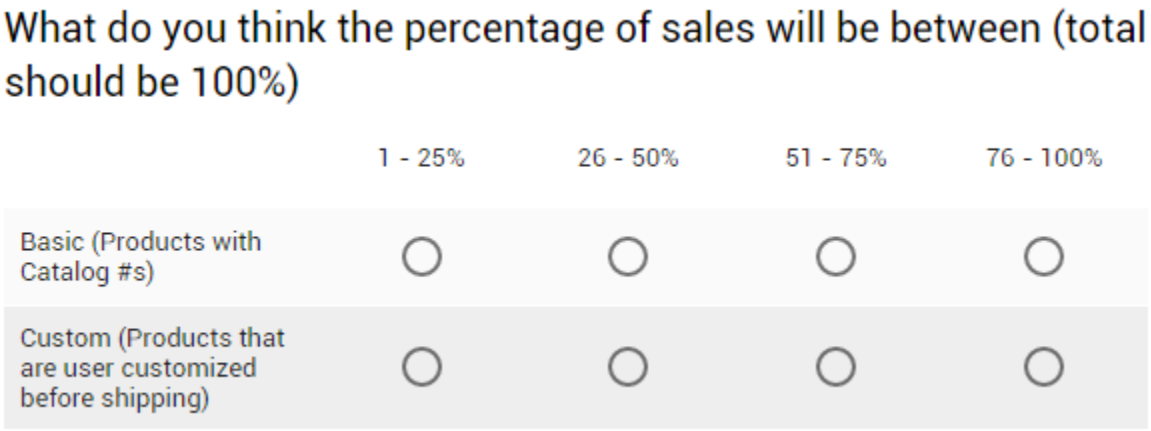
	None	Slight	More than Peers	Strong	Expert
HazLoc Lighting	○	○	○	○	○
Terminal Blocks	○	○	○	○	○
Ty-Rap	○	○	○	○	○
Cable Protection Systems	○	○	○	○	○
Cable Glands / Fittings	○	○	○	○	○
Pin & Sleeve	○	○	○	○	○

4.

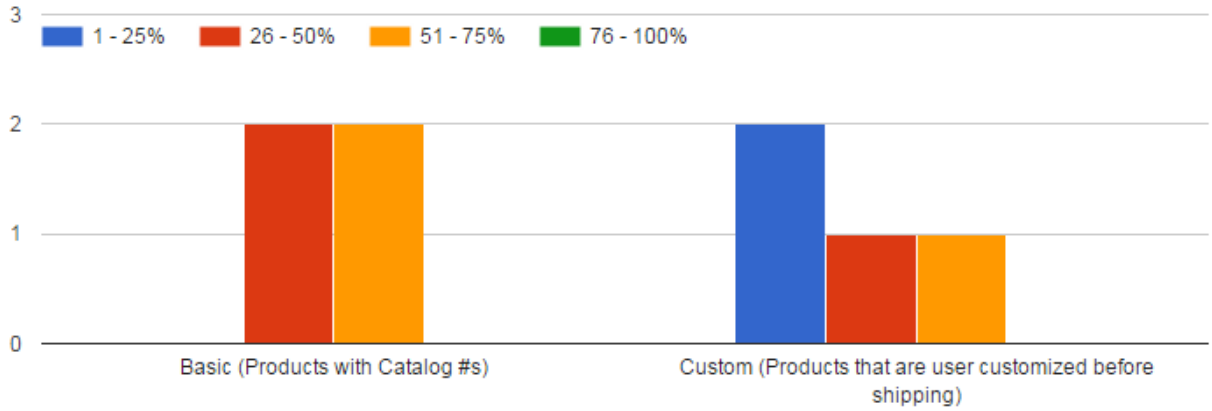




Whereas this might appear to be similar to Question 3 (with a lot of industry jargon), the difference is that these are products that they should be a bit more familiar with as they are ones currently available for them to sell. It shows me which I will probably need a SME to teach (for example the 'HazLoc Lighting') and which ones that fellow-classmates could teach. It is my hope that by their own classmates teaching they will build a tighter sense of 'team' and community with each other and determine whom are the 'go to' people for them.



5.

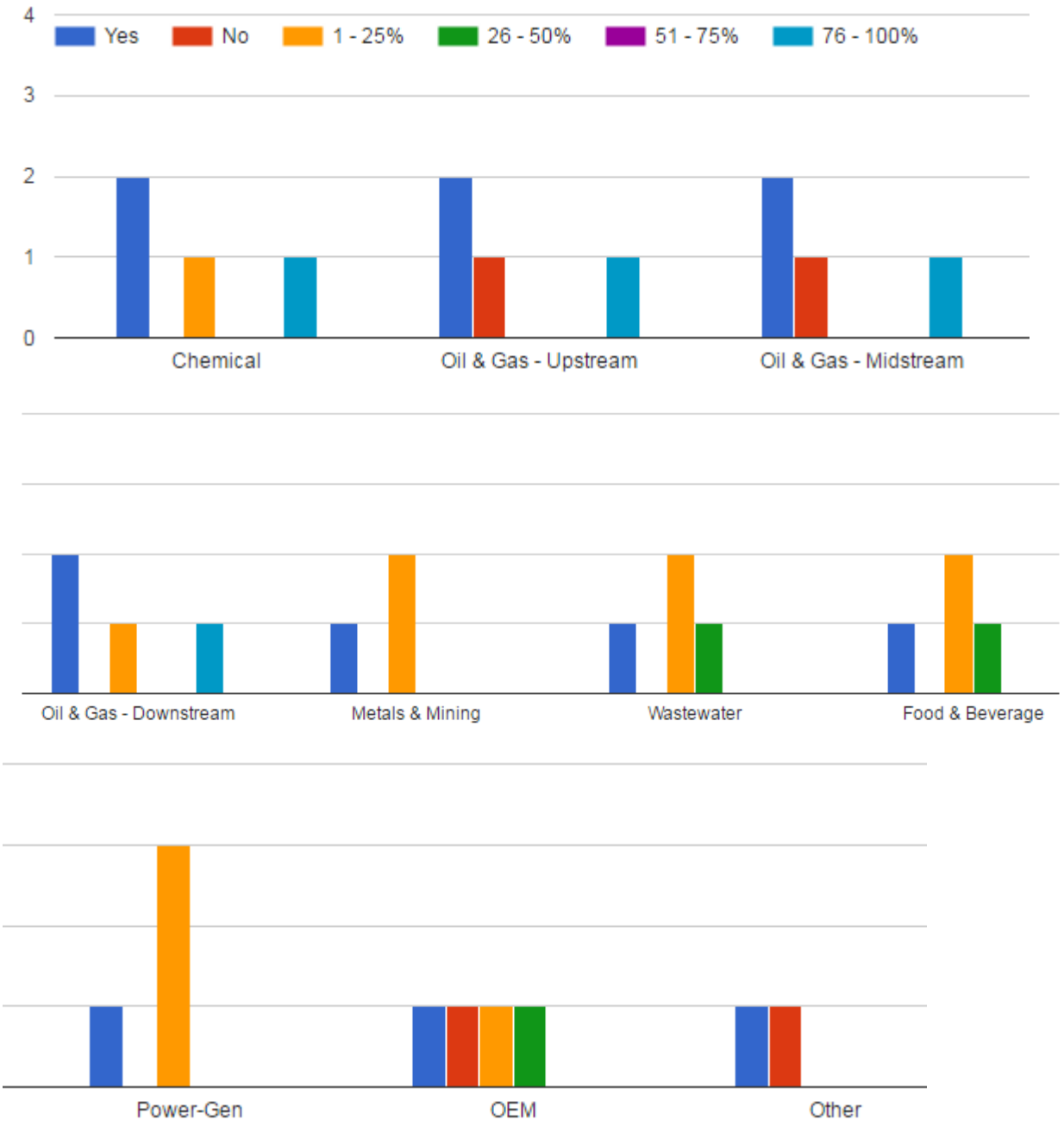


This question is a bit of a 'trick' question (as I believe it was probably a total guess by the audience) and that there is no 'right or wrong' answer. It will be interesting to see how this perception shifts (or maybe it won't!) after their expert training.

What Vertical Markets have you worked with & What percentage do you think we will have success selling into?(two questions squished into one)

	Yes	No	1 - 25%	26 - 50%	51 - 75%	76 - 100%
Chemical	○	○	○	○	○	○
Oil & Gas - Upstream	○	○	○	○	○	○
Oil & Gas - Midstream	○	○	○	○	○	○
Oil & Gas - Downstream	○	○	○	○	○	○
Metals & Mining	○	○	○	○	○	○
Wastewater	○	○	○	○	○	○
Food & Beverage	○	○	○	○	○	○
Power-Gen	○	○	○	○	○	○
OEM	○	○	○	○	○	○
Other	○	○	○	○	○	○

6.



This question (which is hoping for two answers per line item) originally didn't allow for people to answer with 'multiple' answers. This was corrected after the message/note from the initial audience response which means that one of the four participants couldn't fully answer. Either way, it shows to me the breadth of experience and what customers that the team has experience with and where they believe initially sales success will come from. Similar to other questions – I believe this will be a 'class member' led portion of the learning experience due to the wide range of experiences of the team.

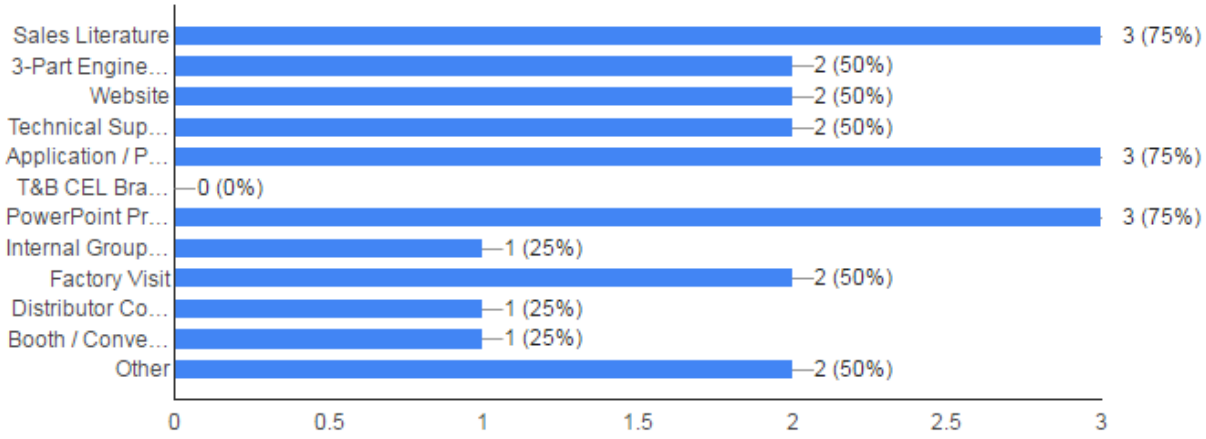
What is/are your best tool(s) for a successful sale (choose all that apply)

- ◯ Sales Literature
- ◯ 3-Part Engineering Specifications
- ◯ Website
- ◯ Technical Support
- ◯ Application / Product Video
- ◯ T&B CEL Branded Truck
- ◯ PowerPoint Presentation(s)
- ◯ Internal Group Training / WebEx / BrainShark
- ◯ Factory Visit
- ◯ Distributor Counter Day
- ◯ Booth / Conventions into key verticals
- ◯ Other : _____

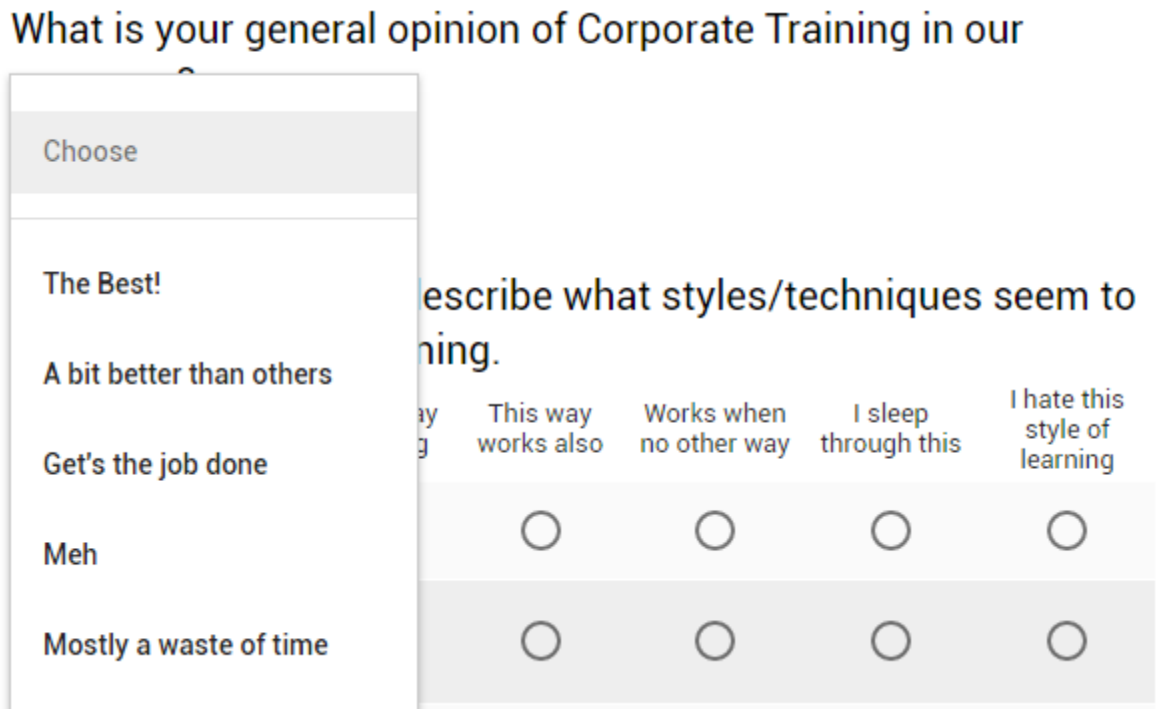
If you chose 'Other' above - please detail here

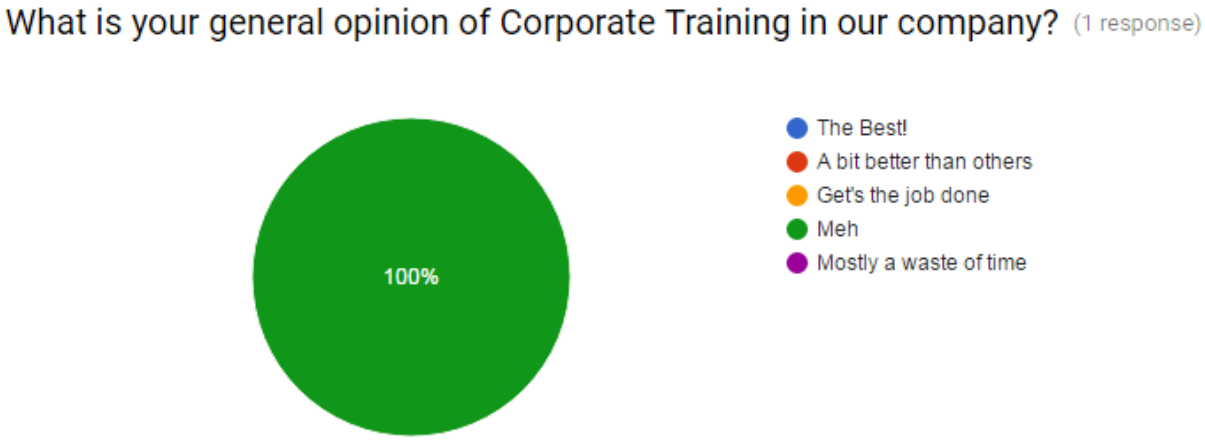
Your answer

7. _____ _____



These responses were very eye-opening upon analysis. While I did expect the majority would be chosen as a tool (specifically because they know they don't typically generate this material and has been expressed again and again by our sales team that they always need that 'one more piece of literature/testing/etc' that will allow them to complete the sale and/or dislodge the competitors in our customer's mindset. One shocking aspect of these results is that while most understand what each entry was – no one choose the 'T&B CEL Branded Truck' which is probably our most expensive item being produced and will require the most work to produce. We will need to have an open discussion while during our learning time to better understand why everyone answered this way or maybe I need to do a better 'sales job' to help them understand the value. Another interesting point is that while two of the four audience members chose 'Other' – only one responded with the answer "Hands on Demo Kit, can be small enough to travel with on airline" which will be totally impossible (and the direct need for an entire truck to move these heavy pieces around).

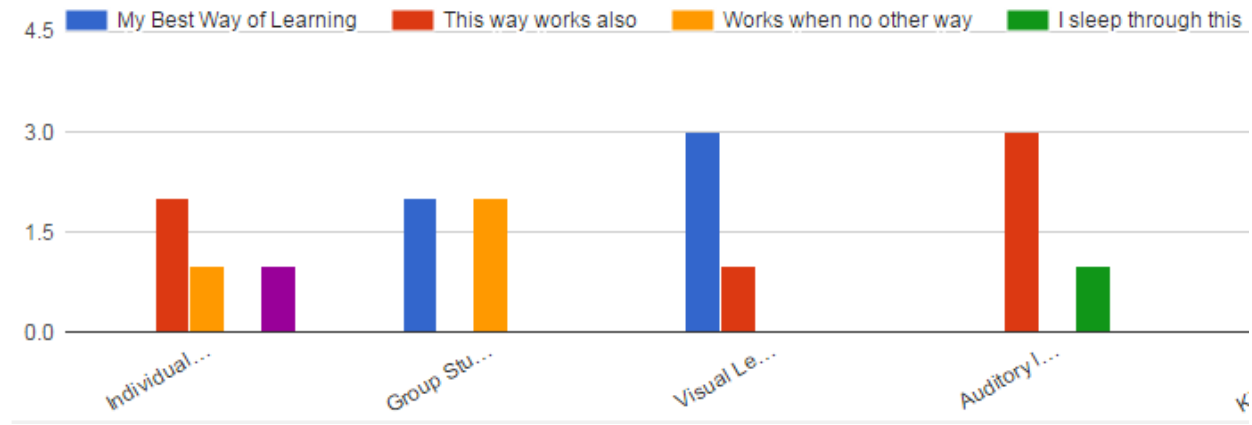
8. 

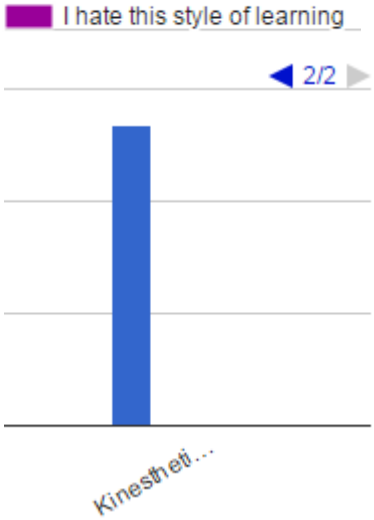


While it may not have 'been fair' to ask such a question, it was extremely interesting that while I know this group is fairly opinionated – they choose not to answer or 'throw someone under the bus' even though the Questionnaire header specifically stated that each entry was totally anonymous and would not be report to managers. Given the sensitive nature, I won't bring up when we're face-to-face.

9. Rank the following to describe what styles/techniques seem to work best for your learning.

	My Best Way of Learning	This way works also	Works when no other way	I sleep through this	I hate this style of learning
Individual Study (I teach myself)	○	○	○	○	○
Group Study (I can only learn when I'm with/in a group)	○	○	○	○	○
Visual Learning (need visual aids / sample drawings / charts / diagrams)	○	○	○	○	○
Auditory learning (lectures, discussion)	○	○	○	○	○
Kinesthetic learning (learn via experience - active demo, must see in real-world example, touch)	○	○	○	○	○

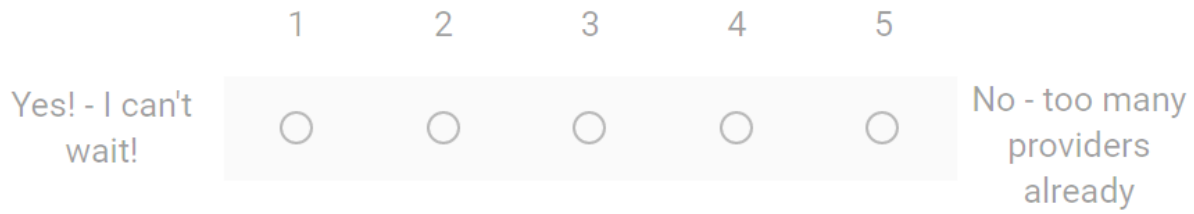




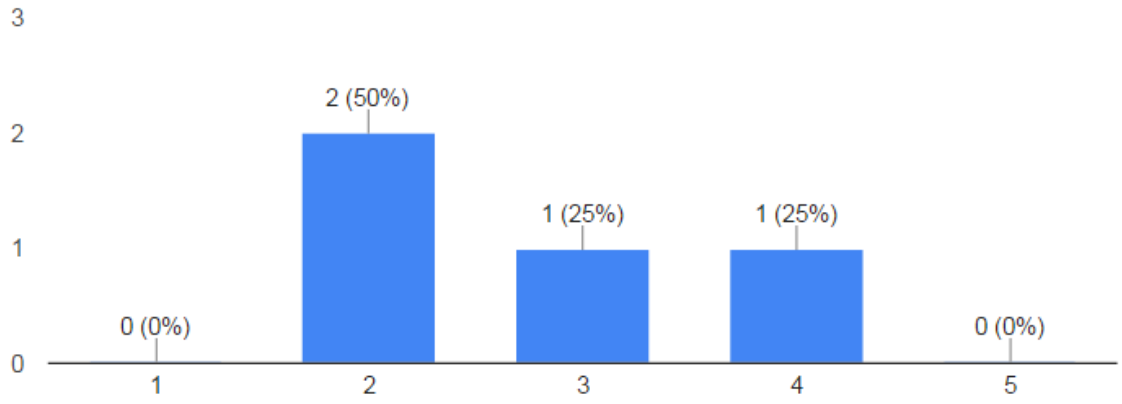
This question/response will probably help me the most when I'm discussing with the SME's what I'm hoping to accomplish and how I want their presentations of the material to be learned to be presented to the group. The responses show what I believe is centric to the modalities in which adults learn – we HAVE to move past just the typical lecture / power-point. This audience is looking for 'group study' with a 'Visual Learning Style' and must include (as all four answered as their 'Best Way of Learning') a hands-on demo/sample.

‘APPENDIX – AFTER QUESTIONS / RATIONALE / AUDIENCE RESPONSES EXAMPLES

After learning more about our product/offering, are you generally excited about the opportunity to provide customers with Hazardous Location Enclosures?



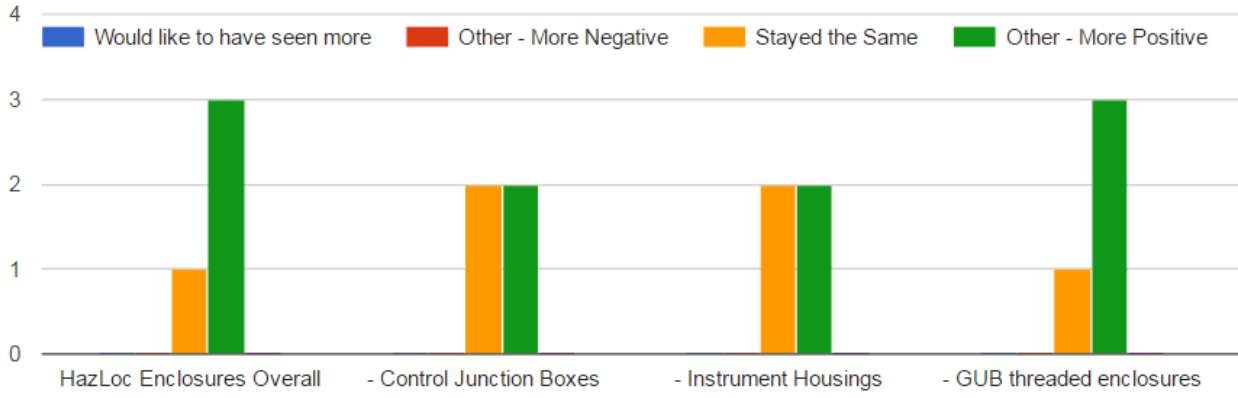
1. Kdkdkdk

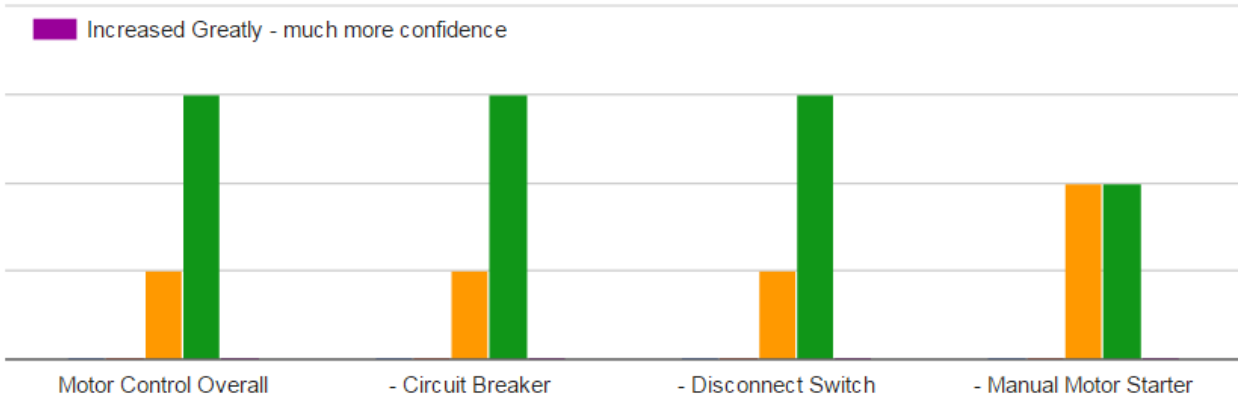


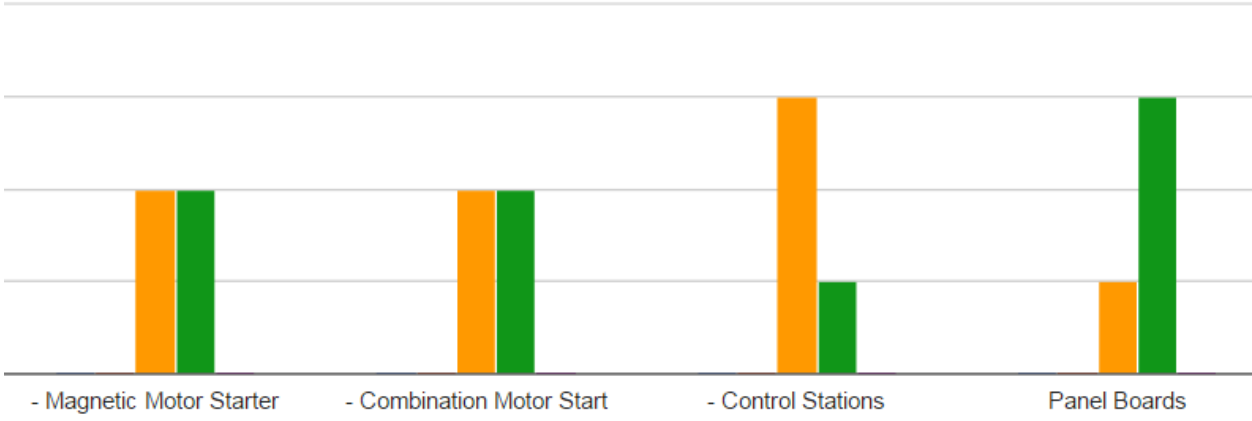
Please rate your understanding of the following afterwards: *

	Would like to have seen more	Other - More Negative	Stayed the Same	Other - More Positive	Increased Greatly - much more confidence
HazLoc Enclosures Overall	○	○	○	○	○
- Control Junction Boxes	○	○	○	○	○
- Instrument Housings	○	○	○	○	○
- GUB threaded enclosures	○	○	○	○	○
Motor Control Overall	○	○	○	○	○
- Circuit Breaker	○	○	○	○	○
- Disconnect Switch	○	○	○	○	○
- Manual Motor Starter	○	○	○	○	○
- Magnetic Motor Starter	○	○	○	○	○
- Combination Motor Start	○	○	○	○	○
- Control Stations	○	○	○	○	○
Panel Boards	○	○	○	○	○

2. Sdgfsdg


4
3
2
1
0
Would like to have seen more
Other - More Negative
Stayed the Same
Other - More Positive
HazLoc Enclosures Overall
- Control Junction Boxes
- Instrument Housings
- GUB threaded enclosures

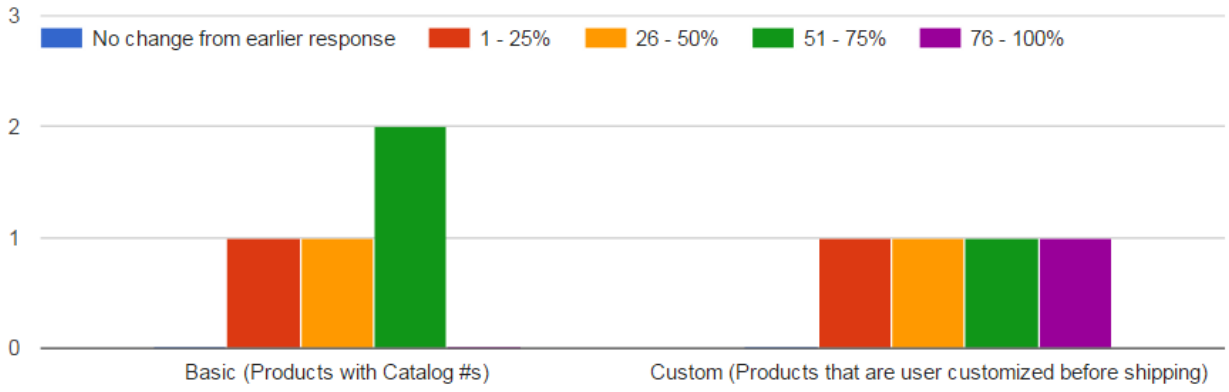

Increased Greatly - much more confidence
Motor Control Overall
- Circuit Breaker
- Disconnect Switch
- Manual Motor Starter


- Magnetic Motor Starter
- Combination Motor Start
- Control Stations
Panel Boards

After the training, do you think the percentage of sales will be between (total should be 100%)

	No change from earlier response	1 - 25%	26 - 50%	51 - 75%	76 - 100%
Basic (Products with Catalog #s)	○	○	○	○	○
Custom (Products that are user customized before shipping)	○	○	○	○	○

3.


3
2
1
0
No change from earlier response
1 - 25%
26 - 50%
51 - 75%
76 - 100%
Basic (Products with Catalog #s)
Custom (Products that are user customized before shipping)

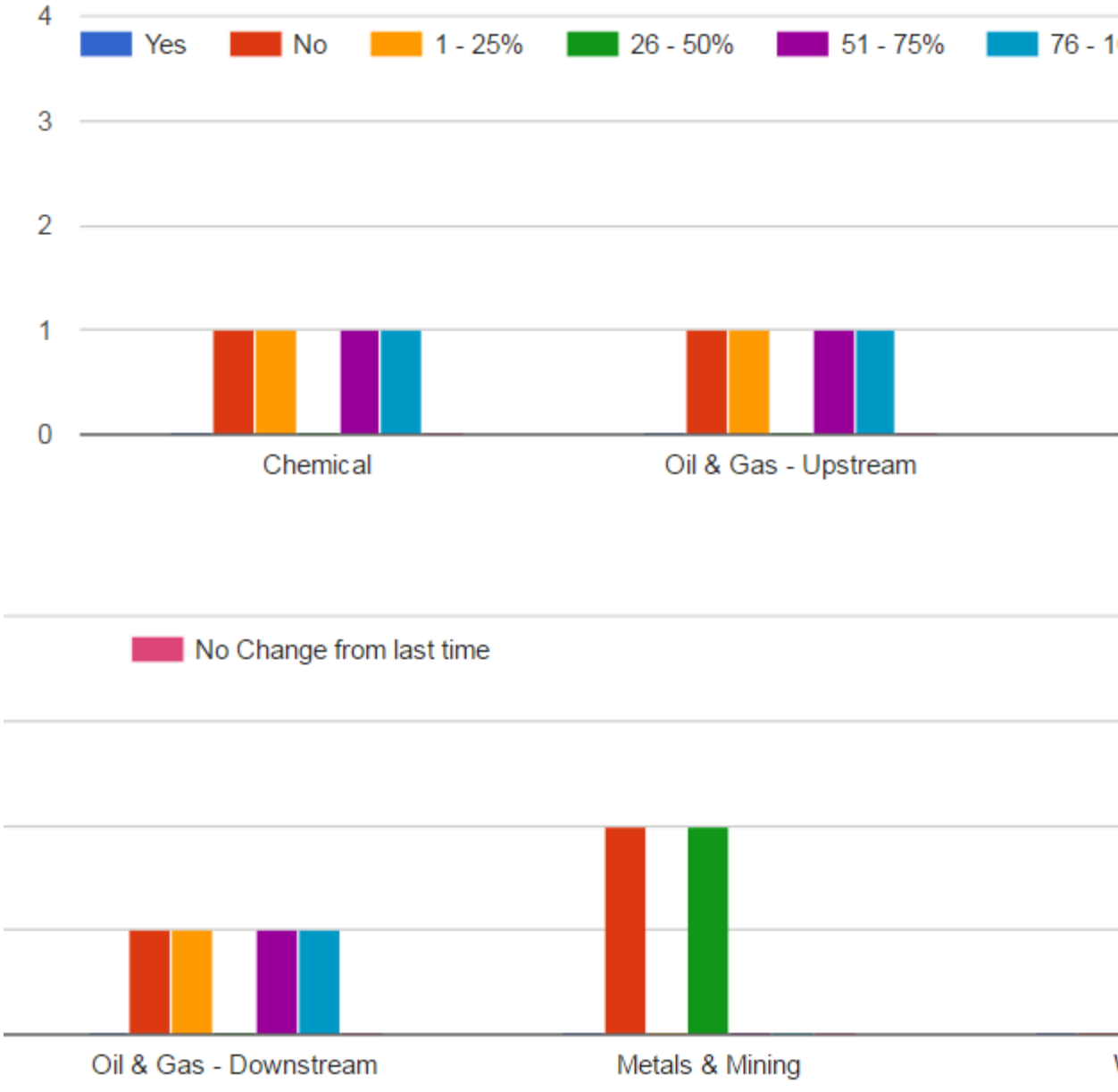
What Vertical Markets have you worked with & What percentage do you think we will have success selling into?(two questions squished into one)

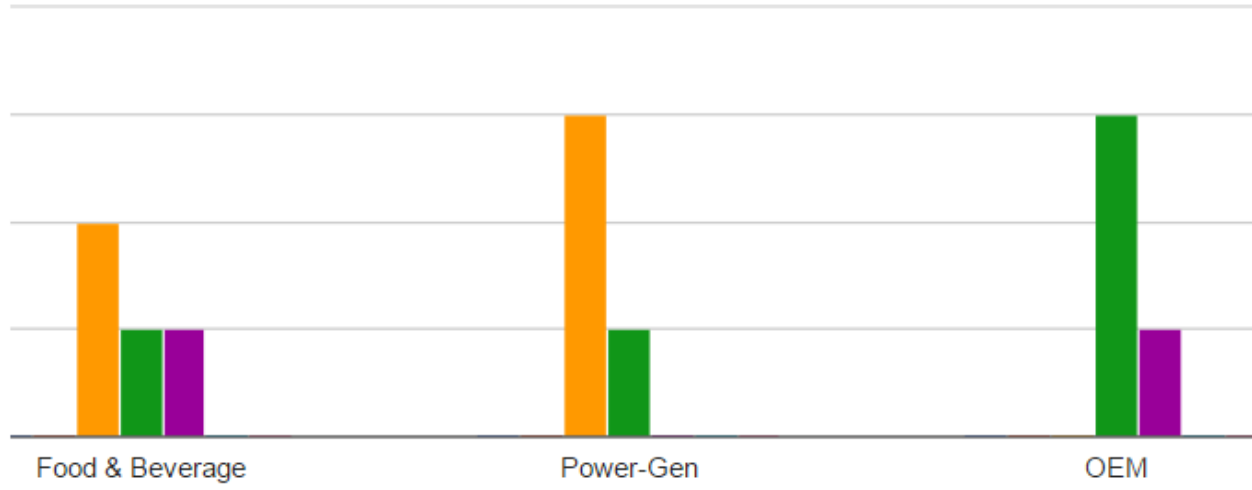
	Yes	No	1 - 25%	26 - 50%	51 - 75%	76 - 100%	No Change from last time
Chemical	○	○	○	○	○	○	○
Oil & Gas - Upstream	○	○	○	○	○	○	○
Oil & Gas - Midstream	○	○	○	○	○	○	○
Oil & Gas - Downstream	○	○	○	○	○	○	○
Metals & Mining	○	○	○	○	○	○	○
Wastewater	○	○	○	○	○	○	○
Food & Beverage	○	○	○	○	○	○	○
Power-Gen	○	○	○	○	○	○	○
OEM	○	○	○	○	○	○	○
Other	○	○	○	○	○	○	○
No Change from Last Time	○	○	○	○	○	○	○

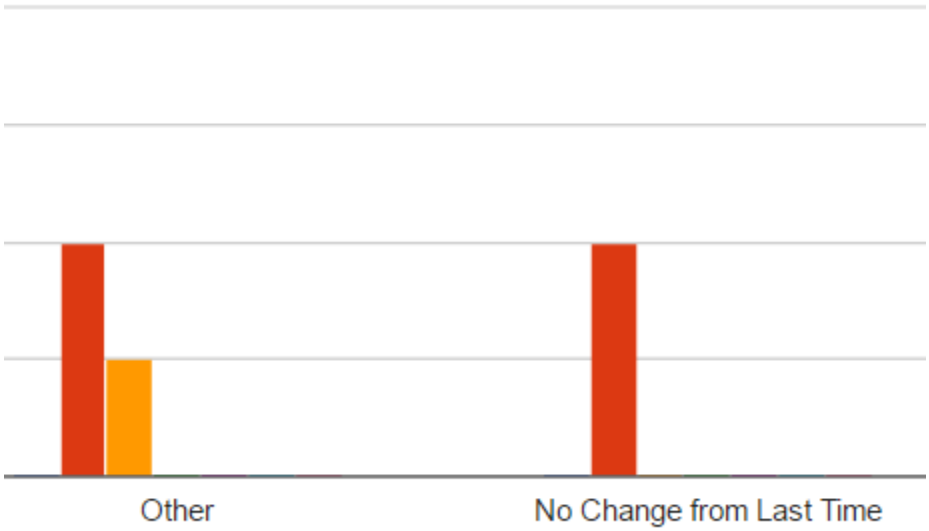
If you chose 'Other' above - please detail here

Your answer

4.


4
3
2
1
0
Yes
No
1 - 25%
26 - 50%
51 - 75%
Chemical
Oil & Gas - Upstream
No Change from last time
Oil & Gas - Downstream
Metals & Mining


Food & Beverage
Power-Gen
OEM


Other
No Change from Last Time

What is your general opinion of this training time compared to other Corporate Training in our company?

Choose

The Best!

A bit better than others

Get's the job done

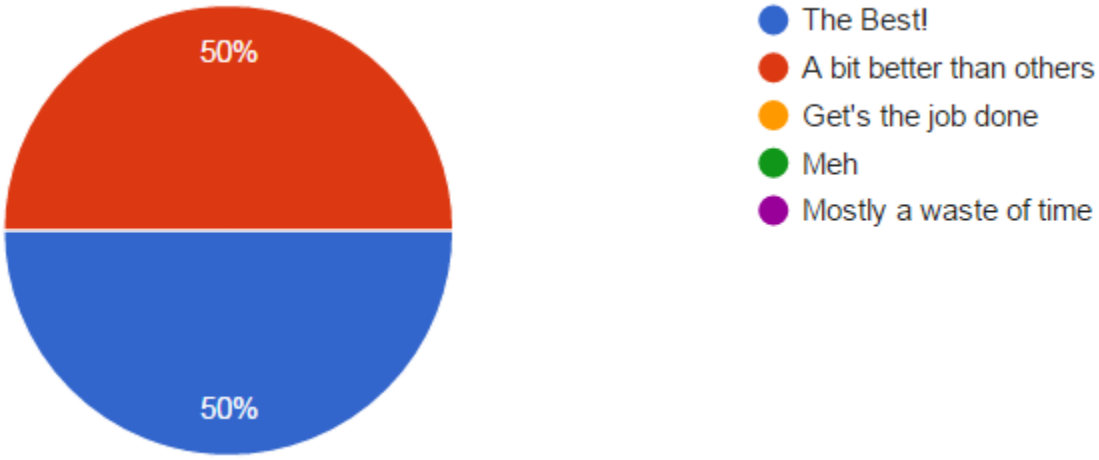
Meh

Mostly a waste of time

or the following types of learning

	Yes	No
	○	○
I'm	○	○
Visual Learning (need visual aids / sample drawings / charts / diagrams)	○	○

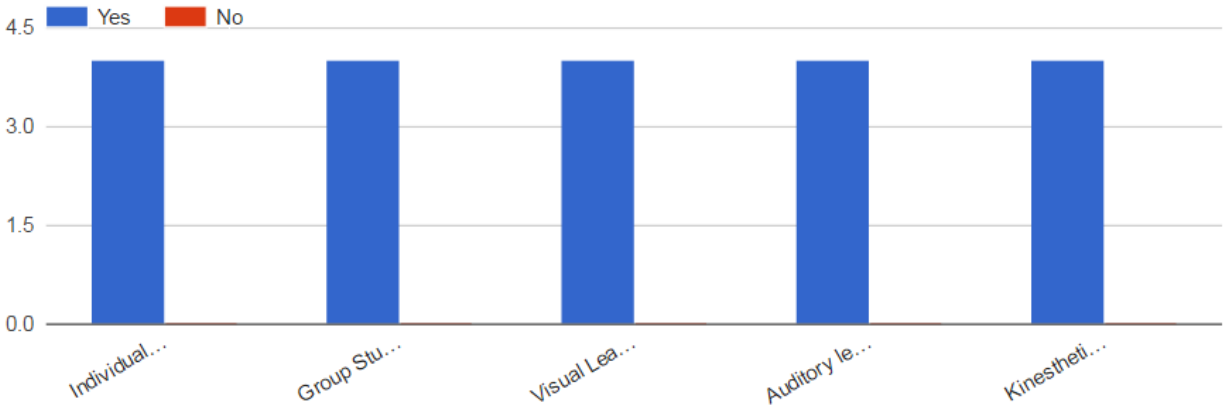
5.



Did our training allow for the following types of learning styles/techniques?

	Yes	No
Individual Study (I teach myself)	○	○
Group Study (I can only learn when I'm with/in a group)	○	○
Visual Learning (need visual aids / sample drawings / charts / diagrams)	○	○
Auditory learning (lectures, discussion)	○	○
Kinesthetic learning (learn via experience - active demo, must see in real-world example, touch)	○	○

6.

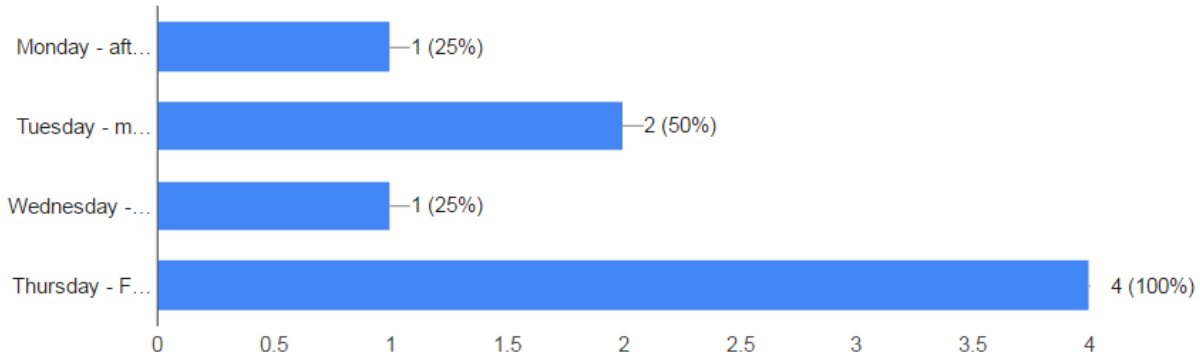


The 'Best' Day of Training was (can choose more than one)

- [ ] Monday - afternoon HazLoc session
- [ ] Tuesday - mostly ABB Products
- [ ] Wednesday - 1/2 Day including StarTeck, Catalog, and Strategy
- [ ] Thursday - Factory Tour & Enclosure 'Operators' close-up

7.

The 'Best' Day of Training was (can choose more than one) (4 responses)



Instructional Designer Biography

Background & Experience

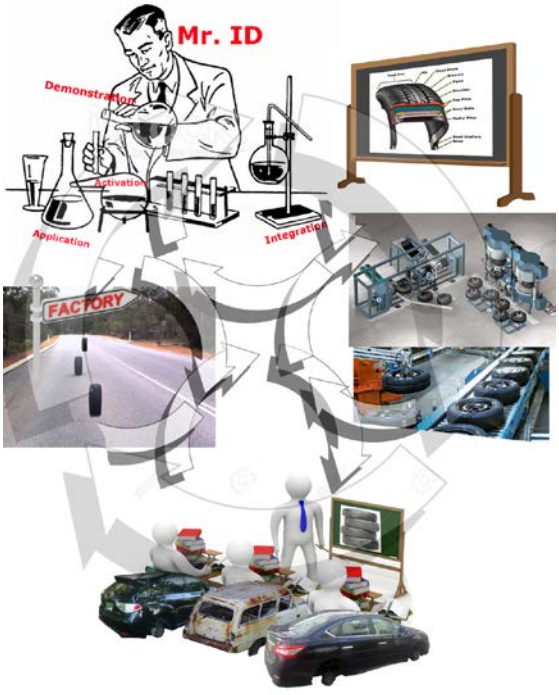
Having worked for the past 20 years in the Electrical Products Manufacturing/Sales field and been called on to present/discuss our products – the ability to 'teach'/convince/win-over adults pursuant to their own level of understanding is essential (because the lack of success equates to loss of real $$). When contemplating about learning and saying to myself, "There has got to be a better way!" led me to search for ways to better instruct and have a lasting impact on the various individuals that come into my teaching environment. The Adult Learning Techniques studied during my Master program has been very eye-opening for me to find better ways to 'light the lightbulbs' in the adult students that I interact with.

Currently, I reside in Memphis, Tennessee but have lived in quite a few places both within the US and outside (Canada, Turkey, Germany) which has given me a great appreciation for a wide-variety of locations, cultures, and climates.

Figure 1 - David at Training Event in Houston Texas

Philosophy of Instructional Design

My philosophy of Instructional Design can be visualized in the conceptual image to the right. It can start with 'Mr. ID' but each location can be the 'launching pad' as they all interrelate to one-another and circle back information, ideas, and constructive feedback to each other. While Mr. ID uses the components of Instructional Design to 'mix his potion' of chemicals – he doesn't lose sight of the final 'tire' that is to be made and passed onto the students. The classroom facilitator works to use the summary of Mr. ID's work (the tire) to provide the necessary missing components to the students to enable them to 'drive themselves'. Mr. ID and the facilitator know that while the students have similar characteristics (they are all the white meeple character) – they are trying to equipment different cars which represents their different learning modalities and ways in which they will take the 'tire' knowledge and create their own usefulness of it. Some tires are



returned to Mr. ID looking for updates, improvements, and creative innovations brought forth by the students, facilitators, and Subject Matter Experts (SMEs). He is then able to tweak the formula and create a new tire that fed back out to the students. In this way each 'cog' in the engine has a necessary usefulness and feeds off of each other to move the entire process forward (hence the never-ending cycling overlay).

Learning Assessment & Evaluations

This section will detail for the facilitator how the Learner Assessment & Evaluations were selected, how some of the sections make sense to combine, include the methodology of how to distribute the surveys online & collect the data, how the evaluations tie to the objectives, and include reflection on ways to modify the coursework to improve learning.

LEARNER ASSESSMENT & FORMATIVE EVALUATION – PRECLASS EVENT

The Learner Assessment & Formative Evaluation for the three-day course (in which the main objective is to convert a few of our salesforce into the 'local Champion' for a new product launch) is to be used by the facilitator in advance of the actual course (suggested at three weeks before) in an effort to better understand who they are working with and how the responses of the students will impact teaching opportunities of the coursework. Given that this will probably be the first exposure (past generalized information) into the specifics of the course for the student – it will also provide for them a sense of what is being covered and how they can start thinking about participation. For example, our Preclass Assessment & Evaluation is based on the three sections:

- **General information** about work experience & prior knowledge about Hazardous Location areas-products (which may help them realize any potential knowledge gaps and prepare them to look for the 'optional' classes beforehand)
- **Marketing Questions** – so the student will realize that a large portion of the upcoming job will be market investigation / development
- **Learning Styles** – by asking these, it will notify the student that we actually understand and care about the various modalities of learning and will potentially cater to their style (which should generate more pre-interest in this training opportunity)

As the majority of these potential students are located in various locations and various timeframes (with various degrees of flexibility in their daily schedule), it is suggested that an online method of Q&A be used to facilitate this evaluation. There exist many tools for this and the contents of this guide can be easily adapted to almost any of them. The author's suggestion is Google Forms (learn more & setup your account at: https://www.google.com/forms/about). When Google Forms is used, the collection of the answers will be tabulated into a visually appealing display showing individual or cumulative results and allows for easy manipulation of a large amount of responses (which is not the case for this course).

Here are the specific questions to ask – with the following instructions to the students being shown first (NOTE: It is important that you also include within the instructions a date/time that the questionnaire will be concluded so that the students can be prepared):

T&B EX Product Training - BEFORE

The purpose of this questionnaire is to best determine everyone's level of knowledge of existing & new products, vertical markets, and Hazardous Locations (HazLoc) overall. It will be anonymous and results will not be share with any of your bosses, our current training team, or any of the Subject Expert Matters (SMEs). It truly is being used to better understand learning gaps, opportunities, and the learner's individualized styles of learning & past experience to produce the best/efficient/effective time together.

Are you generally excited about the opportunity to provide customers with Hazardous Location Enclosures?

	1	2	3	4	5	
Yes! - I can't wait!	○	○	○	○	○	No - too many providers already

How long have you been in the electrical products industry (in some capacity) & how long have you worked for T&B / ABB? (choose two boxes)

- [ ] In Industry - 0 to 5 years
- [ ] In Industry - 6 to 10 years
- [ ] In Industry - 11 to 15 years
- [ ] In Industry - 16+ years
- [ ] With Company - 0 to 5 years
- [ ] With Company - 6 to 10 years
- [ ] With Company - 11 to 15 years
- [ ] With Company - 16+ years

What is your current understanding of:

	None	Slight	More than Peers	Strong	Expert
HazLoc Enclosures Overall	○	○	○	○	○
- Control Junction Boxes	○	○	○	○	○
- Instrument Housings	○	○	○	○	○
- GUB threaded enclosures	○	○	○	○	○
Motor Control Overall	○	○	○	○	○
- Circuit Breaker	○	○	○	○	○
- Disconnect Switch	○	○	○	○	○
- Manual Motor Starter	○	○	○	○	○
- Magnetic Motor Starter	○	○	○	○	○
- Combination Motor Start	○	○	○	○	○
- Control Stations	○	○	○	○	○
Panel Boards	○	○	○	○	○

What is your current understanding of:

	None	Slight	More than Peers	Strong	Expert
HazLoc Lighting	○	○	○	○	○
Terminal Blocks	○	○	○	○	○
Ty-Rap	○	○	○	○	○
Cable Protection Systems	○	○	○	○	○
Cable Glands / Fittings	○	○	○	○	○
Pin & Sleeve	○	○	○	○	○

Market

What do you think the percentage of sales will be between (total should be 100%)

	1 - 25%	26 - 50%	51 - 75%	76 - 100%
Basic (Products with Catalog #s)	◯	◯	◯	◯
Custom (Products that are user customized before shipping)	◯	◯	◯	◯

What Vertical Markets have you worked with & What percentage do you think we will have success selling into?(two questions squished into one)

	Yes	No	1 - 25%	26 - 50%	51 - 75%	76 - 100%
Chemical	◯	◯	◯	◯	◯	◯
Oil & Gas - Upstream	◯	◯	◯	◯	◯	◯
Oil & Gas - Midstream	◯	◯	◯	◯	◯	◯
Oil & Gas - Downstream	◯	◯	◯	◯	◯	◯
Metals & Mining	◯	◯	◯	◯	◯	◯
Wastewater	◯	◯	◯	◯	◯	◯
Food & Beverage	◯	◯	◯	◯	◯	◯
Power-Gen	◯	◯	◯	◯	◯	◯
OEM	◯	◯	◯	◯	◯	◯
Other	◯	◯	◯	◯	◯	◯

What is/are your best tool(s) for a successful sale (choose all that apply)

- [ ] Sales Literature
- [ ] 3-Part Engineering Specifications
- [ ] Website
- [ ] Technical Support
- [ ] Application / Product Video
- [ ] T&B CEL Branded Truck
- [ ] PowerPoint Presentation(s)
- [ ] Internal Group Training / WebEx / BrainShark
- [ ] Factory Visit
- [ ] Distributor Counter Day
- [ ] Booth / Conventions into key verticals
- [ ] Other: _____

If you chose 'Other' above - please detail here

Your answer

Learning Styles

What is your general opinion of Corporate Training in our company?

Choose

Pulldown Choices are: 1) The Best! 2) A bit better than others 3) Get's the job done 4) Meh 5) Mostly a waste of time

Rank the following to describe what styles/techniques seem to work best for your learning.

	My Best Way of Learning	This way works also	Works when no other way	I sleep through this	I hate this style of learning
Individual Study (I teach myself)	○	○	○	○	○
Group Study (I can only learn when I'm with/in a group)	○	○	○	○	○
Visual Learning (need visual aids / sample drawings / charts / diagrams)	○	○	○	○	○
Auditory learning (lectures, discussion)	○	○	○	○	○
Kinesthetic learning (learn via experience - active demo, must see in real-world example, touch)	○	○	○	○	○

LEARNER ASSESSMENT & FORMATIVE EVALUATION – PRECLASS EVENT RESULTS IMPACT

Once the Learner Assessment & Formative Evaluation has been sent to the students and the results collected, their impact will be used based on the following three sections of Q&A:

- **General information**
    1. While the first question may appear to just be a 'filler' – it helps me to gauge the remainder of the answers based on the individual's pre-conceptions about the course/opportunity. You might 'take with a grain of salt' some of the later responses for those naysayers about the program.

    2. The next question lets the facilitator know if they are working with 'young in the industry' individuals – which means more background/fundamental knowledge should be presented by the facilitator and that communicated to the Subject Matter Experts (SMEs) whereas the 'more seasoned' individuals will have lots of examples to share and will be the job of the facilitator to encourage them to be shared with the class.

    3. & 4. This matrix will allow the facilitator to better understand the perceived 'base' knowledge of the subject areas before the class begins. This might lead the facilitator & SMEs to have more seasoned individuals contribute knowledge to the class rather than just the instructor. Again, extracting 'real-world experiences' will be the instructor's job if that level of expertise is shown amongst the students.

- **Marketing Questions**
    5. & 6. These questions will let the facilitator know which markets the students feel 'comfortable' working within. This should also put the students on alert that they might have to 'stretch' the comfort zone as each of the markets listed are potential targets. If the facilitator sees a pattern in the response – then additional questions should be asked like, "Do you believe that customers exist in (Neglected Market) ? What do you believe the dollar size of the opportunities might be?" Through the use of these questions – the facilitator can help the students to realize the market is quite large.

    7. Corporate resources are extremely valuable tools for the sales force. If there exist a pattern of 'useful tools' that this group of students prefers – then the facilitator & SMEs should also focus on those tools (while highlighting any that are specific to their product & deemed popular by those that are high sellers of those products; refer to your SME for this). This information will also better prepare the facilitator for the 'Strategy & Planning' course and help the group hone in on what marketing materials & the priority of completing those materials will be.

- **Learning Styles**
    8. & 9. Due to the fact that this intense three-day course is not for the new salesperson or those without established, successful sales history with the company – some of the students may feel this is just 'another of the training' required classes. The nature of this course is much more interactive and has much more pre-planning than the traditional corporate training that takes place. These questions should help to 'set the stage' in the minds of the students that this won't be a typical course (as they aren't normally asked these kinds of questions beforehand). The results of which should also be shared with the SMEs so that they will individually understand the 'best way to connect' with this group of students and use their preferred modalities within the learning environment.

FORMATIVE EVALUATION – INCLASS EVENT

Each Instructor & Subject Matter Expert was directed to include a few 'Real-World Scenarios' at the end of their class (leaving a few key pieces of information missing so that the students will learn to also formulate the correct questions to obtain the missing information) so that the students could determine the correct part number necessary to fulfill the customer's equipment specification (through role-play between the students and instructor). The facilitator will take the time to verbally poll the small group of students and ask how each one did in obtaining an accurate answer to the question. The specific questions to ask are:

1. Did you get the correct answer that the SME provided?
2. If not, do you understand the difference between your results and the result given by the instructor/SME? Meaning was the difference just a 'dumb mistake' or fundamental misunderstanding?
3. Do you feel that given presented materials (catalogs, product configurators, 'How to Sell' guides, etc) that you can speak intelligently about this product?
4. Do you have any questions that were not addressed in the class while the instructor / SME is still present?
5. Has this presentation / topic been given the proper amount of time for basic understanding? Should it be expanded / shortened?

FORMATIVE EVALUATION – INCLASS EVENT RESULTS IMPACT

It is critical that the facilitator (whom should be present in all classes/courses) read the body language of the individual students to better determine their understanding. Remembering that this group is mostly 'Sales People' that are used to 'fluffing' their way through discussions; the trained eye of the facilitator will be needed to see through to the truth. At this point, the facilitator needs to make a judgement call whether to shift other training/classes around to address any missed learning opportunities or ask the Instructor/SME to cover any singular items that are appearing as patterns based on the answers from the students if/as needed. This information will then be used to make possible adjustments to future courses for additional time/material/examples as needed.

SUMMATIVE EVALUATION

The Summative Evaluation of this coursework provides a variety of important factors for both the students and the facilitators. When the student is working through the 'After' questions – it allows for the 'Generative' learning to occur in which they will summarize the individual courses and see the entirety of the course which will be necessary for their successful day-to-day job role in the future. For the facilitators, this evaluation (which should be send within a week after completing the course time) will help to highlight if overall confidence in product/system knowledge has occurred, help to pinpoint any 'weak' instruction that may necessitate follow-up courses for the group, and will help to pinpoint which portions were successful in the minds of the students (so that they aren't removed in future courses).

Here are the specific questions to ask grouped into the three major divisions which mirror the 'BEFORE' / Formative Evaluation structure (that can be adapted to whatever online Q&A system you choose – but should be the same one as used for the Formative Evaluation so that the students can focus on the answers and not the technology). It is important to include the following instructions to the students (and include your own specific 'ending date' for when the results must be submitted):

T&B EX Product Training - AFTER

The purpose of this questionnaire is to best determine everyone's level of knowledge of existing & new products, vertical markets, and Hazardous Locations (HazLoc) overall. It will be anonymous and results will not be share with any of your bosses, our current training team, or any of the Subject Expert Matters (SMEs). It truly is being used to better understand learning gaps, opportunities, and the learner's individualized styles of learning & past experience to produce the best/efficient/effective time together.

After learning more about our product/offering, are you generally excited about the opportunity to provide customers with Hazardous Location Enclosures?

	1	2	3	4	5	
Yes! - I can't wait!	○	○	○	○	○	No - too many providers already

Please rate your understanding of the following afterwards:

	Would like to have seen more	Other - More Negative	Stayed the Same	Other - More Positive	Increased Greatly - much more confidence
HazLoc Enclosures Overall	○	○	○	○	○
- Control Junction Boxes	○	○	○	○	○
- Instrument Housings	○	○	○	○	○
- GUB threaded enclosures	○	○	○	○	○
Motor Control Overall	○	○	○	○	○
- Circuit Breaker	○	○	○	○	○
- Disconnect Switch	○	○	○	○	○
- Manual Motor Starter	○	○	○	○	○
- Magnetic Motor Starter	○	○	○	○	○
- Combination Motor Start	○	○	○	○	○
- Control Stations	○	○	○	○	○
Panel Boards	○	○	○	○	○

Market

After the training, do you think the percentage of sales will be between (total should be 100%)

	No change from earlier response	1 - 25%	26 - 50%	51 - 75%	76 - 100%
Basic (Products with Catalog #s)	○	○	○	○	○
Custom (Products that are user customized before shipping)	○	○	○	○	○

What Vertical Markets have you worked with & What percentage do you think we will have success selling into?(two questions squished into one)

	Yes	No	1 - 25%	26 - 50%	51 - 75%	76 - 100%	No Change from last time
Chemical	○	○	○	○	○	○	○
Oil & Gas - Upstream	○	○	○	○	○	○	○
Oil & Gas - Midstream	○	○	○	○	○	○	○
Oil & Gas - Downstream	○	○	○	○	○	○	○
Metals & Mining	○	○	○	○	○	○	○
Wastewater	○	○	○	○	○	○	○
Food & Beverage	○	○	○	○	○	○	○
Power-Gen	○	○	○	○	○	○	○
OEM	○	○	○	○	○	○	○
Other	○	○	○	○	○	○	○
No Change from Last Time	○	○	○	○	○	○	○

If you chose 'Other' above - please detail here

Your answer

Learning Styles

What is your general opinion of this training time compared to other Corporate Training in our company?

Choose

Pulldown Choices are: 1) The Best! 2) A bit better than others 3) Get's the job done 4) Meh 5) Mostly a waste of time

Did our training allow for the following types of learning styles/techniques?

	Yes	No
Individual Study (I teach myself)	○	○
Group Study (I can only learn when I'm with/in a group)	○	○
Visual Learning (need visual aids / sample drawings / charts / diagrams)	○	○
Auditory learning (lectures, discussion)	○	○
Kinesthetic learning (learn via experience - active demo, must see in real-world example, touch)	○	○

The 'Best' Day of Training was (can choose more than one)

- ☐ Monday - afternoon HazLoc session
- ☐ Tuesday - mostly ABB Products
- ☐ Wednesday - 1/2 Day including StarTeck, Catalog, and Strategy
- ☐ Thursday - Factory Tour & Enclosure 'Operators' close-up

SUMMATIVE EVALUATION – RESULTS IMPACT

Once the Q&A period has completed for the Summative Evaluation, the responses can be grouped into the following sections with these actions:

- **General information**
    1. It is vital that a sense of excitement and urgency is imbued within the students after this course – if all they've received is date/head-knowledge but no 'drive' to win within this industry then the over-arching point of the training has been missed. If negative comments are recorded by a majority of the students, the facilitator might consider reworking the curriculum with the Instructional Designer with the focus on possibly a new set of objectives (were the originals unrealistic? Did the material that was chosen not help the students find success in the objectives? Were the wrong SMEs chosen?). If the responses were mostly positive then a higher level of confidence, excitement, and opportunities were given to the students (which is the over-arching goal of the course).

    2. Do the students show an overall improvement in their self-assessment of increased knowledge and did the SMEs also share that with the facilitator (that the students 'got it' or maybe have needed additional training and/or time)?

- **Marketing Questions**
    3. While there is no 'right or wrong' answer to this question (as time will actually answer this for them & us all), this should allow the student to compare/contrast their answers to the original 'BEFORE' evaluation. If it was noted that the BEFORE and AFTER were the same, then within the next training class a possible round-table discussion might be on this specific question to determine/compare/contrast answer. It is the authors belief the at the Before/After should be different because the students should have gained a much deeper understanding of the products, their interconnectivity, and use as a system (possibly not fully understanding to the extent that a basic box could be customized).

    4. Like other questions comparing Before/After answers, the After results should show a wider range (meaning more chosen) for the breadth of the market. Ideally each of the sales people should choose each market (and not stick to their 'one or two' comfort groups). If results are grouped around similar answers to the Before questionnaire, then additional round-table discussion should occur within the 'Strategy and Planning' course to help the students realize the various opportunities within all of the markets.

- **Learning Styles**
    5. Since this was a more aggressive & teaching opportunity than traditional corporate training – the responses should be favorable. If the majority are negative – and additional survey should be sent to the students to obtain more detailed information as to which portions or its entirety didn't fulfill their needs.

6. This type of question was asked in the 'Before' section, so the students should have been alerted that a variety of teaching styles may be used. Results from this section should be used/compared to determine if student favored learning modalities were implanted throughout the training course. Negative entries in this question should be communicated with the SMEs and helping them better grasp that style of learning (so they can better incorporate into future classes).

7. The last question gives the students the opportunity to reflect upon the totality of the training events and provide honest feedback as to which 'worked' for this group. If the facilitator finds that a pattern of students saying one day or another was not chosen – then a possible additional survey should be sent to the students to perform a 'deep dive' into some of the possible reasoning's for the miss (and include questions like – "Was the material presented clearly? Do you feel additional time/training should have been given? Was there something about the room that made learning non-optimal? Are there suggestions for improvement to be provided the facilitator and/or SME?)

IMPACT & REPORTING TO STAKEHOLDERS

Ultimately, this success of this course should equate to an increase of sales of these particular products in the market which is measured over a two-year initial growth and then reevaluated over a five-year term to determine future direction (which might include expansion to other countries, additional products, and/or Research & Development to bring new products to market). The personnel involved are initially the Product Management team that are directly responsible financial success of this Product Introduction within their Local Sales Market. After each course, the facilitator should provide a Summary of Execution to the Product Management team to discuss the perceived success (or lack thereof) of the training time and ability of the students to have success within their individual markets. The Product Management team along with the Instructional Designer / Facilitator should review the Summative Evaluation to determine if alternate SMEs should be chosen, additional time is needed, or other aspects of the training time should be altered.

ASSESSMENTS CHOSEN & EXPLANATION

When reviewing the Course Objects (attached in the Appendix), there are a few that can be grouped from an assessment standpoint as they are related or have a repeated type pattern of material being taught. It is also important to embrace the words of Angelo & Cross "Our hope is that each reader will find at least one or two simple Classroom Assessment Techniques (CAT) that can successfully used 'off the shelf' and several more than can be adapted or recast to fit that faculty member's particular requirements." (Classroom Assessment Techniques – A Handbook for College Teachers, 2nd Ed, 1993, pg. 28). The assessments chosen are as follows:

- ***Human Tableau or Class Modeling*** – in which groups of students create 'living scenes' or model processes to show what they know. This CAT is being adapted to the more practical to a

salesperson's role in which they are role-playing (as a group) with the Subject Matter Expert (whom is playing the role of the customer) and presenting the team with a Real-World example of an electrical equipment request. It will be incumbent upon the group to determine what information is missing from the original description of the request (which is quite common in real-world applications) and compose the right questions to the 'customer' to accurately determine the part # needed to fulfill the customer's needs.

This specific CAT was chosen/adapted to our classwork because it will:

- Allow the students to use the basic 'data only' type instruction of the electrical equipment and compose new connections between functionality & requirements.
- The group setting was chosen so that each could:
  - Understand what the 'base knowledge' about each product needs to be to formulate the correct questions for additional knowledge.
  - Allow those that are lacking to see an example before being faced with it in real-life.
  - Determine who the 'student experts' are so that can make connections to get questions answered quickly (if standard support personnel are unavailable).
- Best represents what their typical 'job' will entail and a typical example of day-to-day issues needing resolution.

- ***An adaptation of the 'One Minute' paper CAT*** – which typically is a quick / simple way to collect written feedback on student learning asking questions like "What is the most important thing you learning during this class?" and "What important question remains unanswered?". Our adaptation is to do this verbally with the team so that we gain the advantages of 'team work/discussion' listed above – but differentiates itself from the above by not focusing on product, application, function, inter-connections, customer part # by instead on generalized knowledge, familiarity with overall topics, and improving confidence by rounding out the different viewpoints that individuals have.

  As an example, for our optional course the assessment will be handled more with a one-on-one discussion in which the Subject Matter Expert (SME) will quiz each student verbally and fill in any knowledge gaps as this instruction is foundational to the remaining coursework (and, as such, will be conduct as early as possible after the group discussion/training).

INSTRUCTIONAL CONTENT & ASSESSMENT

FULL INSTRUCTIONAL CONTENT – HAZLOC STANDARDS (OPTIONAL)

To begin this three days of intense product training, it is essential for all of the students to have a very thorough understanding of the industry standards that govern the use, specialty, and requirements necessary for the equipment, personnel, and day-to-day expectations these dangerous Hazardous Locations. While most of the students may already have this experience from previous work with similar electrical products – you should offer a 'refresher' course which lays the foundation for those new (and those who might have forgotten). A knowledge of these standards will help the students to

better understand the nomenclature spoken amongst industry professionals, the need for the product differentiation from more basic / commodity type equipment, and will help raise awareness of the dangers in this industry and how to safely operate equipment in them.

The materials used in this course are located in the 'Sample Content' section under the 'Hazardous Location Industry Standards' section with the components:

- PowerPoint presentation
- a 'take home' for further study/reinforcement document/poster entitled, "UL HazLoc Poster 2016 v4"

The details/discussion of each of the presentation slides is given below:

1. The standards give customers, engineers, equipment manufacturers, operators a 'level playing field' of knowledge in-which to operate their industry safely. For Hazardous Locations, those are found in the National Electrical Code (NEC) Articles 500 (specifically 501-516)

2. These Articles detail three different areas in which people/equipment must operate and differentiated by the designations "Class 1 (in which there could be dangerous/explosive opportunities due to Gases, Vapors, and Liquids), Class 2 (in which dusts could mix with air creating a very fast burning/explosive mix), and Class 3 (areas that could have floating fibers and flyings like those found in textile, paper production, carpet manufacturing). Each will be detailed in the following slides.

3. Class 1 areas (in which there could exist flammable Gases, Vapors, and Liquids) are common in petroleum refining, WasteWater treatment (chlorine, fluorine, and methane), and paint booth areas (due to the chemicals in the paint). All of these areas could have electrical equipment within them that could spark or heat up causing a flame which would then cause a chain-reaction & possibly an explosion. Our goal is to supply equipment to safely operate in these areas that will not interact with the environment from a spark/heat standpoint).

4. Class 2 areas are those that contain dusts. While dust may sound fairly safe, we have all heard of stories in which the grain silos exploded. Remember that it wasn't the grain – but instead the air-borne dust that quickly burns that could cause the explosion. We also find coal/metals dusts in power generation along with pharmaceutical & food production areas.

5. Class 3 areas (which are not as prevalent in the United States as much anymore) are those areas in which small fibers would float in the air (which would be quick burning and could cause an explosion).

6. Time for a test! With these three areas being shown & the equipment being designed to operate in those areas, a question arises which could be, "If I have a Class 2 required product in this area – will a Class 1 suffice or supersede the base requirements"? This should really get the students thinking because their 'gut' wants to believe that the Class 1 areas are the 'most dangerous' therefore they should be 'king'. After giving them time to squirm and internally wrestle with the question – state that "Any explosion is dangerous / deadly" and one area is

NOT more dangerous than another. Also, remember that per the standards equipment is required to be tested per that specific area. How a piece of equipment 'breathes', its wiring, wash-down, etc are all different per each area and MUST be tested (and pass) per the specific requirements of the customer's hazardous location. BUT there is some help in that most equipment is multi-class rated – it has been designed, built, and tested to operate in Class 2 AND Class 3 areas. But you must ensure that the catalog specifically lists as compliant the area listed in the customer specifications (no assumptions in this business).

7. When discussing 'Classes' you'll also always hear the additional phrase, "Division 1 or Division 2". These define if the hazard is 'Always Present' (and therefore a constant threat) or 'Maybe Present' (which means that is it not-normally present and only through some mishap will the hazard be present). While it might seem diminutive between the two – the Division 1 product is typically twice as heavy (and subsequently twice as expensive) as a Division 2 product. It is very important to understand from the customer the required Class and Division specifications before recommending ANY products. Additional, you might hear a customer discussing a 'Group Requirement'. This means they need to specify the actual gas/vapor/dust to ensure testing/compliance for. The A & B gases have a tougher equipment requirement/testing than the C & D gases (so, often if they are including it means they are looking for the tougher builds). While it is not important that you memorize the specifics of each group – understanding the generalities will help you be more comfortable in discussions about these products with customers.

8. Whereas the earlier slides deal with all HazLoc type products, some products will have additional ratings based on the fact that they product heat and in doing so, must detail their 'hottest spot' on their product. This knowledge is very important because you may be operating in an environment with a gas that has a low 'auto-ignition' temperature and while you may have met the proper Class, Division, and Group; the equipment may run hot enough to auto-ignite the gas. This information is displayed as 'T-Ratings'. Say you have a motor, transformer, or lighting fixture that has a T-Rating of T2. That means that the 'hottest spot' on that fixture could reach 300C so the operational gases in that environment must not auto-ignite at a temperature much higher.

9. & 10. Due to the fact that the above presentation on standards can be a bit over-whelming for a new-comer (and as an always needed in this industry, a double-check) we have detailed the Four Step selection method for a piece of electrical equipment.
    a. Understand the customer's requirements from a Class, Division, and Group standpoint. Select a fixture that meets & shows that it has been tested to meet those specific entries.
    b. Consult the catalog of the equipment and determine the manufacturer's listed T-Rating expected in operation.
    c. Consult the listed standards/charts for the gas/dust/material and locate its auto-ignition temperature

d. Compare those temperatures vs. T-Rating to ensure that the auto-ignition temperature is will outside of the equipment T-Rating temperature based on tolerances set by the local inspectors or end-user, whichever is more stringent.

At this point it is time to determine if learning transfer has occurred with the students. I would suggest Role-Playing with the students (which will mimic the real-world skills they will need to work in this field, be compliant with standards, and successfully suggest the correct equipment for the customer to operate safely. Have the students refer to the above mentioned UL-Poster and pose the following questions/assessments:

Real-World Example - Question 1: "We are working with a company that launches rockets – their fueling area fills the rockets with hydrogen. What are the Class, Division, and Grouping for this area?"

Missing Information: none

Answer: This is a trick question. Remember that over and over we (as product manufacturing) do NOT specify what the Hazardous Location should be (we should/could have a general idea) but it is incumbent upon the customer to supply that information (which typically is supplied by their engineering design group and/or insurance group). We (product suppliers) are not licensed or have liability insurance to answer this question. Now, with that out of the way – what do you *think* the customer will answer? The area is probably going to be Class I, Division 2 (remember that the gas is NOT always present – only there when refueling), Group B

Real-World Example - Question 2: "I need to hang a light over some areas of my manufacturing that makes Butane. According NFPA497M, the gas is Group D and auto-ignites as 550°F. What lighting would you recommend? "

Missing Information: The customer hasn't listed the lumen requirements for the area and also hasn't listed mounting height, ceiling reflectance, color temperature required, or preferred lighting technology (incandescent, fluorescent, High-Intensity Discharge, LED, etc). To not become too off-target, respond with, "My engineers say that I need Class I, Div 2 fixture that is equal to a 400W Metal-Halide lighting".

Answer: Ok – we now refer to the Four-Step method discussed in the presentation:

1. Customer requirement is: Class I, Div 2, Group D
2. My Hazlux catalog (which the seasoned sales guys will already have) shows that the LED equal to a 400W Metal-Halide is a DL015 (which does show it is compliant with Class I, Div 2, Group D) and has a T-Rating of T4 (with a 40 ˚C ambient).
3. The customer has told us that NFPA497M lists his specific Gas (Butane) as auto-igniting at 550°F. The tricky part is that the T-Ratings tables only show ˚C so converting 550°F to degree Celsius yields 288 ˚C.
4. Since T4 (which has a maximum hotspot of 135˚C) is well below the auto-ignition temperature of 288˚C, then the DL015 Series fixture can be recommended.

COMPLETE LEARNING ASSESSMENT – DISCONNECTS

This learning assessment will be typical of the various 'Internal Equipment' classes and represents one of the most basic/easiest electrical products to understand; the Disconnect. After a detailed presentation discussing the basic operation of the disconnect, how it used within Real-World examples, the numerous accessories that can included to expand functionality, shown access to where catalogs and online selling guides and product configurators are located, the facilitator or SME should list the details of the proper 'Selection Parameters' for this product – which are:

- UL Standard required (UL98, UL508, etc)
- Fusible or Non-fusible
- Voltage and whether AC or DC
- Ampacity
- Number of poles (2, 3, 4, 5, 8)
- If motor, HP and/or FLA
- For shaft and handle:
  - NEMA class (NEMA 1, 12, 3R, 4, 4X SS)
  - Panel depth
- If enclosed, NEMA Class and enclosure material (plastic, metal sheet, SS)
- For OTDC – Solar Switches – Grounded or non-grounded (OTDC_US_ or OTDCU_)

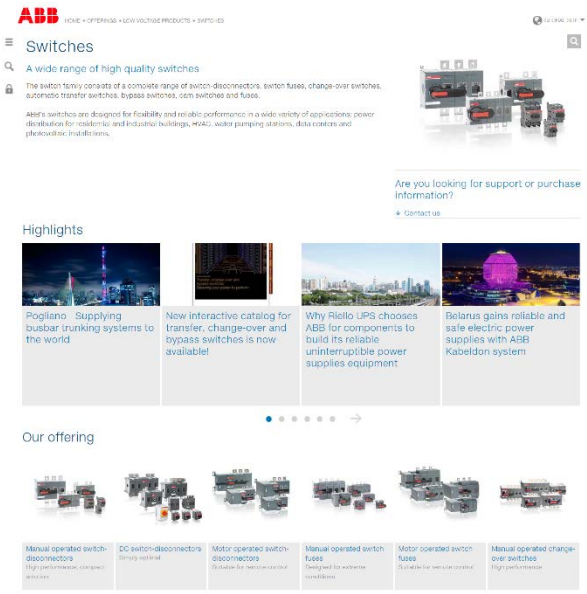


Figure 4 Sample Online Area detailing Variety of Products Available

The SME will now role-play with the students these two Real-World examples (conveniently leaving some necessary information out so that the students will have to formulate what information is missing and ask the proper questions) and request from the students to determine the correct part # to sell to meet the customer's requirements.

Real-World Example – Question 1: "I have a downstream motor that I need to control manually but also have fused protection……but no exposed switch – because I'm putting it into an already existing enclosure."

Missing Information: 3-phase motor 480VAC, 30HP

Answer: OS60GJ12

Real-World Example – Question 2: "I've changed my mind and would like a flange switch & can I get 'CC' type fusing?"

Missing Information: NEMA 4X type handle, cable length 60"

Answer: OS60GJ30 (fusible disconnect) + DSFHN-HS4 (handle) + OXC1L60 (flexible cables) + MKCS4 (operating mechanism). And ‘No’ on the fusing as that size is only available with ‘J’ fuse types.

APPENDIX – OBJECTIVES (PRIMARY & SECONDARY) W/ ASSESSMENT TYPE

- The attending salesperson will be able to distinguish the between the various Hazardous Location ratings as defined in the National Electrical Code (NEC) Articles 500-516
  Assessment Type: Adaptation of the 'One Minute' paper

- The attending salesperson will be able to specify the correct hazardous location enclosure based on customer supplied requirements
  Assessment Type: Human Tableau or Class Modeling

- The attending salesperson will be able to specify the correct internal industrial equipment based on customer supplied requirements

    - The individual will be able to recite the basic functionality of available internal industrial equipment by attending a form/fit/function course taught by a Subject Matter Expert (SME) of each piece of equipment (Disconnects, Contactors, Fusing, Switching, Motor Starters – Magnetic or Manual or Reversing or Non-Reversing, and Breakers)
      Assessment Type: Human Tableau or Class Modeling

    - They will be able to formulate questions based on missing information to determine additional specifics of the customer supplied requirements
      Assessment Type: Human Tableau or Class Modeling

    - The student will determine an accurate part/catalog number of the needed electrical equipment based on a role-play real-world customer scenario with the SME
      Assessment Type: Human Tableau or Class Modeling

    - The individual will demonstrate basic functionality (on, off, start, and stop) of each piece of possible internal equipment with their own hands
      Assessment Type: Adaptation of the 'One Minute' paper

    - Each student will install accessories for each piece of internal industrial equipment
      Assessment Type: Adaptation of the 'One Minute' paper

    - Each attending will construct a basic electrical layout drawing showing functionality and electrical interconnects of the customer supplied project
      Assessment Type: Human Tableau or Class Modeling

- The attending salesperson will be able to specify the correct factory sealed panel boards based on customer supplied requirements
  Assessment Type: Human Tableau or Class Modeling

- The attending salesperson will be able to specify the correct existing pull-thru products based on customer supplied requirements
  Assessment Type: Human Tableau or Class Modeling

- The attending salesperson will be able to describe the manufacturing process of the hazardous location enclosures from raw materials to finished goods
  Assessment Type: Human Tableau or Class Modeling

- The attending salesperson will be able to produce an accurate template drawing of the enclosure's operators, wiring input/output, and hinge locations based on customer supplied requirements
  Assessment Type: Human Tableau or Class Modeling

Sample Content

This next section contains the sample content for each of the classes/courses listed below (which could include presentations, catalogs, product selector guides, etc. as determined by the class Subject Matter Expert (SME) – these are included only as samples & suggestions; the actual content of the course should be determined by the actual Course Facilitator and the SME):

- **Hazardous Location Industry Standards**
- **Enclosure Contents**
  - Disconnects & Accessories
  - Circuit Breakers & Accessories
  - Motor Starters & Accessories
- **Existing Pull-Thru Products**
  - Rigid / GUB Boxes & Ocal
  - Hazlux Lighting
  - StarTeck Fittings

INSTRUCTIONAL CONTENT & ASSESSMENT

FULL INSTRUCTIONAL CONTENT – HAZLOC STANDARDS (OPTIONAL)

To begin this three days of intense product training, it is essential for all of the students to have a very thorough understanding of the industry standards that govern the use, specialty, and requirements necessary for the equipment, personnel, and day-to-day expectations these dangerous Hazardous Locations. While most of the students may already have this experience from previous work with similar electrical products – you should offer a 'refresher' course which lays the foundation for those new (and those who might have forgotten). A knowledge of these standards will help the students to better understand the nomenclature spoken amongst industry professionals, the need for the product differentiation from more basic / commodity type equipment, and will help raise awareness of the dangers in this industry and how to safely operate equipment in them.

The materials used in this course are the attached PowerPoint presentation (entitled, "Hazardous Location Presentation" & a 'take home' for further study/reinforcement document/poster entitled, "UL HazLoc Poster 2016 v4").

The details/discussion of each of the presentation slides is given below:

1. The standards give customers, engineers, equipment manufacturers, operators a 'level playing field' of knowledge in-which to operate their industry safely. For Hazardous Locations, those are found in the National Electrical Code (NEC) Articles 500 (specifically 501-516)

2. These Articles detail three different areas in which people/equipment must operate and differentiated by the designations "Class 1 (in which there could be dangerous/explosive opportunities due to Gases, Vapors, and Liquids), Class 2 (in which dusts could mix with air creating a very fast burning/explosive mix), and Class 3 (areas that could have floating fibers and flyings like those found in textile, paper production, carpet manufacturing). Each will be detailed in the following slides.

3. Class 1 areas (in which there could exist flammable Gases, Vapors, and Liquids) are common in petroleum refining, Wastewater treatment (chlorine, fluorine, and methane), and paint booth areas (due to the chemicals in the paint). All of these areas could have electrical equipment within them that could spark or heat up causing a flame which would then cause a chain-reaction & possibly an explosion. Our goal is to supply equipment to safely operate in these areas that will not interact with the environment from a spark/heat standpoint).

4. Class 2 areas are those that contain dusts. While dust may sound fairly safe, we have all heard of stories in which the grain silos exploded. Remember that it wasn't the grain – but instead the air-borne dust that quickly burns that could cause the explosion. We also find coal/metals dusts in power generation along with pharmaceutical & food production areas.

5. Class 3 areas (which are not as prevalent in the United States as much anymore) are those areas in which small fibers would float in the air (which would be quick burning and could cause an explosion).

6. Time for a test! With these three areas being shown & the equipment being designed to operate in those areas, a question arises which could be, "If I have a Class 2 required product in this area – will a Class 1 suffice or supersede the base requirements"? This should really get the students thinking because their 'gut' wants to believe that the Class 1 areas are the 'most dangerous' therefore they should be 'king'. After giving them time to squirm and internally wrestle with the question – state that "Any explosion is dangerous / deadly" and one area is NOT more dangerous than another. Also, remember that per the standards equipment is required to be tested per that specific area. How a piece of equipment 'breathes', its wiring, wash-down, etc. are all different per each area and MUST be tested (and pass) per the specific requirements of the customer's hazardous location. BUT there is some help in that most equipment is multi-class rated – it has been designed, built, and tested to operate in Class 2 AND Class 3 areas. But you must ensure that the catalog specifically lists as compliant the area listed in the customer specifications (no assumptions in this business).

7. When discussing 'Classes' you'll also always hear the additional phrase, "Division 1 or Division 2". These define if the hazard is 'Always Present' (and therefore a constant threat) or 'Maybe Present' (which means that is it not-normally present and only through some mishap will the hazard be present). While it might seem diminutive between the two – the Division 1 product is typically twice as heavy (and subsequently twice as expensive) as a Division 2 product. It is very important to understand from the customer the required Class and Division specifications before recommending ANY products. Additional, you might hear a customer discussing a 'Group Requirement'. This means they need to specify the actual gas/vapor/dust to ensure testing/compliance for. The A & B gases have a tougher equipment requirement/testing than the C & D gases (so, often if they are including it means they are looking for the tougher builds). While it is not important that you memorize the specifics of each group – understanding the generalities will help you be more comfortable in discussions about these products with customers.

8. Whereas the earlier slides deal with all HazLoc type products, some products will have additional ratings based on the fact that they product heat and in doing so, must detail their 'hottest spot' on their product. This knowledge is very important because you may be operating in an environment with a gas that has a low 'auto-ignition' temperature and while you may have met the proper Class, Division, and Group; the equipment may run hot enough to auto-ignite the gas. This information is displayed as 'T-Ratings'. Say you have a motor, transformer, or lighting fixture that has a T-Rating of T2. That means that the 'hottest spot' on that fixture could reach 300C so the operational gases in that environment must not auto-ignite at a temperature much higher.

9. & 10. Due to the fact that the above presentation on standards can be a bit over-whelming for a new-comer (and as an always needed in this industry, a double-check) we have detailed the Four Step selection method for a piece of electrical equipment.
    a. Understand the customer's requirements from a Class, Division, and Group standpoint. Select a fixture that meets & shows that it has been tested to meet those specific entries.
    b. Consult the catalog of the equipment and determine the manufacturer's listed T-Rating expected in operation.
    c. Consult the listed standards/charts for the gas/dust/material and locate its auto-ignition temperature
    d. Compare those temperatures vs. T-Rating to ensure that the auto-ignition temperature is will outside of the equipment T-Rating temperature based on tolerances set by the local inspectors or end-user, whichever is more stringent.

At this point it is time to determine if learning transfer has occurred with the students. I would suggest Role-Playing with the students (which will mimic the real-world skills they will need to work in this field, be compliant with standards, and successfully suggest the correct equipment for the customer to operate safely. Have the students refer to the above mentioned UL-Poster and pose the following questions/assessments:

Real-World Example - Question 1: "We are working with a company that launches rockets – their fueling area fills the rockets with hydrogen. What are the Class, Division, and Grouping for this area?"

Missing Information: none

Answer: This is a trick question. Remember that over and over we (as product manufacturing) do NOT specify what the Hazardous Location should be (we should/could have a general idea) but it is incumbent upon the customer to supply that information (which typically is supplied by their engineering design group and/or insurance group). We (product suppliers) are not licensed or have liability insurance to answer this question. Now, with that out of the way – what do you *think* the customer will answer? The area is probably going to be Class I, Division 2 (remember that the gas is NOT always present – only there when refueling), Group B

Real-World Example - Question 2: "I need to hang a light over some areas of my manufacturing that makes Butane. According NFPA497M, the gas is Group D and auto-ignites as 550°F. What lighting would you recommend? "

Missing Information: The customer hasn't listed the lumen requirements for the area and also hasn't listed mounting height, ceiling reflectance, color temperature required, or preferred lighting technology (incandescent, fluorescent, High-Intensity Discharge, LED, etc.). To not become too off-target, respond with, "My engineers say that I need Class I, Div 2 fixture that is equal to a 400W Metal-Halide lighting".

Answer: Ok – we now refer to the Four-Step method discussed in the presentation:

1. Customer requirement is: Class I, Div 2, Group D

2. My Hazlux catalog (which the seasoned sales guys will already have) shows that the LED equal to a 400W Metal-Halide is a DL015 (which does show it is compliant with Class I, Div 2,

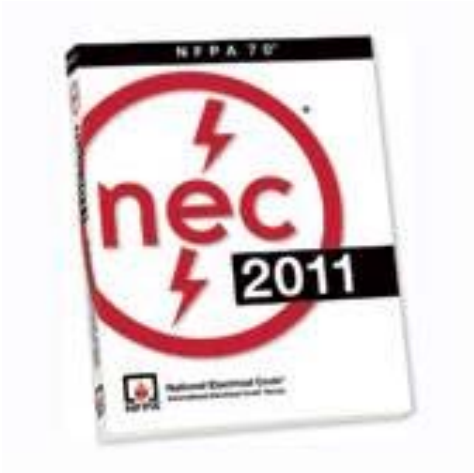
Group D) and has a T-Rating of T4 (with a 40 ˚C ambient).

3. The customer has told us that NFPA497M lists his specific Gas (Butane) as auto-igniting at 550°F. The tricky part is that the T-Ratings tables only show ˚C so converting 550°F to degree Celsius yields 288 ˚C.

4. Since T4 (which has a maximum hotspot of 135˚C) is well below the auto-ignition temperature of 288˚C, then the DL015 Series fixture can be recommended.

Article 500 (Hazardous Locations)

provides the basis for interpreting and correctly applying Articles 501 - 516



How a location is classified depends on the properties of materials in that location or that are likely to be in that location [500.5]

Skip past Hazardous Location Info

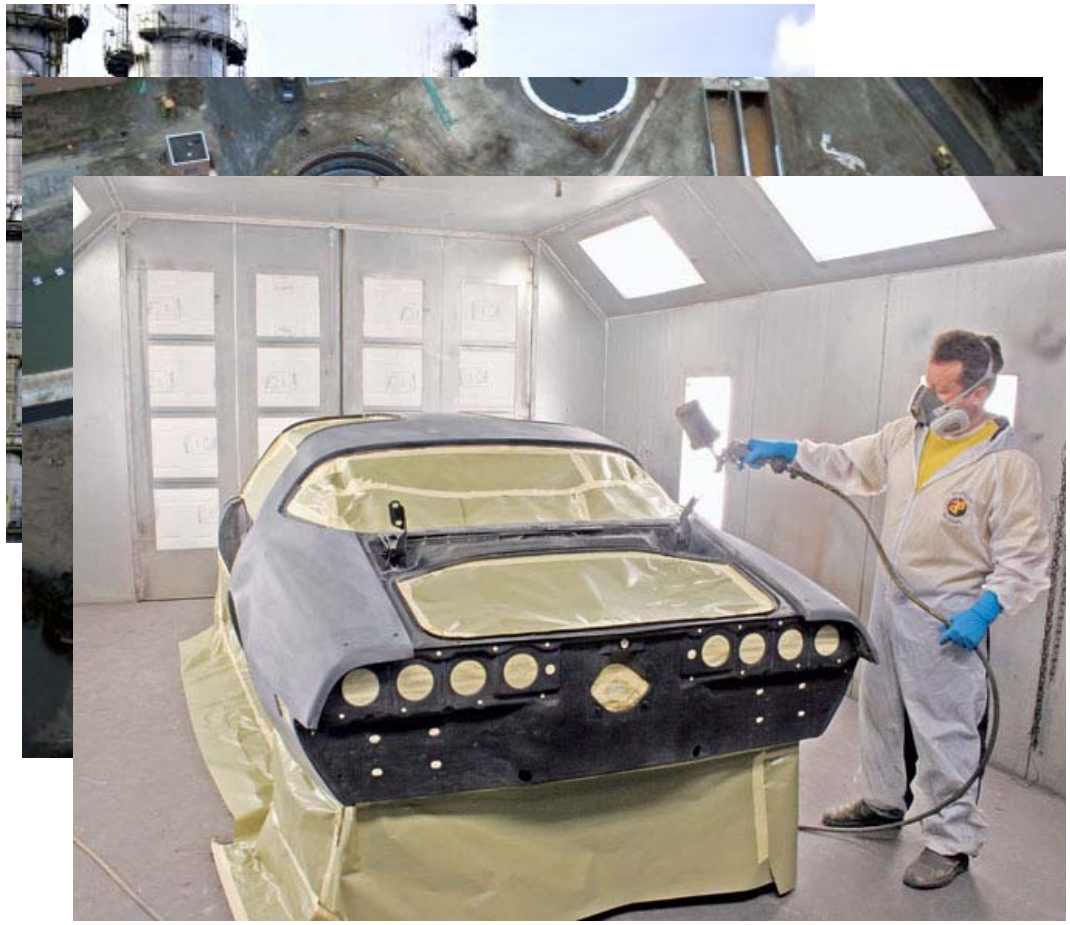
Thomas&Betts
A Member of the ABB Group

NEC Article 500

Thomas&Betts
A Member of the ABB Group

Class 1

Gases,
Vapors,
Liquids



Thomas&Betts
A Member of the ABB Group

Class 2

Dusts

Thomas&Betts
A Member of the ABB Group

Class 3

Fibers and Flyings

Thomas&Betts
A Member of the ABB Group

NEC Article 500

Class 2	Class 3
Dusts	Fibers and Flyings

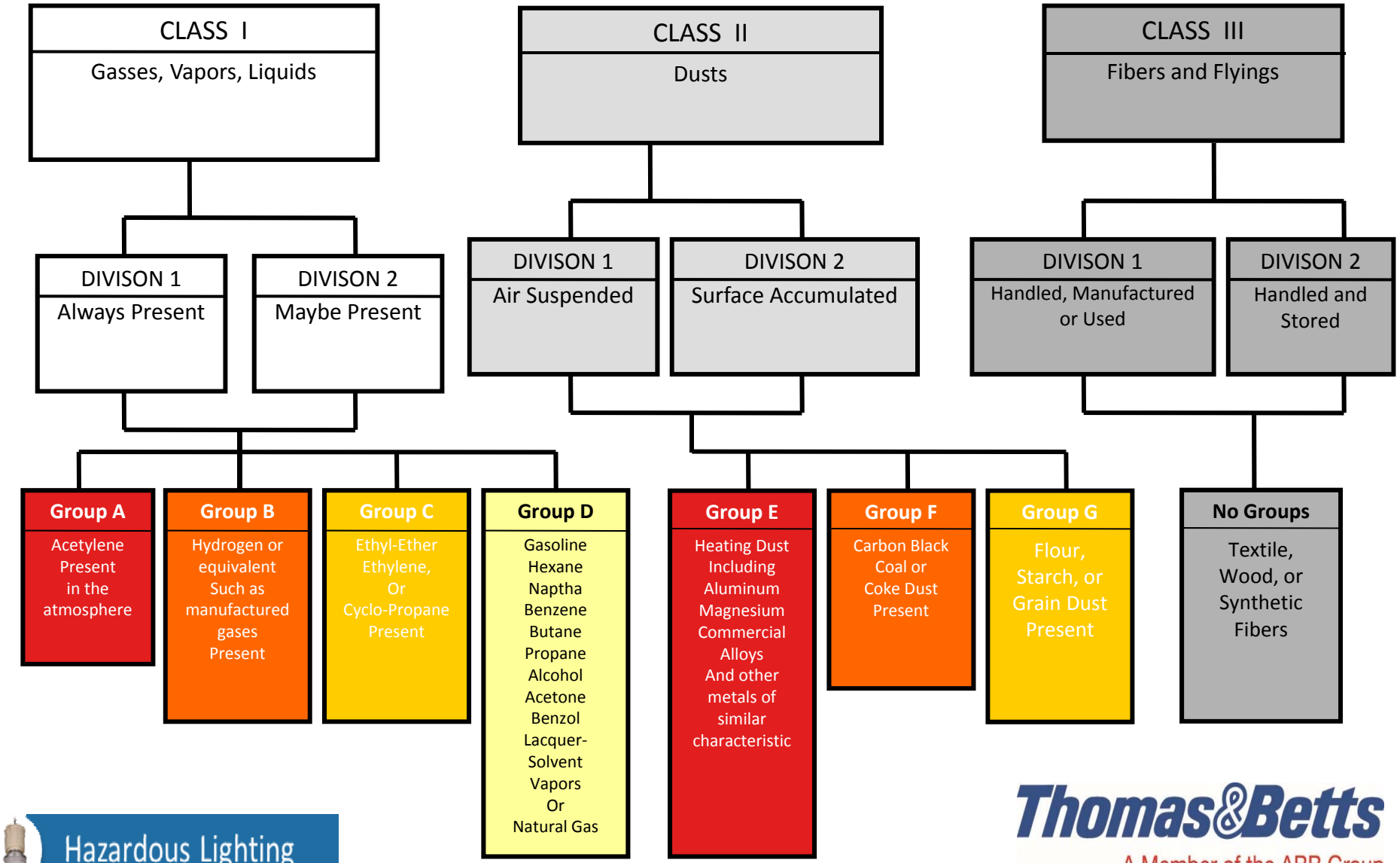
NEC requires equipment to be:

- Dust Tight
- Prevent the escape of sparks
- Operate at temperatures below combustion

Example: Hazlux 3 Fixtures
Meet both Class 2 and Class 3 Requirements

Thomas&Betts
A Member of the ABB Group

Hazardous Area Classifications



Hazardous Lighting

Thomas&Betts
A Member of the ABB Group

T Ratings

- Temperature rating of a fixture
  - The letter designations (T2**A**, T3**C**, etc.) are only used in NEC **Division** rated areas
  - Fixtures for IEC **Zone** rated areas include only the numeric T-ratings (T**1**, T**2**, etc.)
- Used to determine if the temperature of fixture will exceed the ignition temperature of the gas around the fixture

Class I, II Division 1, 2 T-Number	Max. Temp. °C
T1	450
T2	300
T2A	280
T2B	260
T2C	230
T2D	215
T3	200
T3A	180
T3B	165
T3C	160
T4	135
T5	100
T6	85

Hazardous Lighting

Thomas&Betts
A Member of the ABB Group

Hazlux® Hazardous Lighting Basics

Four Step Selection Method

Four Step Method for Selecting Lighting Fixtures for Hazardous Locations

1. **Select a fixture which meets the Class, Group, and Division/Zone Requirements.**

   Examples: Class I, Division 2, Group D

   Class I, Zone 2, Group IIA

   Class II, Division 1, Group G

2. **Determine the T-Number for your selected fixture. Be sure it is for the Specific Wattage, Ballast Housing, Optical Assembly, and Ambient Temperature.**

   Use the published information in the appropriate Hazlux Catalog or brochures.

Thomas&Betts
A Member of the ABB Group

Hazlux® Hazardous Lighting Basics

Four Step Selection Method (continued)

3. **Determine the maximum allowable temperature for the hazardous materials involved.**

   Class I gas:

   - Ignition temperature for the specific gas (from NFPA497M)

   Class II dust:

   - Group E - 200 °C
   - Group F - 200 °C
   - Group G - 165 °C
   - Or ignition temperature of dust if lower

   (Above from NEC® table 500-3(F))

4. **Compare T-Number** (from Step 2) **to Maximum Allowable Temperature** (from Step 3)**.**

   If T-Number is Cooler than the Maximum Allowable Temperature, Selected Fixture is Suitable.

   If T-Number is Hotter than the Maximum Allowable Temperature, Selected Fixture is Not Suitable.

Thomas&Betts
A Member of the ABB Group

UL HAZARDOUS LOCATIONS SERVICES

The international preference in hazardous locations research, testing and certification for over 100 years

EXPLOSIVE GAS ATMOSPHERES (e.g. Class I Division System)

Includes flammable gases, flammable liquid-produced vapors, and combustible liquid-produced vapors

Area Classification

Division 1:
Where ignitable concentrations of flammable gases, vapors or liquids **can exist all of the time or some of the time** under normal operating conditions.

Division 2:
Where ignitable concentrations of flammable gases, vapors or liquids **are not likely to exist** under normal operating conditions.

Zone 0:
Where ignitable concentrations of flammable gases, vapors or liquids **are present continuously or for long periods of time** under normal operating conditions.

Zone 1:
Where ignitable concentrations of flammable gases, vapors or liquids **are likely to exist** under normal operating conditions.

Zone 2:
Where ignitable concentrations of flammable gases, vapors or liquids **are not likely to exist** under normal operating conditions.

Groups

Division 1 and 2:
- **A** acetylene
- **B** hydrogen
- **C** ethylene
- **D** propane

Zone 0, 1 and 2:
- **IIC** acetylene & hydrogen
- **IIB+H2** hydrogen
- **IIB** ethylene
- **IIA** propane

Temperature Classifications

Division 1 and 2:		Zone 0, 1 and 2:	
T1	≤450°C	**T1**	≤450°C
T2	≤300°C	**T2**	≤300°C
T2A	≤280°C	—	
T2B	≤260°C	—	
T2C	≤230°C	—	
T2D	≤215°C	—	
T3	≤200°C	**T3**	≤200°C
T3A	≤180°C	—	
T3B	≤165°C	—	
T3C	≤160°C	—	
T4	≤135°C	**T4**	≤135°C
T4A	≤120°C	—	
T5	≤100°C	**T5**	≤100°C
T6	≤ 85°C	**T6**	≤ 85°C

Division System Electrical Equipment Protection Techniques

Area	Protection Techniques	Applicable Certification Documents: USA (UL Mark)	Canada (C-UL Mark)
Div. 1	• Intrinsic safety	UL 913	CSA 157
	• Explosionproof	UL 1203	CSA 30
	• Purged/pressurized, Type X or Y	NFPA 496	NFPA 496
	• Any Class I, Zone 0 technique	See Zone 0 techniques	See Zone 0 techniques
Div. 2	• Hermetically-sealed	ISA 12.12.01	CSA 213
	• Nonincendive	ISA 12.12.01	CSA 213
	• Non-sparking	ISA 12.12.01	CSA 213
	• Purged/pressurized, Type Z	NFPA 496	NFPA 496
	• Sealed	ISA 12.12.01	CSA 213
	• Any Class I, Division 1 technique	See above	See above
	• Any Class I, Zone 0, 1 or 2 technique	See Zone techniques	See Zone techniques

Note 1: Class I, Division 1 intrinsically safe system requirements are contained in UL 913 (USA) and CSA 157 (Canada).
Note 2: References in one area to "any" protection techniques from another area require these other area techniques to be for the same gas atmosphere; and with a suitable temperature class.

Zone System Electrical Equipment Protection Techniques (Equipment Protection Levels)

Area	Protection Techniques (Equipment Protection Levels)	Applicable Certification Documents: USA (UL Mark)	Canada (C-UL Mark)	IECEx System	Europe (ATEX)
Zone 0	• Flameproof, "da" (Ga)	UL 60079-1	—	IEC 60079-1	EN 60079-1
	• Intrinsic safety, "ia" (Ga)	UL 60079-11	CSA 60079-11	IEC 60079-11	EN 60079-11
	• Encapsulation, "ma" (Ga)	UL 60079-18	CSA 60079-18	IEC 60079-18	EN 60079-18
	• Class I, Div 1 intrinsic safety	UL 913	CSA 157	—	—
Zone 1	• Flameproof, "db" (Gb)	UL 60079-1	CSA 60079-1	IEC 60079-1	EN 60079-1
	• Pressurization, "pxb"/"pyb" (Gb)	UL 60079-2	CSA 60079-2	IEC 60079-2	EN 60079-2
	• Powder filling, "q" (Gb)	UL 60079-5	CSA 60079-5	IEC 60079-5	EN 60079-5
	• Oil immersion, "ob" (Gb)	UL 60079-6	CSA 60079-6	IEC 60079-6	EN 60079-6
	• Increased safety, "eb" (Gb)	UL 60079-7	CSA 60079-7	IEC 60079-7	EN 60079-7
	• Intrinsic safety, "ib" (Gb)	UL 60079-11	CSA 60079-11	IEC 60079-11	EN 60079-11
	• Encapsulation, "mb" (Gb)	UL 60079-18	CSA 60079-18	IEC 60079-18	EN 60079-18
	• Any Zone 0 technique	See above	See above	See above	See above
	• Any Class I, Div 1 technique	See CID1 techniques	See CID1 techniques	—	—
Zone 2	• Flameproof, "dc" (Gc)	UL 60079-1	—	IEC 60079-1	EN 60079-1
	• Pressurization, "pzc" (Gc)	UL 60079-2	CSA 60079-2	IEC 60079-2	EN 60079-2
	• Oil immersion, "oc" (Gc)	—	—	IEC 60079-6	EN 60079-6
	• Increased safety, "ec" (Gc)	—	—	IEC 60079-7	EN 60079-7
	• Intrinsic safety, "ic" (Gc)	UL 60079-11	CSA 60079-11	IEC 60079-11	EN 60079-11
	• Encapsulated, "nC" (Gc)	—	CSA 60079-15	—	—
	• Enclosed-break, "nC" (Gc)	UL 60079-15	CSA 60079-15	IEC 60079-15	EN 60079-15
	• Energy-limited, "nL" (Gc)	—	CSA 60079-15	—	—
	• Hermetically-sealed, "nC" (Gc)	UL 60079-15	CSA 60079-15	IEC 60079-15	EN 60079-15
	• Nonincendive, "nC" (Gc)	UL 60079-15	CSA 60079-15	IEC 60079-15	EN 60079-15
	• Non-sparking, "nA" (Gc)	UL 60079-15	CSA 60079-15	IEC 60079-15	EN 60079-15
	• Restricted breathing, "nR" (Gc)	UL 60079-15	CSA 60079-15	IEC 60079-15	EN 60079-15
	• Sealed, "nC" (Gc)	UL 60079-15	CSA 60079-15	IEC 60079-15	EN 60079-15
	• Encapsulation, "mc" (Gc)	UL 60079-18	CSA 60079-18	IEC 60079-18	EN 60079-18
	• Any Zone 0 or 1 technique	See above	See above	See above	See above
	• Any Class I, Div 1 or 2 technique	See Class I techniques	See Class I techniques	—	—

Note 1: Zone 0, 1 and 2 general requirements are contained in UL 60079-0 (USA), CSA 60079-0 (Canada) and IEC/EN 60079-0 (IECEx System & Europe).
Note 2: Zone 0, 1 and 2 intrinsically safe system requirements are contained in UL 60079-25 (USA), CSA 60079-25 (Canada) and IEC/EN 60079-25 (IECEx System & Europe).
Note 3: Special requirements for certain equipment installations in Zone 0 (Ga) areas are contained in ISA 60079-26 (USA) and IEC/EN 60079-26 (IECEx System & Europe).
Note 4: Equipment Protection Levels (EPLs) are used to provide additional details regarding the level of protection against ignition in explosive atmospheres. EPLs are designated by a letter "G" for Gas, "D" for Dust or "M" for Mining, followed by a letter "a" for "very high", "b" for "high" or "c" for "enhanced" level of protection.
Note 5: Under the ATEX Directive (94/9/EC and 2014/34/EU), the marking of Categories is additionally required. ATEX Categories are similar to EPLs in function and designation as follows, ATEX Category 1G, 2G, 3G, 1D, 2D, 3D, M1, M2 = EPL Ga, Gb, Gc, Da, Db, Dc, Ma, Mb respectively.
Note 6: INMETRO certification requirements are determined by Portaria 179 as of 18 May 2010, with the associated Brazilian NBR Ex standards harmonized with the comparable IEC Ex standards noted above.
Note 7: References in one area to "any" protection techniques from another area require these other area techniques to be for the same gas atmosphere; and with a suitable temperature class.

Zone System Non-Electrical Equipment Protection Techniques (Equipment Protection Levels)

Area	Protection Techniques	Applicable Certification Documents: USA (UL Mark)	Canada (C-UL Mark)	IECEx System	Europe (ATEX)
Zone 0	• Constructional safety, "c" (Ga)	—	—	ISO 80079-37	EN 13463-5
	• Control of ignition source, "b" (Ga)	—	—	ISO 80079-37	EN 13463-6
	• Liquid immersion, "k" (Ga)	—	—	ISO 80079-37	EN 13463-8
Zone 1	• Flameproof, "d" (Gb)	—	—	IEC 60079-1	EN 13463-3
	• Constructional safety, "c" (Gb)	—	—	ISO 80079-37	EN 13463-5
	• Control of ignition source, "b" (Gb)	—	—	ISO 80079-37	EN 13463-6
	• Liquid immersion, "k" (Gb)	—	—	ISO 80079-37	EN 13463-8
	• Pressurization, "pxb"/"pyb"(Gb)	—	—	IEC 60079-2	EN 60079-2
	• Any Zone 0 technique	—	—	See above	See above
Zone 2	• Flow restricting enclosure, "fr"	—	—	—	EN 13463-2
	• Constructional safety, "c" (Gc)	—	—	ISO 80079-37	EN 13463-5
	• Control of ignition source, "b" (Gc)	—	—	ISO 80079-37	EN 13463-6
	• Liquid immersion, "k" (Gc)	—	—	ISO 80079-37	EN 13463-8
	• Pressurization, "pzc" (Gc)	—	—	IEC 60079-2	EN 60079-2
	• Any Zone 0 or 1 technique	—	—	See above	See above

Note 1: Zone 0, 1 and 2 general requirements are contained in ISO/IEC 80079-36 (IECEx System) and EN 13463-1 (Europe).
Note 2: Equipment Protection Levels (EPLs) are used to provide additional details regarding the level of protection against ignition in explosive atmospheres. EPLs are designated by a letter "G" for Gas, "D" for Dust or "M" for Mining, followed by a letter "a" for "very high", "b" for "high" or "c" for "enhanced" level of protection.
Note 3: Under the ATEX Directive (94/9/EC and 2014/34/EU), the marking of Categories is additionally required. ATEX Categories are similar to EPLs in function and designation as follows, ATEX Category 1G, 2G, 3G, 1D, 2D, 3D, M1, M2 = EPL Ga, Gb, Gc, Da, Db, Dc, Ma, Mb respectively.
Note 4: References in one area to "any" protection techniques from another area require these other area techniques to be for the same gas atmosphere; and with a suitable temperature class.

EXPLOSIVE DUST ATMOSPHERES (e.g. Class II & III Division Systems)

Includes combustible dusts and ignitable fibers/flyings

Area Classification

Class II, Division 1:
Where ignitable concentrations of combustible dust **can exist all of the time or some of the time** under normal operating conditions.

Class II, Division 2:
Where ignitable concentrations of combustible dust **are not likely to exist** under normal operating conditions.

Class III, Division 1:
Where easily ignitable fibers or materials producing combustible flyings **are handled, manufactured or used**.

Class III, Division 2:
Where easily ignitable fibers **are stored or handled.**

Zone 20:
Where ignitable concentrations of combustible dust or ignitable fibers/flyings **are present continuously or for long periods of time** under normal operating conditions.

Zone 21:
Where ignitable concentrations of combustible dust or ignitable fibers/flyings **are likely to exist** under normal operating conditions.

Zone 22:
Where ignitable concentrations of combustible dust or ignitable fibers/flyings **are not likely to exist** under normal operating conditions.

Groups

Class II, Division 1 and 2:
- **E** metal dust — Div. 1 only
- **F** carbonaceous dust
- **G** non-conductive dust

Class III, Division 1 and 2:
None.

Zone 20, 21 and 22:
- **IIIC** conductive dust
- **IIIB** non-conductive dust
- **IIIB** non-conductive dust

Zone 20, 21 and 22:
- **IIIA** combustible flyings

Temperature Classifications

Class II, Division 1 and 2:

T1	≤450°C	**T2C**	≤230°C	**T3B**	≤165°C	**T5**	≤100°C
T2	≤300°C	**T2D**	≤215°C	**T3C**	≤160°C	**T6**	≤ 85°C
T2A	≤280°C	**T3**	≤200°C	**T4**	≤135°C		
T2B	≤260°C	**T3A**	≤180°C	**T4A**	≤120°C		

Zone 20, 21 and 22: None.
Note: For Zone 20, 21 and 22, equipment shall be marked to show the maximum surface temperature

Class III, Division 1 and 2: None.
Note: Article 503 of the NEC, and Appendix J of the CEC, limit the maximum surface temperature for Class III equipment to 165°C for equipment not subject to overloading and to 120°C for equipment that may be overloaded.

Division System Electrical Equipment Protection Techniques

Area	Protection Techniques	Applicable Certification Documents: USA (UL Mark)	Canada (C-UL Mark)
Div. 1	• Intrinsic safety (Class II & III)	UL 913	CSA 157
	• Dust-ignitionproof (Class II)	UL 1203	CSA 25
	• Pressurized, Type X or Y (Class II)	NFPA 496	NFPA 496
	• Dusttight (Class III)	ISA 12.12.01	CSA 157
	• Hermetically-sealed (Class III)	ISA 12.12.01	—
	• Nonincendive (Class III)	ISA 12.12.01	—
	• Sealed (Class III)	ISA 12.12.01	—
	• Any Zone 20 technique (Class II & III)	See Zone 20 techniques	See Zone 20 techniques
Div. 2	• Dusttight (Class II)	ISA 12.12.01	CSA 157
	• Hermetically-sealed (Class II)	ISA 12.12.01	—
	• Nonincendive (Class II)	ISA 12.12.01	—
	• Sealed (Class II)	ISA 12.12.01	—
	• Pressurized, Type Z (Class II)	NFPA 496	NFPA 496
	• Any CIID1 or CIIID1 technique	See above	See above
	• Any Zone 20, 21, 22 tech (Class II & III)	See Zone techniques	See Zone techniques

Note 1: Class II and Class III, Division 1 intrinsically safe system requirements are contained in UL 913 (USA) and CSA 157 (Canada)
Note 2: References in one area to "any" protection techniques from another area require these other area techniques to be for the same dust atmosphere; and with a suitable temperature class.

Zone System Electrical Equipment Protection Techniques (Equipment Protection Levels)

Area	Protection Techniques (Equipment Protection Levels)	Applicable Certification Documents: USA (UL Mark)	Canada (C-UL Mark)	IECEx System	Europe (ATEX)
Zone 20	• Enclosure, "ta" (Da)	UL 60079-31	CSA 60079-31	IEC 60079-31	EN 60079-31
	• Intrinsic safety, "ia" (Da)	UL 60079-11	CSA 60079-11	IEC 60079-11	EN 60079-11
	• Encapsulation, "ma" (Da)	UL 60079-18	CSA 60079-18	IEC 60079-18	EN 60079-18
	• Any CIID1 technique	See CIID1 techniques	See CIID1 techniques	—	—
Zone 21	• Enclosure, "tb" (Db)	UL 60079-31	CSA 60079-31	IEC 60079-31	EN 60079-31
	• Pressurization, "pxb"/"pyb" (Db)	ISA 61241-2	CSA 61241-4	IEC 60079-2	EN 60079-2
	• Intrinsic safety, "ib" (Db)	UL 60079-11	CSA 60079-11	IEC 60079-11	EN 60079-11
	• Encapsulation, "mb" (Db)	UL 60079-18	CSA 60079-18	IEC 60079-18	EN 60079-18
	• Any Zone 20 technique	See above	See above	See above	See above
	• Any CIID1 technique	See CIID1 techniques	See CIID1 techniques	—	—
Zone 22	• Enclosure, "tc" (Dc)	UL 60079-31	CSA 60079-31	IEC 60079-31	EN 60079-31
	• Pressurization, "pzc" (Dc)	ISA 61241-2	CSA 61241-4	IEC 60079-2	EN 60079-2
	• Intrinsic safety, "ic" (Dc)	UL 60079-11	CSA 60079-11	IEC 60079-11	EN 60079-11
	• Encapsulation, "mc" (Dc)	UL 60079-18	CSA 60079-18	IEC 60079-18	EN 60079-18
	• Any Zone 20, 21 technique	See above	See above	See above	See above
	• Any CIID1, CIID2 technique	See Class II techniques	See Class II techniques	—	—

Note 1: Zone 20, 21 and 22 general requirements are contained in UL 60079-0 or ISA 61241-0 (USA), CSA 60079-0 (Canada) and IEC/EN 60079-0 (IECEx System & Europe).
Note 2: Zone 20, 21 and 22 intrinsically safe system requirements are contained in UL 60079-25 (USA), CSA 60079-25 (Canada) and IEC/EN 60079-25 (IECEx System & Europe).
Note 3: Equipment Protection Levels (EPLs) are used to provide additional details regarding the level of protection against ignition in explosive atmospheres. EPLs are designated by a letter "G" for Gas, "D" for Dust or "M" for Mining, followed by a letter "a" for "very high", "b" for "high" or "c" for "enhanced" level of protection.
Note 4: Under the ATEX Directive (94/9/EC and 2014/34/EU), the marking of Categories is additionally required. ATEX Categories are similar to EPLs in function and designation as follows, ATEX Category 1G, 2G, 3G, 1D, 2D, 3D, M1, M2 = EPL Ga, Gb, Gc, Da, Db, Dc, Ma, Mb respectively.
Note 5: INMETRO certification (INMETRO/UL-BR Mark) requirements are determined by Portaria 179 as of 18 May 2010, with the associated Brazilian NBR Ex standards harmonized with the comparable IEC Ex standards noted above.
Note 6: References in one area to "any" protection techniques from another area require these other area techniques to be for the same dust atmosphere; and with a suitable temperature class.

Zone System Non-Electrical Equipment Protection Techniques (Equipment Protection Levels)

Area	Protection Techniques	Applicable Certification Documents: USA (UL Mark)	Canada (C-UL Mark)	IECEx System	Europe (ATEX)
Zone 20	• Constructional safety, "c" (Da)	—	—	ISO 80079-37	EN 13463-5
	• Control of ignition source, "b" (Da)	—	—	ISO 80079-37	EN 13463-6
	• Liquid immersion, "k" (Da)	—	—	ISO 80079-37	EN 13463-8
	• Enclosure, "ta" (Da)	—	—	IEC 60079-31	EN 60079-31
Zone 21	• Constructional safety, "c" (Db)	—	—	ISO 80079-37	EN 13463-5
	• Control of ignition source, "b" (Db)	—	—	ISO 80079-37	EN 13463-6
	• Liquid immersion, "k" (Db)	—	—	ISO 80079-37	EN 13463-8
	• Flameproof, "d" (Db)	—	—	IEC 60079-1	EN 13463-3
	• Pressurization, "pxb"/"pyb" (Db)	—	—	IEC 60079-2	EN 60079-2
	• Enclosure, "tb" (Db)	—	—	IEC 60079-31	EN 60079-31
	• Any Zone 20 technique	—	—	See above	See above
Zone 22	• Flow restricting enclosure, "fr"	—	—	—	EN 13463-2
	• Constructional safety, "c" (Dc)	—	—	ISO 80079-37	EN 13463-5
	• Control of ignition source, "b" (Dc)	—	—	ISO 80079-37	EN 13463-6
	• Liquid immersion, "k" (Dc)	—	—	ISO 80079-37	EN 13463-8
	• Pressurization, "pzc" (Dc)	—	—	IEC 60079-2	EN 60079-2
	• Enclosure, "tc" (Dc)	—	—	IEC 60079-31	EN 60079-31
	• Any Zone 20 or 21 technique	—	—	See above	See above

Note 1: Zone 20, 21 and 22 general requirements are contained in ISO/IEC 80079-36 (IECEx System) and EN 13463-1 (Europe).
Note 2: Equipment Protection Levels (EPLs) are used to provide additional details regarding the level of protection against ignition in explosive atmospheres. EPLs are designated by a letter "G" for Gas, "D" for Dust or "M" for Mining, followed by a letter "a" for "very high", "b" for "high" or "c" for "enhanced" level of protection.
Note 3: Under the ATEX Directive (94/9/EC and 2014/34/EU), the marking of Categories is additionally required. ATEX Categories are similar to EPLs in function and designation as follows, ATEX Category 1G, 2G, 3G, 1D, 2D, 3D, M1, M2 = EPL Ga, Gb, Gc, Da, Db, Dc, Ma, Mb respectively.
Note 4: References in one area to "any" protection techniques from another area require these other area techniques to be for the same dust atmosphere; and with a suitable temperature class.

MARKINGS

NEC & CEC Class I, II, and III, Division 1 & 2 (USA & Canada)

This marking would include:
Class(es), Division(s), Gas/Dust Group(s), Temperature Classification

Example: Class I, Division 1, Groups C & D; Class II, Division 1, Groups E, F and G; Class III, Division 1,T4A

NEC Class I, Zone 0, 1, & 2 (USA)

The marking would include:
For Zone Listings based on USA 60079 series standards: Class, Zone, AEx, Protection Technique(s), Gas Group, Temperature Classification

Example: Class I, Zone 1, AEx de IIB T4

For Zone Listings based on USA Division standards: Class, Zone, Gas Group, Temperature Classification

Example: Class I, Zone 1, Group IIB T4

NEC Zone 20, 21, & 22 (USA)

The marking would include:
For Zone Listings based on USA 60079 or 61241 series standards: Zone, AEx, Protection Technique(s), Dust Group, Temperature Classification

Example: Zone 21, AEx tb IIIB T135°C

For Zone Listings based on USA Division Standards: Zone, Dust Group, Temperature Classification

Example: Zone 21, IIIB T135°C

CEC Zone 0, 1 & 2 (Canada) CEC Zone 20, 21 & 22 (Canada)

This marking would include:
For Zone 0, 1 & 2 Listings: Ex, Protection Technique(s), Gas Group, Temperature Classification, Equipment Protection Level (EPL)

Example: Ex de IIB T4 Gb

For Zone 20, 21 & 22 Listings: Ex, Protection Technique(s), Dust Group, Temperature Classification, Equipment Protection Level (EPL)

Example: Ex tb IIIB T135°C Db

EN Zone 0, 1, & 2 (Europe)

This marking would include:
Electrical Equipment: Ex, Protection Technique(s), Gas Group, Temperature Classification, Equipment Protection Level (EPL)

Example: Ex de IIB T4 Gb

Non-Electrical Equipment: Gas Group, Protection Technique(s), Temperature Classification

Example: IIB ck T4

EN Zone 20, 21, & 22 (Europe)

This marking would include:
Electrical Equipment: Ex, Protection Technique(s), Dust Group, Temperature Classification, Equipment Protection Level (EPL)

Example: Ex tb IIIB T135°C Db

Non-Electrical Equipment: Protection Technique(s), Temperature Classification

Example: ck T135°C

ATEX Directive (Europe)

In addition to the European Ex marking strings noted to the left, this marking would include:
Non-mining: CE, NB Identifier, Ex, Equipment Group & Category, G (gas)/D (dust), Date Code

Example (for DEMKO):
CE 0539 Ex II 2 G 2016

Mining: CE, NB Identifier, Ex, Equipment Group & Category, Date Code

Example (for DEMKO):
CE 0539 Ex I M2 2016

IEC Zone 0, 1, & 2 (IECEx System)

This marking would include:

Electrical Equipment: Ex, Protection Technique(s), Gas Group, Temperature Classification, Equipment Protection Level (EPL)

Example: Ex de IIB T4 Gb

Non-Electrical Equipment: Ex, Protection Technique, Gas Group, Temperature Classification, Equipment Protection Level (EPL)

Example: Ex h IIB T4 Gb

IEC Zone 20, 21, & 22 (IECEx System)

This marking would include:
Electrical Equipment: Ex, Protection Technique(s), Dust Group, Temperature Classification, Equipment Protection Level (EPL)

Example: Ex tb IIIB T135°C Db

Non-Electrical Equipment: Ex, Protection Technique, Dust Group, Temperature Classification, Equipment Protection Level (EPL)

Example: Ex h IIIB T135°C Db

INMETRO Regulation (Brazil)

This marking would include:
Zone 0, 1 & 2: INMETRO/UL-BR Mark, Ex, Protection Technique(s), Gas Group, Temperature Classification, Equipment Protection Level (EPL)

Example: Ex de IIB T4 Gb

Zone 20, 21 & 22: INMETRO/UL-BR Mark, Ex, Protection Technique, Dust Group, Temperature Classification, Equipment Protection Level (EPL)

Example: Ex tb IIIB T135°C Db

UL.COM/HAZLOCAPP Download on the App Store | ANDROID APP ON Google Play

UL.COM/HAZLOC

INSTRUCTIONAL CONTENT & ASSESSMENT

SUBJECT MATTER EXPERT (SME) SAMPLE CONTENT - DISCONNECTS

This section details what the content of a SME might include. To convey the message to the students, it is important that they start from the 'beginning' (even though there are probably some students that are very well versed in the 'basics') to ensure that everyone has a chance at a 'level playing field' of knowledge. The attached Presentation (entitled "Simmons Content – SME Disconnect Presentation.pptx) is something that demonstrates what you should request from each SME:

- Personalized Biography – this helps build a connection with the class and helps them to better understand your background/history and should include contact information for future follow-up
- Show how additional features build upon each other through analogy, photos, and real-world demonstration pieces for the students to investigate
- The presentation should include detailed 'Notes' section so that when referenced in the future (for when the current students become the field trainers for their own sales people and customers) they are able to remember the basic discussion and highlighted points to be made per slide
- Keep detailed information available as a Reference. For example, this SME has included a catalog showing basic background information, detailed part number constructions, information about accessories, and detailed dimensional drawings all available (but not the main focus soas to lose the interest of the students) named, "Simmons Content – SME Disconnect Catalog.pdf"

Facilitator's Guide Point

When reviewing the overall objectives for this (and any) coursework, it is vital for the Facilitator to locate the right Subject Matter Experts (SMEs) to present the material. While a generalist might feel they can 'give the data/facts' of the learning – it is the ability of the SME to 'take it deeper' that the students will appreciate, respect, and have an opportunity for increased learning. This course will require the use of 8+ SMEs from the various Product fields of HazLoc products, products that could be integrated with the enclosures, manufacturing, and those products that are 'pull-thru' for the system approach.

After each product and/or standards class, the student should be able to not only discuss the individual product but, more importantly, understand the interconnection between the components and development of an electrical system in response to customer needs. As a result, the use of Role-Playing (with the SME being the customer and the students being the Sales Person) to present the students with 'Real-World' scenarios will be used to test knowledge transfer. An example of which is to ask after the Disconnects course the following questions (leaving some information out so that the students will have to formulate questions to ask the customer – much like real-life – to supply the correct product):